Z I N C®

Programmer's Reference

Zinc® Application Framework™
Version 5

Zinc Software Incorporated
Pleasant Grove, Utah

ACKNOWLEGEMENTS

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Table of Contents

Introduction 9

Class Reference 15

Class Hierarchy 17
ZafApplication 20
ZafAttachment 24
ZafBignum 29
ZafBignumData 33
ZafBitmapData 43
ZafBitmapStruct 46
ZafBorder 48
ZafButton 51
ZafChart 65
ZafChartStub 74
ZafCodeSetData 75
ZafComboBox 82
ZafConstraint 87
ZafCoordinateStruct 90
ZafCursor 92
ZafData 95
ZafDataManager 101
ZafDataPersistence 103
ZafDataRecord 112
ZafDate 114
ZafDateData 119
ZafDevice 122
ZafDialogWindow 126
ZafDimensionConstraint. 129
ZafDiskFile 133
ZafDiskFileSystem 135
ZafDisplay 140

ZafElement 160
ZafEraStruct 170
ZafErrorStub 172
ZafErrorSystem 174
ZafEventManager 176
ZafEventMap 181
ZafEventStruct 183
ZafFile 190
ZafFileDialog 197
ZafFileInfoStruct 201
ZafFileSystem 203
ZafFormatData 208
ZafFormattedString 211
ZafGeometryManager 217
ZafGroup 221
ZafHelpStub 225
ZafHelpSystem 226
ZafHelpTips 230
ZafHzList 235
ZafI18nData 240
ZafIcon 245
ZafIconData 250
ZafIconStruct 253
ZafImage 255
ZafImageData 260
ZafImageStruct 262
ZafInteger 263
ZafIntegerData 267
ZafKeyboard 272
ZafKeyStruct 275
ZafLanguageData 276
ZafLanguageStruct 280
ZafList 281
ZafListBlock 285
ZafLocaleData 286
ZafLocaleStruct 289
ZafMaximizeButton 295
ZafMessageWindow 298

ZafMDIWindow 303
ZafMinimizeButton 307
ZafMouse 310
ZafMouseData 314
ZafMouseStruct 318
ZafMSWindowsApp 321
ZafNotebook 327
ZafNotification 331
ZafObjectPersistence 339
ZafPaletteData 348
ZafPaletteMap. 351
ZafPaletteStruct 352
ZafPath 356
ZafPathElement 357
ZafPopUpItem 359
ZafPopUpMenu 366
ZafPositionStruct 369
ZafProgressBar 371
ZafPrompt 377
ZafPullDownItem 382
ZafPullDownMenu 388
ZafQueueBlock 391
ZafQueueElement 392
ZafReal 393
ZafRealData 397
ZafRegionStruct 401
ZafRelativeConstraint. 405
ZafScrollBar 410
ZafScrollData 414
ZafScrollStruct 418
ZafScrolledWindow 420
ZafSpinControl 424
ZafStandardArg 428
ZafStatusBar 431
ZafStorage 434
ZafStorageFile 439
ZafString 441
ZafStringData 452

ZafSystemButton 462
ZafTable 468
ZafTableHeader 480
ZafTableRecord 485
ZafText. 488
ZafTime 495
ZafTimeData 499
ZafTimer 502
ZafTitle 506
ZafToolBar 509
ZafTreeItem 513
ZafTreeList 521
ZafUTime. 528
ZafUTimeData 533
ZafVtList 541
ZafWindow 545
ZafWindowManager 565
ZafWindowObject 570

Utility Reference. 663

Convert. 665
Rep 666
Rep4to5 667
ZMake 682

Appendices 687

Zinc Coding Standards. A-689
DynamicPtrCast B-698
Event Definitions C-699
ZAF 5 to 4 Class Comparisons D-716
Property Matrices. E-720
X Resources F-736

Index 739

Introduction

Zinc Application Framework Version 5 is a sophisticated product with many nuances. As you will soon discover, there are as many ways to accomplish a given task using ZAF as there are programmers. Zinc has created this reference with this principle in mind. Not only does this reference manual define and publish the ZAF API, it also offers examples and hints on its use.

The Programmer's Reference is available in two formats: hard copy documentation and electronic documentation using Adobe® Acrobat®. Electronic documentation is supplied with Zinc Application Framework. Hard copy documentation is available as a separate purchase.

Many programmers are already familiar with the advantages of electronic documentation and have become accustomed to using it. If you are not one of these people, you've probably had a bad experience with first-generation electronic documentation. We encourage you to try again! The ZAF 5 Programmer's Reference will be the best on-line documentation you've ever experienced—and may change your mind forever about electronic docs.

This introduction chapter will familiarize you with the organization and formatting conventions of the Programmer's Reference, and provide useful tips for effective use of the electronic documentation. Contact information for Zinc software is provided at the end of the chapter.

Organization

This manual is divided into five major sections as follows:

- **Table of Contents**

  The table of contents is hypertext linked in the electronic documentation. This allows rapid navigation to each chapter.

- **Class Reference**

  All ZAF 5 classes and structures are documented in this section—the majority of the manual. Each class is formatted similarly to provide complete yet comfortable information about each class. (Refer to the "Conventions and Formats" section below for more information.) For programmers using electronic documentation, these chapters are internally hypertext linked, plus linked to related and base classes for rapid reference.

- **Utility Reference**

  External applications supplied with ZAF 5 are documented in this section, with one notable exception—Zinc Designer is documented separately in its own manual. If you are converting applications developed using a previous version of Zinc Application Framework to ZAF 5, this section contains useful information including a complete correlation of ZAF 4 symbols to their new ZAF 5 equivalents.

- **Appendices**

  Appendices include all essential reference information for ZAF 5 that cannot be comfortably categorized as "Class Reference" or "Utility Reference." Information found here includes a comprehensive reference to messages, Zinc internal coding conventions, and useful tables of object properties including defaults.

- **Index**

  The Programmer's Reference index includes every public member function in the ZAF 5 API, plus many additional references to information found only in this manual. This section is fully hypertext linked for programmers using electronic documentation.

Conventions and Formats

The majority of this manual is dedicated to the documentation of classes and structures. The following format is generally followed in each chapter:

ClassName

Member 1	Member 2	Operator 1

A table at the beginning of each chapter lists all members documented in the chapter. Only those members that meet *all* of the following criteria are documented:

- The member is public
- The member is overloaded in this class (not simply inherited from a base class)
- The member is substantially changed from the base class implementation, if any
- The member is not a "Blocking function." Blocking functions are those members overloaded simply to prevent modification of a class property in a derived class.

These are not normally documented. Blocking functions can be identified by entries in the "Member Initializations" table of the chapter's "Constructors" section.

Inheritance

```
ZafDialogWindow : ZafWindow : ((ZafWindowObject :
   ZafElement), ZafList)
```

The inheritance list shows the complete class hierarchy for this class. It uses a terse notation (shown above) where a ":" (colon) separates a derived class from its base class, and a "," is used to denote multiple inheritance. "( )" may also be used for simple grouping.

The class hierarchy depicted above can be represented hierarchically as:

```
ZafDialogWindow
        ZafWindow
             ZafWindowObject
                  ZafElement
             ZafList
```

In this hierarchy, "ZafDialogWindow" multiply inherits from "ZafWindow". "ZafWindow" in turn inherits from "ZafWindowObject" (which inherits from "ZafElement") and "ZafList".

Base classes are hypertext linked to their reference chapters for rapid access by programmers using electronic documentation.

Declaration

```
#include <z_dlgwin.hpp>
```

The declaration directs the programmer to the ZAF header file (found in the "\include" directory) that contains the definition for the class. The programmer does not typically need to specifically include this header file since it is automatically included with "#include <zaf.hpp>."

Description

This section describes the purpose of the class and its typical uses. Often the description will also include important information about class interactions, caveats, and specific application usage.

Constructor(s)

The “constructors” section begins with a brief description of the purpose for the classes constructors and is followed by a table of “Member Initializations” as follows:

Member Initializations

ZafWindow	
`Destroyable()`	`false`
`...`	
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`...`	

The member initializations table lists the referenced class and any relevant base classes along with their individual members that are specifically set in the constructors for this class. To emphasize proper API usage, the public accessor functions used to manipulate the protected and private data members are listed instead of the data members themselves.

When present, “†” indicates a “blocking function” that prevents changes to the attribute in this class. The value is set in the constructor and should not be altered.

Destructor

Specific information important to the deallocation of this class is presented in this section. ZAF classes chain their destructor to the destructors of base classes.

Members

SetCurrentPage

```
virtual int SetCurrentPage(ZafWindowObject *currentPage)
```

Each member variable and function is documented with its complete declaration from the header file, and a full description of the purpose and usage of the member. Parameters are detailed and sample code snippets are often provided.

Tips for Electronic Docs

To maximize the utility of electronic documentation programmers may wish to consider the following tips:

- Obtain the latest version of Adobe Acrobat with full text search capabilities. Zinc's documentation relies on the capabilities of Adobe Acrobat version 3.0 with full text search. The Zinc ftp site (ftp://ftp.zinc.com) and web site (http://www.zinc.com) maintain copies of Acrobat, but Adobe's site (http://www.adobe.com) is the authoritative source.
- Maximize the Acrobat window. You're looking at a document formatted for printing. Pages are larger than the display and fonts are relatively small. The bigger the viewing area the better!
- For maximum performance, select "File | Preferences | General" and deselect the option to "Smooth text and monochrome images." This will greatly enhance the speed of scrolling and page redisplay.
- Set continuous page display mode by selection "View | Continuous" from the menu. This will allow you to more easily read sections that are split across two pages.
- If you know which class you are looking for, use the Acrobat's "bookmarks" (the left side of the display) to expand the "Class Reference" section and directly the select the class you want.
- Once you're positioned on the correct class, click once in the document to automatically "zoom" the display to full page width. This is the best size for actually reading the content!
- Scan the members table at the top of the class. If you find the member you want, click it and you'll be taken directly to the reference for that member.
- If you don't find the member you want, chances are good that the member was inherited from a base class. Click on the first base class in the class' "Inheritance" diagram to jump directly to the base class. Repeat the process of scanning for the member you want.
- To jump back to a previous view (i.e. "undo" a hypertext jump) use the "<<" button on the Acrobat toolbar.
- If you don't know which class you're looking for, select the member in the "Index" portion of Acrobat's "bookmarks" (the left side of the display). You'll jump into the index where you can select which of the references to use for that member. Click on the page number of the reference to jump directly to the member.
- Copy and paste code snippets into your own projects using the native clipboard features of your OS. Note, however, that Acrobat is not a textual application and does not preserve indenting when copying to the clipboard.
- Use the "full text indexing" capability of Acrobat to search for words that cannot be found any other way. Select "Tools | Search" from the menu. This is a rapid, full-text search. If your version of Acrobat does not support full-text searching,

select “Tools | Find” from the menu for a slower, sequential search of the documentation.

Contacting Zinc

We want to hear from you! Your feedback drives the progress of the products and services at Zinc. Watch our web site regularly for the latest information from Zinc, and participate in Zinc’s discussion groups.

To contact Zinc directly, please refer to the information at the beginning of this manual.

Class Reference

Class Hierarchy

The class hierachy for ZAF 5 is presented below. “<-” indicates multiple inheritance and specifies additional base classes.

```
ZafApplication                                         (z_app.hpp)
ZafCoordinateStruct                                  (z_coord.hpp)
    ZafDisplay                                         (z_dsp.hpp)
    ZafPositionStruct                                  (z_pos.hpp)
    ZafRegionStruct                                 (z_region.hpp)
ZafDataPersistence                                    (z_data.hpp)
    ZafObjectPersistence                               (z_win.hpp)
ZafElement                                            (z_list.hpp)
    ZafConstraint                                     (z_gmgr.hpp)
        ZafAttachment                                 (z_gmgr.hpp)
        ZafDimensionConstraint                        (z_gmgr.hpp)
        ZafRelativeConstraint                         (z_gmgr.hpp)
    ZafData <- ZafNotification                        (z_data.hpp)
        ZafDataRecord <- ZafList                      (z_data.hpp)
            ZafDataManager                            (z_data.hpp)
        ZafFormatData                                (z_fdata.hpp)
            ZafBignumData                             (z_bnum.hpp)
            ZafIntegerData                             (z_int.hpp)
            ZafRealData                               (z_real.hpp)
            ZafStringData                              (z_str.hpp)
            ZafUTimeData                             (z_utime.hpp)
                ZafDateData                           (z_date.hpp)
                ZafTimeData                           (z_time.hpp)
        ZafI18nData                                  (z_idata.hpp)
            ZafCodeSetData                            (z_cset.hpp)
            ZafLanguageData                           (z_lang.hpp)
            ZafLocaleData <- ZafLocaleStruct           (z_loc.hpp)
        ZafImageData                                (z_idata1.hpp)
            ZafBitmapData <- ZafBitmapStruct        (z_bitmap.hpp)
            ZafIconData <- ZafIconStruct              (z_icon.hpp)
            ZafMouseData <- ZafMouseStruct          (z_mouse1.hpp)
        ZafPaletteData                                (z_pal1.hpp)
        ZafScrollData <- ZafScrollStruct            (z_scrll1.hpp)
    ZafDevice                                          (z_dev.hpp)
        ZafCursor                                   (z_cursor.hpp)
        ZafHelpTips                                  (z_htips.hpp)
        ZafKeyboard                                 (z_keybrd.hpp)
        ZafMouse                                    (z_mouse2.hpp)
        ZafTimer                                     (z_timer.hpp)
    ZafPathElement                                    (z_file.hpp)
    ZafQueueElement                                 (z_evtmgr.hpp)
```

```
ZafWindowObject                                (z_win.hpp)
    ZafBorder                               (z_border.hpp)
    ZafButton                               (z_button.hpp)
        ZafIcon                              (z_icon1.hpp)
        ZafMaximizeButton                      (z_max.hpp)
        ZafMinimizeButton                      (z_min.hpp)
        ZafPopUpItem                         (z_popup.hpp)
        ZafPullDownItem                      (z_plldn.hpp)
        ZafSystemButton                        (z_sys.hpp)
        ZafTitle                             (z_title.hpp)
    ZafChartStub                             (z_chart.hpp)
        ZafChart                      (cf_api/bz_zcht.hpp)
    ZafGeometryManager <- ZafList             (z_gmgr.hpp)
    ZafImage                                 (z_image.hpp)
    ZafProgressBar                          (z_prgrss.hpp)
    ZafPrompt                               (z_prompt.hpp)
    ZafString                                 (z_str1.hpp)
        ZafBignum                            (z_bnum1.hpp)
        ZafDate                              (z_date1.hpp)
        ZafFormattedString                  (z_fmtstr.hpp)
        ZafInteger                            (z_int1.hpp)
        ZafReal                              (z_real1.hpp)
        ZafTime                              (z_time1.hpp)
        ZafUTime                            (z_utime1.hpp)
    ZafWindow <- ZafList                       (z_win.hpp)
        ZafComboBox                          (z_combo.hpp)
        ZafDialogWindow                     (z_dlgwin.hpp)
            ZafFileDialog                   (z_fildlg.hpp)
            ZafMessageWindow                (z_msgwin.hpp)
        ZafGroup                             (z_group.hpp)
        ZafHelpSystem <- ZafHelpStub          (z_help.hpp)
        ZafHzList                            (z_hlist.hpp)
        ZafMDIWindow                        (z_mdiwin.hpp)
        ZafNotebook                         (z_notebk.hpp)
        ZafPopUpMenu                         (z_popup.hpp)
        ZafPullDownMenu                      (z_plldn.hpp)
        ZafScrollBar                        (z_scrll2.hpp)
        ZafScrolledWindow                   (z_sclwin.hpp)
        ZafSpinControl                        (z_spin.hpp)
        ZafStatusBar                        (z_status.hpp)
        ZafTable                             (z_table.hpp)
        ZafTableHeader                       (z_table.hpp)
        ZafTableRecord                       (z_table.hpp)
        ZafText                               (z_text.hpp)
        ZafToolBar                            (z_tbar.hpp)
        ZafTreeItem                           (z_tree.hpp)
        ZafTreeList                           (z_tree.hpp)
        ZafVtList                            (z_vlist.hpp)
        ZafWindowManager                       (z_win.hpp)
```

```
ZafEraStruct                                       (z_loc.hpp)
ZafErrorStub                                     (z_error.hpp)
    ZafErrorSystem                               (z_error.hpp)
ZafEventMap                                        (z_win.hpp)
ZafEventStruct                                   (z_event.hpp)
ZafFile                                             (z_file.hpp)
    ZafDiskFile                                 (z_dskfil.hpp)
    ZafStorageFile                               (z_store.hpp)
ZafFileInfoStruct                                 (z_file.hpp)
ZafFileSystem                                     (z_file.hpp)
    ZafDiskFileSystem                           (z_dskfil.hpp)
    ZafStorage                                   (z_store.hpp)
ZafHelpStub                                       (z_help.hpp)
    ZafHelpSystem <- ZafWindow                    (z_help.hpp)
ZafImageStruct                                     (z_dsp.hpp)
    ZafBitmapStruct                                (z_dsp.hpp)
        ZafBitmapData <- ZafImageData           (z_bitmap.hpp)
    ZafIconStruct                                  (z_dsp.hpp)
        ZafIconData <- ZafImageData               (z_icon.hpp)
    ZafMouseStruct                                 (z_dsp.hpp)
        ZafMouseData <- ZafImageData            (z_mouse1.hpp)
ZafKeyStruct                                       (z_key.hpp)
ZafLanguageStruct                                 (z_lang.hpp)
ZafList                                           (z_list.hpp)
    ZafDataRecord <- ZafData                      (z_data.hpp)
        ZafDataManager                            (z_data.hpp)
    ZafEventManager                             (z_evtmgr.hpp)
    ZafGeometryManager <- ZafWindowObject         (z_gmgr.hpp)
    ZafListBlock                                  (z_list.hpp)
        ZafQueueBlock                           (z_evtmgr.hpp)
    ZafPath                                       (z_file.hpp)
    ZafWindow <- ZafWindowObject                   (z_win.hpp)
ZafLocaleStruct                                    (z_loc.hpp)
    ZafLocaleData <- ZafI18nData                   (z_loc.hpp)
ZafMSWindowsApp                                    (w_app.hpp)
ZafNotification                                 (z_notify.hpp)
    ZafData <- ZafElement                         (z_data.hpp)
ZafPaletteMap                                     (z_pal1.hpp)
ZafPaletteStruct                                   (z_pal.hpp)
ZafScrollStruct                                  (z_scrll.hpp)
    ZafScrollData <- ZafData                    (z_scrll1.hpp)
ZafStandardArg                                  (z_stdarg.hpp)
```

ZafApplication

argc	Control	Main
argv	LinkMain	

Inheritance Root Class

Declaration `#include <z_app.hpp>`

Description ZafApplication provides a platform independent entry point for ZAF applications called ZafApplication::Main() and a mechanism for managing global objects used by these applications.

Execution of a C/C++ application begins with a call to main() or WinMain() (for Microsoft Windows applications). ZAF includes main() or WinMain() in its interface library so that it need not be provided by the ZAF developer. Instead, the ZAF developer provides ZafApplication::Main().

A ZafApplication class instance is created and destroyed within the main() or WinMain() function provided in the Zinc Application Framework library. This allows ZafApplication to perform initialization of global objects before ZafApplication::Main() is called, and to perform clean-up after. The following global pointers are initialized by the ZafApplication constructor:

- zafDisplay
- zafEventManager
- zafWindowManager
- zafLanguage
- zafLocale
- zafCodeSet
- zafI18nStorage
- zafErrorSystem
- zafSearchPath

ZafApplication also provides an event processing loop, ZafApplication::Control(). This loop controls the event flow for an application by getting events from the ZAF event manager and passing them to the window manager. It does not exit until program termination.

Constructor The ZafApplication constructor initializes global objects for use by ZAF applications. The constructor is called when a ZafApplication class instance is created inside of the main() or WinMain() function found in the library. The ZafApplication constructor should not be called by the ZAF developer.

ZafApplication(int argc, char **argv);

The *argc* and *argv* parameters are equivalent to the parameters passed to a program's main() function. *argc* is an integer containing the number of arguments passed to the program, and *argv* is an array of strings representing the arguments passed to the program. argv[0] always contains the full path name of the program being executed. Note: Under Microsoft Windows, *argc* and *argv* are synthesized from the parameters passed to WinMain().

Several global pointers are initialized by the constructor:

- zafDisplay—a pointer to the display
- zafEventManager—a pointer to the event manager
- zafWindowManager—a pointer to the window manager
- zafLanguage—a pointer to a ZafLanguageData object containing information about active language
- zafLocale—a pointer to a ZafLocaleData object containing information about the active locale
- zafCodeSet—a pointer to a ZafCodeSetData object containing information about the active code page
- zafI18nStorage—a pointer to a ZafStorage object associated with I18N.ZNC, if it was found
- zafErrorSystem—a pointer to a ZafErrorSystem object for reporting errors
- zafSearchPath—a pointer to a ZafPath object associated with the application startup directory

In addition, ZafKeyboard, ZafMouse, ZafCursor, and ZafHelpTips devices are added to the event manager. See ZafEventManager for additional information.

Destructor

~**ZafApplication**(void);

The ZafApplication destructor destroys all objects allocated by the constructor.

Members

argc

int **argc**;
argc is an integer value specifying the number of arguments passed to the program at start-up. These arguments can be found in the argv member array.

argv

ZafIChar ****argv**;

argv is an array of strings representing the arguments passed to the program at start-up. argv[0] always contains the full path name of the program being executed. The number of arguments passed to the program is contained in argc.

Control

`ZafEventType **Control**(ZafQFlags flags = Q_NORMAL);`

Control() is an event processing loop suitable for most applications. It removes events from the event manager's event queue and passes them to the window manager. The Control() loop does not terminate until an S_EXIT is removed from the event queue or until no windows are left on the window manager.

Control() returns either S_EXIT, or S_NO_OBJECT. S_EXIT indicates that an application is terminating because an S_EXIT message was processed, while S_NO_OBJECT indicates that an application is terminating because there are no windows left to process events.

The code for ZafApplication::Control() is shown below:

```
ZafEventType ZafApplication::Control(ZafQFlags flags)
{
   // Make sure there is a window attached to the window manager.
   if (!zafWindowManager->First())
      return (S_NO_OBJECT);
   // Wait for user response.
   ZafEventStruct event;
   ZafEventType ccode;
   do
   {
      if (zafEventManager->Get(event, flags) == 0)
         ccode = zafWindowManager->Event(event);
   } while (ccode != S_EXIT && ccode != S_NO_OBJECT);
   // Return the final code.
   return (ccode);
}
```

It is sometimes desirable to process special events or to perform other special actions inside of the control loop. In such cases, a custom control loop can be written and the code above can be used as a starting point. See ZafEventManager and ZafWindowManager for details on relevant functions.

LinkMain

`void **LinkMain**(void);`

LinkMain() is a stub used to overcome a deficiency with some linkers. If main() (or WinMain()) is not found in an object file, most linkers will search the libraries to find it. Some, however, do not. Since main() is included in the interface library, linkers that do not look for it there may not find it and generate an error. ZAF developers who run into this error can resolve it by adding a call to LinkMain() inside of ZafApplication::Main().

Main

`int Main(void);`

Main() is the entry point for a ZAF application and must be provided by the ZAF programmer. Execution of a C/C++ application begins with a call to main() (or WinMain() for Microsoft Windows applications). ZAF includes main() or WinMain() in its interface library so that it need not be provided by the ZAF developer. Instead, the ZAF developer provides the ZafApplication::Main() function. This provides a platform independent entry point for all ZAF applications.

The code below shows the Main() function for a simple ZAF application:

```
int ZafApplication::Main()
{
  zafWindowManager->Add(new HellowWindow());
  Control();
  return (0);
}
```

The argc and argv member variables can be used in place of the parameters normally passed to a C/C++ main() function. These variables are initialized in the ZafApplication constructor (see argc and argv).

Main() is typically where the user would reinitialize internationalization for the program. For more information on adding internationalization, see the ZafI18nData chapter.

ZafAttachment

Event	Reference	Type
Offset	SetReference-NumberID	
OppositeSide	Stretch	

Inheritance `ZafAttachment : ZafConstraint : ZafElement`

Declaration `#include <z_gmgr.hpp>`

Description ZafAttachment geometry management constraints allow window objects to be attached to the edges of sibling or parent window objects. ZafAttachment constraints must be added to the ZafGeometryManager object that has been added to the managed object's parent. (See ZafGeometryManager for more information.)

Constructors All ZafAttachment constructors initialize the member variables associated with an instantiated ZafAttachment object. The default values set by the ZafAttachment and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafAttachment

`Offset()`	`-1`
`OppositeSide()`	`false`
`Reference()`	`null`
`Stretch()`	`false`
`Type()`	`user-supplied parameter`

ZafElement

`ClassID()`	`ID_ZAF_ATTACHMENT`
`ClassName()`	`"ZafAttachment"`

```
ZafAttachment(ZafWindowObject *object, ZafAttachmentType
   type);
```

This constructor is useful in straight-code situations to create a ZafAttachment object. *object* specifies the window object the constraint applies to, and *type* specifies the type of attachment constraint. See ZafConstraint::Object() and ZafAttachment::Type() for more information.

`**ZafAttachment**(const ZafAttachment &copy);`

The copy constructor creates a new ZafAttachment object and initializes its data from *copy*.

```
ZafAttachment(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. Refer to `ZafWindow` for more information, since most persistence is done at the ZafWindow level.

An example of how to create an attachment constraint follows:

```
// Create a status bar with geometry-managed children.
ZafStatusBar *stat = new ZafStatusBar(0, 0, 0, 1);
ZafString *string = new ZafString(0, 0, 15, new
   ZafStringData("String"));
stat->Add(string);
ZafTime *time = new ZafTime(15, 0, 15, new ZafTimeData);
stat->Add(time);

// Time field will remain at the right side.
ZafAttachment *attach = new ZafAttachment(time, ZAF_ATCF_RIGHT);
attach->SetOffset(0);

// Create the geometry manager and add the first constraint.
ZafGeometryManager *geo = new ZafGeometryManager;
geo->Add(attach);

// String field will occupy the remaining space.
attach = new ZafAttachment(string, ZAF_ATCF_RIGHT);
attach->SetStretch(true);
attach->SetReference(time);
attach->SetOppositeSide(true);
attach->SetOffset(1);

// Add the second constraint to the geometry manager.
geo->Add(attach);

// Add the geometry manager to the status bar.
stat->Add(geo);
```

Destructor `virtual ~**ZafAttachment**(void);`

The destructor is used to free the memory associated with a ZafAttachment object. It chains to the ZafConstraint and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafAttachment object, since it is automatically destroyed when its parent geometry manager is destroyed. For more information on child object deletion, see the ZafWindow destructor.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events sent to the ZafAttachment object. The events handled by ZafAttachment are as follows:

ZafEventType	**Description**
S_COMPUTE_SIZE	causes the constraint to compute and modify the size or position of its window object
S_INITIALIZE	causes the constraint to initialize its numberID, stringID, Object(), and Reference()

Offset

```
int Offset(void) const;
int SetOffset(int offset);
```

Offset() is the distance from the edge of the Reference() object that the edge of Object() is positioned. Distances depend on Type() and OppositeSide(), and are specified in the same coordinate type as Object()->Region().

For example, if Type() is ZAF_ATCF_LEFT, Offset() is 0, and OppositeSide() is false, then the left edge of Object() will be set to the same value as the left edge of Reference(). This attribute defaults to -1, requiring the programmer to change it with SetOffset().

OppositeSide

```
bool OppositeSide(void) const;
bool SetOppositeSide(bool oppositeSide);
```

If OppositeSide() is true, then the opposite edge of the Reference() object is used when computing the position of Object().

For example, if Type() is ZAF_ATCF_LEFT, Offset() is 10, and Opposite-Side() is true, then the left edge of Object() will be set to 10 pixels to the right of the right edge of Reference(). If OppositeSide() is false, then the left edge of Object() would be set to 10 pixels to the right of the left edge of Reference(). This attribute defaults to false, but the programmer may change it with SetOppositeSide().

Reference

```
ZafWindowObject *Reference(void);
ZafError SetReference(ZafWindowObject *reference);
```

Reference() is the window object whose Region() is used when computing the position of Object() (or the object to which this object is attached). If Reference() is null, the Region() of the parent of Object() is used as a reference. This attribute defaults to null, but the programmer may change it with SetReference().

SetReference-NumberID

```
void SetReferenceNumberID(ZafNumberID referenceNumberID);
```

SetReferenceNumberID() specifies to the constraint the numberID of the Reference() object. When reading a constraint from a persistent data file, the constraint is tied to its Reference() object via the numberID. *referenceNumberID* is the numberID of the Reference() object.

Stretch

```
bool Stretch(void) const;
bool SetStretch(bool stretch);
```

If Stretch() is true, then the opposite side of Object() than that specified by Type() is not modified. For example, if Type() is ZAF_ATCF_RIGHT, Offset() is 0, and Stretch() is true, then the right edge of Object() will be set to the same value as the right edge of Reference() and the left edge of Object() will remain where it is, in effect making it possible to stretch Object(). If Stretch() is false, then the left edge of Object() would be modified so that the width of Object() would remain the same. This attribute defaults to false, but the programmer may change it with SetStretch().

Type

```
ZafAttachmentType Type(void) const;
ZafAttachmentType SetType(ZafAttachmentType type);
```

Type() is the attachment constraint's type, which specifies the side of Object() used when calculating its position. If OppositeSide() is false, then Type() also specifies the side of the Reference() object used when calculating the position of Object(). If OppositeSide() is true, then the opposite side of the Reference()

object is used when calculating the position of Object(). The programmer may use SetType() to change this attribute. The possible values for Type() follow:

Type()	**Description**
`ZAF_ATCF_BOTTOM`	causes the constraint to affect the bottom side of Object()
`ZAF_ATCF_LEFT`	causes the constraint to affect the left side of Object()
`ZAF_ATCF_RIGHT`	causes the constraint to affect the right side of Object()
`ZAF_ATCF_TOP`	causes the constraint to affect the top side of Object()

ZafBignum

BignumData	Event

Inheritance `ZafBignum : ZafString : ZafWindowObject : ZafElement`

Declaration `#include <z_bnum1.hpp>`

Description

ZafBignum is a single-line arbitrary precision numeric object designed for financial and scientific use. ZafBignum allows user input through the keyboard. ZafBignum is fully internationalized to display and input using any format.

All ZafBignum objects refer to data contained in a ZafBignumData object (refer to this class for additional essential information).

Formats

ZafString and derived classes parse input and display output based on default or programmer-defined input and output formats. Programmers may use the SetInputFormat() and SetOutputFormat() families of functions to change the default format. These functions are documented in the ZafString reference.

Each class derived from ZafFormatData handles a different set of formatting arguments, in addition to those supported by its base classes. ZafBignumData (and therefore ZafBignum) handles the following arguments in addition to those used by ZafReal, ZafInteger, and ZafString:

Format Argument	Substitution
%[$ @+-,]B	Bignum, with any combination of the following options:
$	adds the currency symbol
’ ’ (space character)	inserts a space between the currency symbol and the number
@	adds credit symbols such as parens for a negative number
+	adds a positive sign for positive numbers
-	causes the bignum to be left-justified
,	adds thousands separators

Constructors

All ZafBignum constructors initialize the member variables associated with an instantiated ZafBignum object. The default values set by the ZafBignum and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafBignum. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafBignum	
`BignumData()`	`null`
ZafString	
`LowerCase()`	`false`†
`Password()`	`false`†
`StringData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_BIGNUM`
`ClassName()`	`"ZafBignum"`

```
ZafBignum(int left, int top, int width, long value);
ZafBignum(int left, int top, int width, double value);
```

These constructors are useful in straight-code situations, particularly if the ZafBignum object is to create, maintain and destroy its own ZafBignumData object automatically. *left*, *top*, and *width* specify the position and size of the object on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

value is the value that initially appears in the new ZafBignum object and can be either an integral or a floating point value.

```
ZafBignum(int left, int top, int width, ZafBignumData
    *bignumData = ZAF_NULLP(ZafBignumData));
```

This constructor is useful in straight-code situations where a ZafBignumData object has already been created. This constructor could be used when manually maintaining a ZafBignumData object, rather than having the ZafBignum class create and maintain the data object automatically. For more information on using ZafBignumData objects, see the chapter on ZafBignumData. See the previous constructor for a description of *left*, *top*, and *width* parameters.

ZafBignum(const ZafBignum &copy);

The copy constructor calls the overloaded Duplicate() to create a new ZafBignum object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafBignum object simply points to the original data, otherwise StaticData() copies are made.

ZafBignum(const ZafIChar *name, ZafObjectPersistence
&persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafBignum creation techniques follow:

```
// Create a sample window with bignum objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Create bignum objects and pass in the values directly.
window1->Add(new ZafBignum(0, 1, 25, 3.1415927));
window1->Add(new ZafBignum(0, 2, 25, 100));
...
// Create a sample window with bignum objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
// Create bignum data objects.
ZafBignumData *bigData1 = new ZafBignumData(3.1415927);
ZafBignumData *bigData2 = new ZafBignumData(100);
// Create bignums that use the data previously created.
window2->Add(new ZafBignum(0, 1, 25, bigData1));
window2->Add(new ZafBignum(0, 2, 25, bigData2));
```

Destructor

virtual ~**ZafBignum**(void);

The destructor is used to free the memory associated with a ZafBignum object, including all data objects that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafBignum object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

BignumData

ZafBignumData ***BignumData**(void) const;
virtual ZafError **SetBignumData**(ZafBignumData
*bignumData);

*BignumData() contains the actual information used by ZafBignum. The BignumData() object may be used by one or more ZafBignum objects, or other objects. If shared, all associated ZafBignum objects will be notified when the

BignumData() changes. For more information on data sharing in ZAF, see ZafDataManager. SetBignumData() will delete the previous BignumData() object if it is Destroyable() and no other object uses it.

BignumData() returns a pointer to the BignumData() object associated with the ZafBignum object. The return value for SetBignumData() is normally ZAF_ERROR_NONE. See the constructor code snippet for an example using ZafBignumData objects with ZafBignum.

Event

`virtual ZafEventType **Event**(const ZafEventStruct &event);`

This overloaded function receives all events that get sent to the ZafBignum object and either handles them or passes them to ZafString, its immediate base class. See ZafWindowObject for more information.

ZafBignum specifically handles the following events:

Event	**Description**
N_RESET_I18N	causes the object to redisplay its data according to the new internationalization values
S_COPY_DATA	causes the object to copy event.windowObject's BignumData() if event.windowObject is a ZafBignum object
S_SET_DATA	causes the object to create a new BignumData() object, then copy into it event.windowObject's BignumData() if event.windowObject is non-null and is a ZafBignum object

ZafBignumData

Clear	operator +	operator /=
double	operator ++	operator %=
FormattedText	operator *	operator ==
IValue	operator /	operator !=
long	operator %	operator <
RValue	operator =	operator <=
SetBignum	operator +=	operator >
operator -	operator -=	operator >=
operator --	operator *=	

Inheritance

`ZafBignumData : ZafFormatData : ZafData : (ZafElement, ZafNotification)`

Declaration

`#include <z_bnum.hpp>`

Description

ZafBignumData objects can be used to store and manipulate large numeric values to an arbitrary level of precision. Internally, ZafBignumData uses BCD (Binary Coded Decimal) representation to store and manipulate large numbers.

ZafBignumData combines number encapsulation with data and object notification from ZafData. It is most often used in conjunction with the ZafBignum user interface object but may be used as a stand-alone object if desired.

Numeric precision of ZafBignumData defaults to thirty digits to the left of the decimal and eight to the right. If desired, this precision may be changed by rebuilding the library after changing two constants (ZAF_NUMBER_WHOLE, ZAF_NUMBER_DECIMAL) in z_bnum.hpp.

All ZafData objects may make use of printf-style formatting and parsing arguments during string operations. In addition to printf arguments normally used by real and integer data types, ZafBignumData adds additional custom arguments (conversion characters) to those normally available to the printf family of functions:

Format conversion char	Description
`"B"`	Formats the printf() argument as a bignum. The stream is right-padded with zeros to the full precision of a bignum. Leading zeros are suppressed.
Parse conversion char	
`"B"`	Parses a scanf() stream component as a bignum and stores the resulting value in the supplied bignum argument.

Refer to standard library documentation for detailed information on printf functions and conversion characters.

Constructors

ZafBignumData constructors initialize the member variables associated with a new ZafBignumData object and allocate space to hold the bignum data.

The default values set by ZafBignumData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafBignumData	
`IValue()`	`(varies by constructor)`
`RValue()`	`(varies by constructor)`
ZafElement	
`ClassID()`	`ID_ZAF_BIGNUM_DATA`
`ClassName()`	`"ZafBignumData"`

`ZafBignumData``(void);`

The basic constructor allocates a ZafBignumData instance and initializes its value to 0.

`ZafBignumData``(long value);`
`ZafBignumData``(double value);`

These constructors allocate a ZafBignumData instance and initialize its contents to *value*. Since a compiler error may result in passing a value of type int, such a value must be explicitly cast by the programmer. The data is automatically converted to its equivalent BCD representation and stored in an internal buffer.

ZafBignumData`(const ZafIChar *string, const ZafIChar *format = ZAF_NULLP(ZafIChar));`

This constructor allocates a ZafBignumData instance and initializes its value to the numeric equivalent of *string*. The conversion uses the printf-style specifier *format* to interpret the string. If *format* is null ZafBignumData uses its locale-specific default format.

ZafBignumData`(const ZafBignumData &copy);`

This constructor is the copy constructor. It allocates a new ZafBignumData instance and copies all member data from *copy*.

ZafBignumData`(const ZafIChar *name, ZafDataPersistence &persist);`

This constructor is the persistent constructor. It allocates a new ZafBignum-Data instance and reads most member data from the *name* directory of the persistent data file referred to by *persist*. The StringID() of the new data is *name*.

```
// Sample ZafBignumData creation techniques
double value = 123.45;
ZafBignumData bignum1(value);
ZafBignumData copyBignum = bignum1;
ZafBignumData stringBignum("123.45");
ZafBignumData zeroBignum;
```

Destructor

`virtual ~`**ZafBignumData**`(void);`

The destructor is used to free the memory associated with an instantiated Zaf-BignumData object. A ZafBignumData object is usually destroyed automatically when all ZafBignum objects that refer to it are destroyed (unless the last ZafBignum object referring to the ZafBignumData object has its StaticData() set to true).

Members

Clear

`virtual void` **Clear**`(void);`

Clear() sets the value of a ZafBignumData object to zero.

double

```
operator double();
```

See RValue().

FormattedText

```
virtual int FormattedText(ZafIChar *buffer, int
    maxLength, const ZafIChar *format = 0) const;
```

FormattedText() fills *buffer* with a string representation of the ZafBignumData using the printf-style specifier *format* to build the string. A locale-specific default format is used if *format* is not included. Buffer contents will be truncated if they exceed *maxLength* characters. FormattedText() returns the integer value it receives from its call to Sprintf().

```
// Show various results of FormattedText().
ZafIChar buffer[256];

ZafBignumData bignum(12345.6789);
bignum.FormattedText(buffer, 256);
printf("bignum - %s\n", buffer);

bignum.FormattedText(buffer, 256, "%.0B");
printf("integer - %s\n", buffer);

bignum.FormattedText(buffer, 256, "%5.2B");
printf("real - %s\n", buffer);

==========
bignum - 12345.67890000
integer - 12346
real - 12345.68
```

IValue
long

```
long IValue(void) const;
operator long();
```

IValue() returns the integer equivalent of a ZafBignumData object as a long. The convenience operator long(), which returns IValue(), is more commonly used.

In the examples below, note that the compiler must be able to resolve static values to longs or doubles to properly interpret the overloaded operator.

```
// Perform numerical operations on a bignum.

ZafBignumData bignum(12345.6789);
bignum = bignum.IValue() + 1.0;
printf("bignum - %b\n", bignum);
```

```
bignum = bignum - 0.1;
printf("bignum - %b\n", bignum);

==========
bignum - 12346.00000000
bignum - 12345.90000000
```

```
operator long();
```

See IValue().

RValue

```
double RValue(void) const;
operator double();
```

RValue() returns the real value of a ZafBignumData object as a double. The convenience operator double(), which returns RValue(), is more commonly used.

In the examples below, note that the compiler must be able to resolve static values to longs or doubles to properly interpret the overloaded operator. Compare the following code to the IValue() code above.

```
// Perform numerical operations on a bignum.

ZafBignumData bignum(12345.6789);
bignum = bignum.RValue() + 1.0;
printf("bignum - %B\n", bignum);

bignum = double(bignum) - 0.1;
printf("bignum - %B\n", bignum);

==========
bignum - 12346.67890000
bignum - 12346.57890000
```

SetBignum

```
virtual ZafError SetBignum(long value);
virtual ZafError SetBignum(double value);
virtual ZafError SetBignum(const ZafIChar *buffer, const
    ZafIChar *format);
virtual ZafError SetBignum(const ZafBignumData &number);
```

SetBignum() functions set the value of the ZafBignumData object from various numeric input types, sscanf-style specifiers *buffer* and *format* (if not included, a locale-specific default format is used), or another bignum. Refer to

FormattedText() for more information on bignum/string conversions. The overloaded operator = offers similar functionality to SetBignum().

operator -

ZafBignumData **operator-**(const ZafBignumData &number1, const ZafBignumData &number2);

ZafBignumData **operator-**(const ZafBignumData &number, long value);

ZafBignumData **operator-**(long value, const ZafBignumData &number);

ZafBignumData **operator-**(const ZafBignumData &number, double value);

ZafBignumData **operator-**(double value, const ZafBignumData &number);

These operators allow simple inline subtraction operations involving ZafBignumData objects, longs and doubles. The following code shows the proper use of these operators:

```
// Create some ZafBignumData objects.
ZafBignumData big1(1000), big2(500000), big3(2000000);
// Create another ZafBignumData object and modify the others.
ZafBignumData big4 = big2 - big1;
big3 -= big4;
big1--;
// Compare two of the objects.
if (big4 > big3)
  return (-1);
```

operator --

ZafBignumData **operator--**(void);

ZafBignumData **operator--**(int);

These pre- and post-operators decrement the ZafBignumData object's value by 1. See operator - for sample code.

operator +

ZafBignumData **operator+**(const ZafBignumData &number1, const ZafBignumData &number2);

ZafBignumData **operator+**(const ZafBignumData &number, long value);

ZafBignumData **operator+**(long value, const ZafBignumData &number);

ZafBignumData **operator+**(const ZafBignumData &number, double value);

```
ZafBignumData operator+(double value, const ZafBignumData
    &number);
```

These operators allow simple inline addition operations involving ZafBignum-Data objects, longs and doubles. See operator - for sample code.

operator ++

```
ZafBignumData operator++(void);
ZafBignumData operator++(int);
```

These pre- and post-operators increment the ZafBignumData object's value by 1. See operator - for sample code.

*operator **

```
ZafBignumData operator*(const ZafBignumData &number1,
    const ZafBignumData &number2);
ZafBignumData operator*(const ZafBignumData &number, long
    value);
ZafBignumData operator*(long value, const ZafBignumData
    &number);
ZafBignumData operator*(const ZafBignumData &number,
    double value);
ZafBignumData operator*(double value, const ZafBignumData
    &number);
```

These operators allow simple inline multiplication operations involving Zaf-BignumData objects, longs and doubles. See operator - for sample code.

operator /

```
ZafBignumData operator/(const ZafBignumData &number1,
    const ZafBignumData &number2);
ZafBignumData operator/(const ZafBignumData &number, long
    value);
ZafBignumData operator/(long value, const ZafBignumData
    &number);
ZafBignumData operator/(const ZafBignumData &number,
    double value);
ZafBignumData operator/(double value, const ZafBignumData
    &number);
```

These operators allow simple inline division operations involving ZafBignum-Data objects, longs and doubles. See operator - for sample code.

operator %

```
ZafBignumData operator%(const ZafBignumData &number1,
    const ZafBignumData &number2);
```

```
ZafBignumData operator%(const ZafBignumData &number, long
    value);
ZafBignumData operator%(long value, const ZafBignumData
    &number);
ZafBignumData operator%(const ZafBignumData &number,
    double value);
ZafBignumData operator%(double value, const ZafBignumData
    &number);
```

These operators allow simple inline modulus operations involving ZafBignum-Data objects, longs and doubles. See operator - for sample code.

operator =

```
ZafBignumData &operator=(long value);
ZafBignumData &operator=(double value);
```

These operators assign the ZafBignumData object's value to the input *value* which may be a long, double, or another ZafBignumData. See operator - for sample code.

operator +=

```
ZafBignumData &operator+=(long value);
ZafBignumData &operator+=(double value);
```

These operators increment the ZafBignumData object's value by the input *value*. See operator - for sample code.

operator -=

```
ZafBignumData &operator-=(const ZafBignumData &number);
ZafBignumData &operator-=(long value);
ZafBignumData &operator-=(double value);
```

These operators decrement the ZafBignumData object's value by the input *value*. See operator - for sample code.

*operator *=*

```
ZafBignumData &operator*=(const ZafBignumData &number);
ZafBignumData &operator*=(long value);
ZafBignumData &operator*=(double value);
```

These operators multiply the ZafBignumData object's value by the input value and use the resulting product to set the ZafBignumData object's *value*. See operator - for sample code.

operator /=

```
ZafBignumData &operator/=(const ZafBignumData &number);
ZafBignumData &operator/=(long value);
ZafBignumData &operator/=(double value);
```

These operators divide the ZafBignumData object's value by the input value and use the resulting quotient to set the ZafBignumData object's value. *value* is used as the divisor. See operator - for sample code.

operator %=

```
ZafBignumData &operator%=(const ZafBignumData &number);
ZafBignumData &operator%=(long value);
ZafBignumData &operator%=(double value);
```

These operators work exactly the same as the /= operators above, but use the operation's remainder to set the ZafBignumData's value. See operator - for sample code.

operator ==

```
bool operator==(const ZafBignumData &number1, const
   ZafBignumData &number2)
bool operator==(const ZafBignumData &number, long value)
bool operator==(long value, const ZafBignumData &number)
bool operator==(const ZafBignumData &number, double
   value)
bool operator==(double value, const ZafBignumData
   &number)
```

operator !=

```
bool operator!=(const ZafBignumData &number1, const
   ZafBignumData &number2)
bool operator!=(const ZafBignumData &number, long value)
bool operator!=(long value, const ZafBignumData &number)
bool operator!=(const ZafBignumData &number, double
   value)
bool operator!=(double value, const ZafBignumData
   &number)
```

These operators allow simple inline equivalence comparisons between ZafBignumData objects, longs and doubles. See operator - for sample code.

operator <

```
bool operator<(const ZafBignumData &number1, const
   ZafBignumData &number2)
bool operator<(const ZafBignumData &number, long value)
bool operator<(long value, const ZafBignumData &number)
bool operator<(const ZafBignumData &number, double value)
bool operator<(double value, const ZafBignumData &number)
```

operator <=

```
bool operator<=(const ZafBignumData &number1, const
   ZafBignumData &number2)
bool operator<=(const ZafBignumData &number, long value)
bool operator<=(long value, const ZafBignumData &number)
bool operator<=(const ZafBignumData &number, double
   value)
bool operator<=(double value, const ZafBignumData
   &number)
```

operator >

```
bool operator>(const ZafBignumData &number1, const
   ZafBignumData &number2)
bool operator>(const ZafBignumData &number, long value)
bool operator>(long value, const ZafBignumData &number)
bool operator>(const ZafBignumData &number, double value)
bool operator>(double value, const ZafBignumData &number)
```

operator >=

```
bool operator>=(const ZafBignumData &number1, const
   ZafBignumData &number2)
bool operator>=(const ZafBignumData &number, long value)
bool operator>=(long value, const ZafBignumData &number)
bool operator>=(const ZafBignumData &number, double
   value)
bool operator>=(double value, const ZafBignumData
   &number)
```

These operators allow simple inline magnitude comparisons between ZafBignumData objects, longs and doubles. See operator - for sample code.

ZafBitmapData

Array	Height	Width
Clear	SetBitmap	operator =

Inheritance

```
ZafBitmapData : ((ZafImageData : ZafData :
   (ZafNotification, ZafElement)), ZafBitmapStruct)
```

Declaration

```
#include <z_bitmap.hpp>
```

Description

ZafBitmapData objects can be used to store and manipulate bitmap information. ZafBitmapData is used in conjunction with ZAF classes that utilize bitmap information, such as ZafButton.

Constructors

All ZafBitmapData constructors initialize the member variables associated with an instantiated ZafBitmapData object. The default values set by the ZafBitmapData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafBitmapData	
`Array()`	`null`
ZafElement	
`ClassID()`	`ID_ZAF_BITMAP_DATA`
`ClassName()`	`"ZafBitmapData"`

ZafBitmapData`(const ZafImageStruct &data);`
ZafBitmapData`(const ZafBitmapStruct &data);`

These constructors allocate a ZafBitmapData instance and initialize its data to the values in *data*.

ZafBitmapData`(const ZafBitmapData &copy);`

The copy constructor creates a new ZafBitmapData object and initializes its data from *copy*.

`ZafBitmapData(const ZafIChar *name, ZafDataPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code snippet shows how to create a ZafBitmapData object:

```
// Create a bitmap array.
#define gnd ZAF_CLR_BACKGROUND
#define blk ZAF_CLR_BLACK
static ZafLogicalColor ZAF_FARDATA upArrowArray[28] =
{
   gnd,gnd,gnd,blk,gnd,gnd,gnd,
   gnd,gnd,blk,blk,blk,gnd,gnd,
   gnd,blk,blk,blk,blk,blk,gnd,
   blk,blk,blk,blk,blk,blk,blk
};
static ZafBitmapStruct upArrowStruct(7, 4, upArrowArray, true);

// Create ZafBitmapData objects based on the bitmap array.
ZafBitmapData bitmap1(upArrowStruct);
ZafBitmapData bitmap2(bitmap1);
```

Destructor

`virtual ~ZafBitmapData(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafBitmapData object.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Array

`ZafLogicalColor *Array(void) const;`

Array() returns the portable logical color array that the bitmap data is based on. This array is converted to a native environment bitmap handle. Each element of the array is a ZAF logical color. See ZafDisplay for more information.

Clear

`virtual void Clear(void);`

Clear() destroys the portable Array() if StaticArray() is false, and it destroys the environment handle if StaticHandle() is false. Regardless of StaticArray()

and StaticHandle(), the portable Array() and the environment handle are both set to null, effectively clearing the bitmap data.

Height

```
int Height(void) const;
```

Height() returns the height of the bitmap data.

SetBitmap

```
virtual ZafError SetBitmap(int width, int height,
   ZafLogicalColor *array);
virtual ZafError SetBitmap(const ZafBitmapStruct
   &bitmap);
```

These functions copy the data passed in to the ZafBitmapData object. *width* and *height* are the width and height of *array*, respectively. If StaticArray() is true, *array* becomes Array(); otherwise, a new array is created for Array(). In the second function, the data is copied from *bitmap*. These functions always return ZAF_ERROR_NONE.

Width

```
int Width(void) const;
```

Width() returns the width of the bitmap data.

operator =

```
ZafBitmapData &operator=(const ZafBitmapData &bitmap);
```

This operator copies the data from *bitmap* into this ZafBitmapData object.

ZafBitmapStruct

StaticHandle

Inheritance `ZafBitmapStruct : ZafImageStruct`

Declaration `#include <z_dsp.hpp>`

Description ZafBitmapStruct is used to store bitmap information. The base ZafImageStruct stores the portable image array using elements of ZafLogicalColors, and ZafBitmapStruct defines additional members that store environment-specific structures for the bitmap filled by the ZafDisplay conversion function ZafDisplay::ConvertToOSBitmap().

Constructors All ZafBitmapStruct constructors initialize the member variables associated with an instantiated ZafBitmapStruct object. The default values set by the ZafBitmapStruct constructors follow.

Member Initializations

ZafBitmapStruct	
`StaticHandle()`	`false`
ZafImageStruct	
`array`	`null`
`height`	`0`
`StaticArray()`	`false`
`width`	`0`

`ZafBitmapStruct``(void);`

This constructor allocates a ZafBitmapStruct instance and initializes its data to indicate that no bitmap information has been set.

`ZafBitmapStruct``(const ZafImageStruct &data);`

This constructor allocates a ZafBitmapStruct instance and initializes its data to the values in *data*. The environment-specific bitmap information is initialized to indicate that the bitmap has not yet been converted.

`ZafBitmapStruct(int width, int height, ZafLogicalColor *array, bool staticArray);`

This constructor allocates a ZafBitmapStruct instance and initializes its data to the values passed in. *width* and *height* indicate the size of the image, *array* specifies a pointer to the portable array of ZafLogicalColors, and *staticArray* indicates if *array* is declared static.

The following code snippet shows how to create a ZafBitmapStruct object:

```
// Create a bitmap structure.
#define gnd ZAF_CLR_BACKGROUND
#define blk ZAF_CLR_BLACK
static ZafLogicalColor ZAF_FARDATA upArrowArray[28] =
{
   gnd,gnd,gnd,blk,gnd,gnd,gnd,
   gnd,gnd,blk,blk,blk,gnd,gnd,
   gnd,blk,blk,blk,blk,blk,gnd,
   blk,blk,blk,blk,blk,blk,blk
};
static ZafBitmapStruct upArrowStruct(7, 4, upArrowArray, true);
```

Members

StaticHandle

```
bool StaticHandle(void) const;
bool SetStaticHandle(bool staticHandle);
```

If StaticHandle() is true, the environment-specific information (generally known as a handle) of the ZafBitmapStruct is recognized as static, so that it will not be deleted by ZAF, and may be used by several ZafBitmapStruct objects. This attribute is initialized to false, but it may be changed with SetStaticHandle(). Both functions return the current value of the StaticHandle() attribute.

ZafBorder

Width

Inheritance ZafBorder : ZafWindowObject : ZafElement

Declaration #include <z_border.hpp>

Description The ZafBorder object may only be added to a ZafWindow. The ZafBorder is the border decoration on a ZafWindow, and is generally drawn by the environment. The width of the ZafBorder is therefore determined by the environment, and may not be modified by the programmer in most cases. The ZafBorder is used to size the parent window with the ZafMouse device.

Constructors All ZafBorder constructors initialize the member variables associated with an instantiated ZafBorder object. The default values set by the ZafBorder and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafBorder. "†"Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafBorder	
`Width()`	`Environment specific`
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`CopyDraggable()`	`false`†
`Disabled()`	`false`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`QuickTip()`	`null`†
`RegionType()`	`ZAF_OUTSIDE_REGION`†
`Selected()`	`false`†

Member Initializations

`SupportObject()`	`true`†
`UserFunction()`	`null`†
ZafElement	
`ClassID()`	`ID_ZAF_BORDER`
`ClassName()`	`“ZafBorder”`
`NumberID()`	`ZAF_NUMID_BORDER`
`StringID()`	`“ZAF_NUMID_BORDER”`

ZafBorder(void);

The first constructor is useful in straight-code situations, and is used to instantiate a ZafBorder object to be added to a ZafWindow object.

`ZafBorder(const ZafBorder &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafBorder object and copies the object’s information.

```
ZafBorder(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. The parameters and values of this constructor are deferred to the `ZafWindow` section of this manual, since most persistence is done at the ZafWindow level.

Below is a simple example:

```
// Create a sample window.
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
ZafBorder *border = new ZafBorder;
window->Add(border);
```

Destructor

`virtual ~ZafBorder(void);`

The destructor is used to free the memory associated with a ZafBorder object. It chains to the ZafWindowObject and ZafElement destructors. Generally, the programmer will not directly destroy a ZafBorder object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Width

```
virtual int Width(void);
virtual ZafError SetWidth(int width);
```

Since a ZafBorder object is normally a decoration added to the window by the host environment, the width of a ZafBorder is usually dictated by the environment, and the programmer may not change it. The Width() function returns the width of the ZafBorder object.

SetWidth() allows the programmer to change the width of the ZafBorder object on environments that allow it. Normally the width of a border is set by the operating system.

ZafButton

AllowDefault	Depressed	SelectOnDownClick
AllowToggling	Depth	SendMessage
AutoRepeatSelection	Event	SendMessageText
AutoSize	HotKeyChar	SendMessageWhenSelected
BitmapData	HotKeyIndex	StringData
ButtonType	HzJustify	Text
ClearImage	Region	Value
ClearText	SelectOnDoubleClick	VtJustify

Inheritance `ZafButton : ZafWindowObject : ZafElement`

Declaration `#include <z_button.hpp>`

Description The ZafButton class provides support for native buttons, 3-D buttons, flat buttons, toolbar buttons, radio buttons and check boxes. By default, ZafButton objects support the native environment look-and-feel, but by deriving from ZafButton, the programmer may provide custom button objects.

The ZafButton class is used as a base class for other selectable action classes such as ZafIcon and ZafPopUpItem. These classes inherit much of the base functionality provided by ZafButton.

Constructors All ZafButton constructors initialize the member variables associated with an instantiated ZafButton object. Default values set by the ZafButton constructor are listed below, as well as values overridden from those set by base class constructors.

Member Initializations

ZafButton

`AllowDefault()`	`false`
`AllowToggling()`	`false`
`AutoRepeatSelection()`	`false`
`AutoSize()`	`true`
`BitmapData()`	`ZAF_NULLP(ZafBitmapData)`
`ButtonType()`	`ZAF_NATIVE_BUTTON`
`Depressed()`	`false`
`Depth()`	`2`
`HotKeyChar()`	`'\0'`
`HotKeyIndex()`	`-1`
`HzJustify()`	`ZAF_HZ_CENTER`
`SelectOnDoubleClick()`	`false`

Member Initializations

`SelectOnDownClick()`	`false`
`SendMessageText()`	`null`
`SendMessageWhen-Selected()`	`false`
`StringData()`	`ZAF_NULLP(ZafStringData)`
`Value()`	`0`
`VtJustify()`	`ZAF_VT_CENTER`
ZafElement	
`ClassID()`	`ID_ZAF_BUTTON`
`ClassName()`	`"ZafButton"`

```
ZafButton(int left, int top, int width, int height, const
    ZafIChar *text, ZafBitmapData *bitmapData =
    ZAF_NULLP(ZafBitmapData), ZafButtonType buttonType =
    ZAF_NATIVE_BUTTON);
```

This constructor is useful in straight-code situations, particularly if you wish the ZafButton object to create, maintain and destroy its own ZafStringData object automatically. Simply pass the string into the *text* parameter. *left* and *top* specify the position where the left and top of the button will be placed on its parent. *width* and *height* specify the width and height of the button. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

bitmapData specifies the bitmap to be displayed on the button object. *buttonType* specifies the type of button to be created. See ButtonType() for more information on button types.

```
ZafButton(int left, int top, int width, int height,
    ZafStringData *stringData, ZafBitmapData *bitmapData =
    ZAF_NULLP(ZafBitmapData), ZafButtonType buttonType =
    ZAF_NATIVE_BUTTON);
```

This constructor is also useful in straight-code situations, particularly if you have already created a ZafStringData object to be associated with the button. This constructor could be used to maintain string data pieces manually, rather than having the ZafButton class create and maintain the string data pieces automatically. For example, to maintain a database of ZafStringData objects and tie them into ZafButton objects, maintain some ZafStringData objects and create ZafButton objects using the ZafStringData objects. For more information on using ZafStringData objects, see ZafStringData. *stringData* specifies the string data object to be associated with the button. Either *bitmapData* or *stringData* may be null, to provide a string-only or bitmap-only button. Otherwise, this constructor (and parameters) is the same as the first.

ZafButton`(const ZafButton &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafButton object (*copy*) and copies the object's information. If the data objects are StaticData(), then the new ZafButton object simply points to the original data objects. If the data objects are not StaticData(), then a copy is made for the new ZafButton object. This behavior allows a programmer to use static data for more than one ZafButton object.

ZafButton`(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. The parameters and values of this constructor are deferred to the ZafWindow section of this manual, since most persistence is done at the ZafWindow level.

Here are some code snippets that show various ZafButton object creation techniques.

```
// Create a sample window with some button objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);

// Add the buttons to the window.
extern ZafBitmapData *bitmapData;
window1->Add(new ZafButton(1, 4, 15, 1,
   ZAF_NULLP(ZafStringData), bitmapData));
window1->Add(new ZafButton(20, 4, 15, 1, "Button2",
   ZAF_NULLP(ZafBitmapData)));
...
// Create a sample window with a group of radio buttons.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
ZafGroup *group = new ZafGroup(1, 1, 30, 5, "Group");

// Add the radio buttons to the group.
group->SetAutoSelect(true);
group->Add(new ZafButton(1, 0, 25, 1, "Choice 1",
   ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
group->Add(new ZafButton(1, 1, 25, 1, "Choice 2",
   ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
group->Add(new ZafButton(1, 2, 25, 1, "Choice 3",
   ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
```

```
group->Add(new ZafButton(1, 3, 25, 1, "Choice 4",
    ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
// Finally, add the group of radio buttons to the window.
window2->Add(group);
```

Destructor

`virtual ~`**`ZafButton`**`(void);`

The destructor is used to free the memory associated with a ZafButton object, including all the data object pieces (such as StringData()) that are Destroyable(). It chains to the ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafButton object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AllowDefault

`bool `**`AllowDefault`**`(void) const;`
`virtual bool `**`SetAllowDefault`**`(bool allowDefault);`

A default button is the button that will be selected when the user types <Enter> or <Return>. The default button commonly has a bold border around it to indicate to the user that it is the default button. If a ZafButton object is to display as the default button on a window, AllowDefault() must be true; otherwise, the default border may not be drawn, even when the button is the default button. The default value of this attribute is false, but the user may call SetAllowDefault() to change it.

In order to specify a button as the default button, ZafWindow::SetDefaultButton() must also be called. ZafWindow::SetDefaultButton() tells the parent window which button is to function as the default button, but does not set the AllowDefault() attribute on the button. SetAllowDefault(true) must be called for all the buttons that are aligned together, if one of them is to be the default button. The AllowDefault() attribute affects the visual aspect of a button, and ZafWindow::SetDefaultButton() affects which button functions as the default button on the window. Refer to ZafWindow::DefaultButton() for more information.

In edit mode, such as when modifying a ZafButton object in Zinc Designer, the ZafButton object displays a large border, indicating the largest area the object may occupy in any environment. Currently, the largest area a default button will occupy is under Motif.

The following code provides a brief example:

```
// Get the attribute.
if (object->AllowDefault())
  break;
...
// Create the OK button as the default button.
ZafButton *button1 = new ZafButton(1, 4, 12, 1, "OK",
    ZAF_NULLP(ZafBitmapData));
ZafButton *button2 = new ZafButton(15, 4, 12, 1, "Cancel",
    ZAF_NULLP(ZafBitmapData));
button1->SetAllowDefault(true);
button2->SetAllowDefault(true);
window->Add(button1);
window->Add(button2);
window->SetDefaultButton(button1);
```

AllowToggling

`bool` **`AllowToggling`**`(void) const;`
`virtual bool` **`SetAllowToggling`**`(bool allowToggling);`

A toggle button may stay in the selected or de-selected state. A check box and a radio button may be considered toggle buttons, since they keep their selection state. When the end-user clicks a toggle button, it toggles its selection state. For example, if the toggle button is in its normal state, and the user selects it, it will display itself in its selected state. For a check box, that means a mark inside its box. For a normal toggle button, the selected button stays depressed, so that the user knows that it is currently selected. AllowToggling() is false by default, but the user may call SetAllowToggling() to change it.

The following code shows how to create a toggle button:

```
// Create a toggle button.
ZafButton *button = new ZafButton(1, 4, 12, 1, "Toggle Button",
    ZAF_NULLP(ZafBitmapData));
button->SetAllowToggling(true);
```

AutoRepeat-Selection

`bool` **`AutoRepeatSelection`**`(void) const;`
`virtual bool` **`SetAutoRepeatSelection`**`(bool`
    `autoRepeatSelection);`

If AutoRepeatSelection() is true, the button performs its action repeatedly at a delay rate specified by the environment as long as the button is depressed by the user. See ZafWindowObject::InitialDelay and ZafWindowObject::Repeat-Delay for more information on the delay rate. For example, if the button is also SendMessageWhenSelected(), then the button will repeatedly post events on the event manager's queue. If a user function is specified for the button, the user function will be repeatedly called. A scroll bar's arrow button is an example of an object with this behavior. While the user selects the arrow button, the scroll bar's thumb button moves, scrolling the associated object, such as a list. The default value of this attribute is false, but the user may call SetAutoRepeatSelection() to change it.

The following code shows how to create an auto-repeat button:

```
// Create a button that automatically repeats during selection.
ZafButton *button = new ZafButton(1, 4, 12, 1, "Repeat Button",
    ZAF_NULLP(ZafBitmapData));
button->SetSendMessageWhenSelected(true);
button->SetValue(USER_ACTION_EVENT);
button->SetAutoRepeatSelection(true);
```

AutoSize

`bool` **`AutoSize`**`(void) const;`
`virtual bool` **`SetAutoSize`**`(bool autoSize);`

If AutoSize() is true, the button will automatically grow (up) vertically to the size it needs to be to display all of its data. If the button does not contain bitmap data, then the button is sized vertically to the default size used by the native environment, depending on the system font. For example, an "OK" button that is AutoSize() will be the same size as a normal "OK" button that you would see in the native environment's system utility applications. The default value of this attribute is true, but the user may call SetAutoSize() to change it.

BitmapData

`ZafBitmapData *`**`BitmapData`**`(void) const;`
`virtual ZafError` **`SetBitmapData`**`(ZafBitmapData`
`    *bitmapData);`

The BitmapData() object is where the actual bitmap data is stored. The BitmapData() may be shared among several ZafButton objects (perhaps to save memory by allowing many button objects to use the same bitmap data), or it may belong to a single ZafButton object. If shared among several ZafButton objects, all the associated ZafButton objects will be updated when the BitmapData() changes. SetBitmapData() may be used to associate a BitmapData() object with a ZafButton object. For more information on data sharing in ZAF, see ZafDataManager. SetBitmapData() will delete the previous BitmapData() object if it is Destroyable() and no other object uses it.

The return value for BitmapData() is a pointer to the BitmapData() object associated with the ZafButton object. The return value for SetBitmapData() is normally ZAF_ERROR_NONE.

The following code shows the proper use of these functions:

```
// Get the data.
const ZafBitmapData *data = button->BitmapData();
...
// Add the bitmap data.
extern ZafBitmapData *bitmapData;
button->SetBitmapData(bitmapData);
```

ButtonType

```
ZafButtonType ButtonType(void) const;
virtual ZafButtonType SetButtonType(ZafButtonType
    buttonType);
```

ButtonType() specifies the type of button a ZafButton object is. The default value of this attribute is ZAF_NATIVE_BUTTON, but the user may call Set-ButtonType() to change it. Here are the possible button types:

ButtonType()	Description
ZAF_NATIVE_BUTTON	Creates a native push button object (may look different from environment to environment)
ZAF_RADIO_BUTTON	Creates a radio button object
ZAF_CHECK_BOX	Creates a check box object
ZAF_3D_BUTTON	Creates a 3-D push button object
ZAF_FLAT_BUTTON	Creates a flat push button object
ZAF_TOOLBAR_BUTTON	Creates a push button object that displays specially to look appropriate when placed on a toolbar object

The parent's SelectionType() directly affects the behavior of buttons on a window. For example, a group with radio buttons in it must be SelectionType() == ZAF_SINGLE_SELECTION to behave as expected, and a group with check boxes in it must be SelectionType() == ZAF_MULTIPLE_SELECTION to behave as expected. Only one radio button should be selected at a time, whereas multiple check boxes may be selected at a time. This way, the parent correctly acts as the container of the button objects and the button objects need not know of their siblings' states. See ZafWindow::SelectionType() for more information.

ClearImage

```
virtual void ClearImage(void);
```

ClearImage() deletes the bitmap data portion of a ZafButton object, if the bit-map data is Destroyable(). ClearImage() is an advanced routine, and should normally not be called by the programmer. This routine is called internally by the Zinc libraries.

ClearText

```
virtual void ClearText(void);
```

ClearText() deletes the string data portion of a ZafButton object, if the string data is Destroyable(). ClearText() is an advanced routine, and should normally not be called by the programmer. This routine is called internally by the Zinc libraries.

Depressed

```
bool Depressed(void) const;
virtual bool SetDepressed(bool depressed);
```

A button in the process of being selected appears depressed until the selection operation is completed (for example, by releasing the mouse button). Depressed() and SetDepressed() are advanced routines, and should normally not be called by the programmer. These routines are called internally by the Zinc libraries, since each environment handles button depression differently. Selected() and SetSelected() provide correct support for selecting and de-selecting a button.

Depth

```
int Depth(void) const;
virtual int SetDepth(int depth);
```

The depth of a button is the number of pixels the button appears to be above the plane of its parent. Depth() and SetDepth() are advanced routines, and should normally not be called by the programmer. These routines are called internally by the Zinc libraries, since each environment dictates its own button depth.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events that are sent to the ZafButton object, either by processing the events itself, or by passing the event down for base class processing. Refer to ZafWindowObject::Event() for complete details. Following are events that are handled by ZafButton in addition to those handled by its base classes:

Event type	Description
`S_HOT_KEY`	Causes the object to perform its action, if event.key.value is the object's hot key
`S_REDISPLAY_DEFAULT`	Causes the object to display or erase its default border, as appropriate

HotKeyChar
HotKeyIndex

```
ZafIChar HotKeyChar(void) const;
int HotKeyIndex(void) const;
virtual ZafIChar SetHotKey(ZafIChar hotKeyChar, int index
   = -1);
```

An object's hot key character is the character that when typed with a modifier key (such as <ALT> or <Command>) causes the object to be selected. The object's action (such as an event being posted to the event manager's queue if the button is SendMessageWhenSelected()) is performed as a result of the selection.

The hot key index is the zero-based index into the object's text that specifies the character to be visually displayed as the hot key character, usually with an underline.

The hot key character does not cause any display modification, and the hot key index does not cause any action to be performed when that character is typed with the modifier key. The default value of HotKeyChar() is 0, indicating that there is no hot key character associated with the object, and the default value of HotKeyIndex() is -1, indicating that no character is to be displayed as the hot key character on the object. The user may call SetHotKey() to change the HotKeyChar() and the HotKeyIndex() attributes. *hotKeyChar* specifies the hot key character, and *index* specifies the hot key index.

The following code shows how to create a button with a hot key:

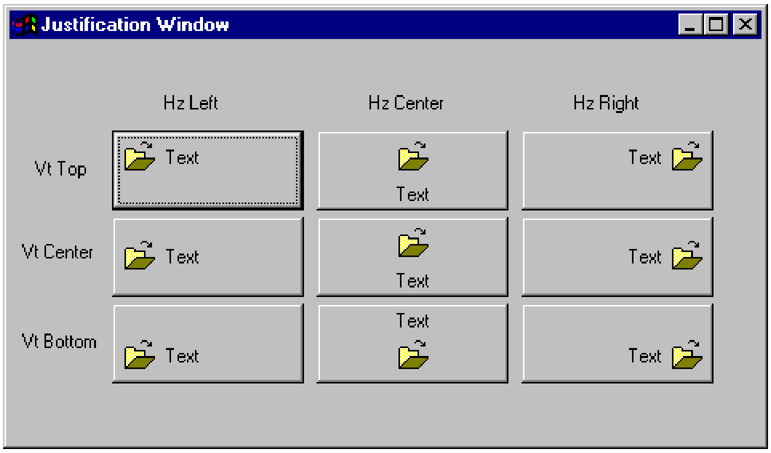
```
// Create a button with a hot key.
ZafButton *button = new ZafButton(1, 4, 12, 1, "Quit",
   ZAF_NULLP(ZafBitmapData));
button->SetHotKey('Q', 0);
```

HzJustify
VtJustify

```
ZafHzJustify HzJustify(void) const;
ZafVtJustify VtJustify(void) const;
virtual ZafHzJustify SetHzJustify(ZafHzJustify
   hzJustify);
virtual ZafVtJustify SetVtJustify(ZafVtJustify
   vtJustify);
```

HzJustify() and VtJustify() control the button's horizontal and vertical justification, respectively. HzJustify() is ZAF_HZ_CENTER by default, and VtJustify() is ZAF_VT_CENTER by default. The user may call SetHzJustify() or SetVtJustify() to change them.

If there are both textual and bitmap pieces associated with the button, both are justified as a unit within the available space on the button. With combinations of horizontal and vertical justification other than ZAF_HZ_CENTER and ZAF_VT_CENTER together, the bitmap is justified first, and then the text. When the button is ZAF_HZ_CENTER and ZAF_VT_CENTER together, the bitmap is placed on top of the text, and both as a unit are centered horizontally and vertically on the button. The following picture illustrates how justification effects a button object.



Region

```
virtual ZafRegionStruct **Region**(void) const;
virtual void **SetRegion**(const ZafRegionStruct &region);
```

Region() and SetRegion() overload the ZafWindowObject methods, and provide specific functionality for the ZafButton class. A button object that is either AutoSize() or AllowDefault() may appear on the screen larger than its corresponding object region. For that reason, these overloaded functions are necessary to allow for this discrepancy between the object's region and the operating environment's representation of the object. See ZafWindowObject for more detailed descriptions of these functions.

SelectOnDouble-Click

```
bool **SelectOnDoubleClick**(void) const;
virtual bool **SetSelectOnDoubleClick**(bool
    selectOnDoubleClick);
```

If SelectOnDoubleClick() is true, the button performs its action on a double-click, as opposed to a single click. The maximum time between the first up-click and the second down-click is determined by the operating environment. For MS-DOS, ZafWindowObject::doubleClickRate is used. See ZafWindowObject::doubleClickRate for more information on the double-click rate. An example of an object with this behavior is an icon that causes an application to be launched by the operating environment. A single click simply causes the icon to receive focus, and a double-click causes the operating environment to launch the application associated with the icon. The default value of this attribute is false, but the user may call SetSelectOnDoubleClick() to change it.

SelectOnDownClick

```
bool SelectOnDownClick(void) const;
virtual bool SetSelectOnDownClick(bool
    selectOnDownClick);
```

If SelectOnDownClick() is true, the button performs its action on a down-click, as opposed to an up-click. An example of an object with this behavior is a combo-box button. A down-click on the combo-box button causes the list of choices to appear, allowing the user to position the mouse over an item and up-clicking to choose it. Normal buttons wait until the up-click to perform their action. The default value of this attribute is false, but the user may call SetSelectOnDownClick() to change it.

SendMessage

SendMessage-WhenSelected

```
ZafEventType SendMessage(const ZafEventStruct &event,
    ZafEventType ccode);
bool SendMessageWhenSelected(void) const;
virtual bool SetSendMessageWhenSelected(bool
    sendMessageWhenSelected);
```

One way to tie a button to an action is through the SendMessageWhenSelected() attribute. The default value of this attribute is false, but the programmer may call SetSendMessageWhenSelected() to change it. The programmer may define a user event type, set the value of the button to the user event type through SetValue(), and handle the user event type in a derived object's Event() method. For example:

```
// Define the user event type.
const ZafEventType USER_ACTION_EVENT = 20001;
...
// Create a button that posts an event on the event manager's
// queue.
ZafButton *button = new ZafButton(1, 4, 12, 1, "Action",
    ZAF_NULLP(ZafBitmapData));
button->SetSendMessageWhenSelected(true);
button->SetValue(USER_ACTION_EVENT);
```

Alternatively, the programmer may wish to use a pre-defined ZAF event type. For example, to create a button that will cause the application to close down, use the following code snippet.

```
// Create a button that causes the application to close down.
ZafButton *button = new ZafButton(1, 4, 12, 1, "Quit",
    ZAF_NULLP(ZafBitmapData));
button->SetSendMessageWhenSelected(true);
button->SetValue(S_EXIT);
```

If SendMessageWhenSelected() is true, the SendMessage() method is automatically called when the button is selected. SendMessage() simply packages an event of the same type as the button's Value() attribute with event.windowObject pointing to the button, and posts the event on the event manager's queue. If SendMessageText() is non-null, then SendMessageText() is copied into event.text, and the object handling the event must delete event.text. The programmer should never need to call SendMessage(), since it is called internally by the ZafButton class.

The return value for SendMessage() is an error code indicating any error that may have occurred. The return value is usually ZAF_ERROR_NONE, meaning that no error occurred.

SendMessageText

`const ZafIChar *`**`SendMessageText`**`(void) const;`

`virtual const ZafIChar *`**`SetSendMessageText`**`(const ZafIChar *text);`

SendMessageText() stores the text that is copied to event.text when a message is posted to the event manager's queue for SendMessageWhenSelected() buttons. See SendMessageWhenSelected() for more information. SendMessageText() is null by default, but the user may call SetSendMessageText() to change it.

The object handling the event where event.text contains a duplicate of SendMessageText() must delete event.text. Otherwise, a memory leak will occur. If SendMessageText() is null, there is no need to delete event.text. The following code snippet shows how to create a button that utilizes SendMessageText().

```
// Create a button that closes an extra window.
ZafButton *button = new ZafButton(1, 4, 12, 1, "Clean Up",
    ZAF_NULLP(ZafBitmapData));
button->SetSendMessageWhenSelected(true);
button->SetValue(A_CLOSE_WINDOW);
```

```
// The window to be closed has a stringID of "EXTRA_WINDOW".
button->SetSendMessageText("EXTRA_WINDOW");
```

StringData

```
ZafStringData *StringData(void) const;
virtual ZafError SetStringData(ZafStringData
    *stringData);
```

The StringData() object is the piece of the ZafButton object where the actual string data is stored. The StringData() may be shared among several ZafButton objects, or it may belong to a single ZafButton object. If shared among several ZafButton objects, all the associated ZafButton objects will be updated when the StringData() piece changes. SetStringData() may be used to associate a StringData() object with a ZafButton object. For more information on data sharing in ZAF, see the chapter on ZafDataManager. SetStringData() will delete the previous StringData() object if it is Destroyable() and no other object uses it.

The return value for StringData() is a pointer to the StringData() object associated with the ZafButton object. The return value for SetStringData() is normally ZAF_ERROR_NONE.

Text

```
virtual const ZafIChar *Text(void);
virtual ZafError SetText(const ZafIChar *text);
```

The textual data of a ZafButton (contained in the StringData() object) may be returned or set with Text() and SetText(). These functions provide simple accessibility to the StringData() of a ZafButton, and may be used if the programmer does not wish to interact directly with the data portion of the object.

The return value for Text() is a pointer to the textual information in the data object of a ZafButton. The return value for SetText() is normally ZAF_ERROR_NONE.

Value

```
ZafEventType Value(void) const;
virtual ZafEventType SetValue(ZafEventType value);
```

Value() stores the event type that is posted on the event manager's queue for SendMessageWhenSelected() buttons. See SendMessageWhenSelected() for more information. Value() is 0 by default, but the user may call SetValue() to change it to any event type desired, including user-defined event types.

VtJustify

```
ZafVtJustify VtJustify(void) const;
```

```
virtual ZafVtJustify SetVtJustify(ZafVtJustify
   vtJustify);
```

See HzJustify().

ZafChart

ActiveModel	DataGroup	IndexMethod
AddDataGroup	DataGroupBackgroundColor	MarksXAxis
AddDataPoint	DataGroupFillPattern	MarksYAxis
AxisColor	DataGroupFont	TextTitle
ChartType	DataGroupForegroundColor	TextXAxis
ClearDataAll	DataGroupLineStyle	TextYAxis
ClearDataGroup	DataPoint	

Inheritance `ZafChart : ZafChartStub : ZafWindowObject : ZafElement`

Declaration `#include <cf_api/bz_zcht.hpp>`

Description ZafChart supports graphical charting of data groups. Each data group is represented by points, lines, bars, pie slices, or another representation.

ZafChart is a unique ZAF class. It is a “wrapper” class serving only as a ZAF-like interface to a third-party library: DPC Technology’s ChartFolio™. Basic use of the ZafChart class is supported directly by Zinc Software. Technical support for specific functionality and underlying ChartFolio operation is provided directly by DPC Technology.

The “cf_zaf” directory of the ZAF 5 distribution contains the source code for a limited version of DPC’s ChartFolio library. Before utilizing the ZafChart class, the ChartFolio library must be built using the supplied make files. The cf_zaf/include directory must be part of the compiler’s include search path in order to utilize the ChartFolio header files.

The limited ChartFolio library supplied with ZAF provides two-dimensional chart types including pie, bar, column, stack, point-series, line, and integral/area. Data-domain indexing modes supplied include natural number (n=1, 2, 3, .. N) and integral number (i=0, 1, 2, .. I).

DPC Technology also publishes advanced, full-featured versions of ChartFolio that provide complete 3-D charting support, additional chart types, real-time rotation and scaling, real number value indexing, user dialog and chart control objects, and more. These add-on products are available from Zinc Software, or directly from DPC Technology.

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92121 USA

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Fax: 619 / 622-1833

http://www.dpc-tech.com
Email: info@dpc-tech.com

Constructors

All ZafChart constructors initialize the member variables associated with an instantiated ZafChart object. The default values set by the ZafChart and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafChart. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafChart	
`AxisColor()`	`ZAF_CLR_BLACK`
`ChartType()`	`user-supplied parameter`
`IndexMethod()`	`user-supplied parameter`
`MarksXAxis()`	`true`
`MarksYAxis()`	`true`
`TextTitle()`	`null`
`TextXAxis()`	`null`
`TextYAxis()`	`null`
ZafWindowObject	
`AcceptDrop()`	`false`†
`Changed()`	`false`†
`CopyDraggable()`	`false`†
`Disabled()`	`false`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`OSDraw()`	`false`
ZafElement	
`ClassID()`	`ID_ZAF_CHART`
`ClassName()`	`"ZafChart"`

ZafChart(int left, int top, int width, int height, int iChartTypeID = CF_ID_BASE_CHART, int iIndexMethodID = CF_ID_YVALS_ON_NAT_NS);

This constructor is useful in straight-code situations. *left*, *top*, *width*, and *height* specify the position and size of the object on its parent. These values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *iChartTypeID* specifies the chart type (see ChartType() for more information). *iIndexMethodID* specifies the chart index method (see IndexMethod() for more information).

ZafChart(const ZafChart &copy);

The copy constructor creates a new ZafChart object and initializes its data from *copy*. Data groups and data points are part of the ChartFolio data as opposed to the user interface ZafChart object, and are not copied. The programmer must create new data groups and new data points for the copy.

ZafChart(const ZafIChar *name, ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level. Data groups and data points are part of the ChartFolio data as opposed to the user interface ZafChart object, and are not stored. The programmer must create new data groups and new data points for the new ZafChart object.

An example of how to create a chart object follows:

```
// Create the sample window.
ZafWindow *window = new ZafWindow(0, 0, 35, 10);
window->AddGenericObjects(new ZafStringData("Sample Chart
   Window"));

// Create a line chart.
ZafChart *chart = new ZafChart(1, 0, 30, 7, CF_ID_LINE_2D,
   CF_ID_YVALS_ON_NAT_NS);

// Define 5 data groups of 10 values each and add them to the
// chart.
double chartData[5][10] =
{
  { 20.0, 10.0, 20.0, 10.0, 20.0, 10.0, 20.0, 10.0, 20.0, 10.0 },
  { 20.0, 18.0, 14.0, 2.0, 14.0, 37.0, 35.0, 30.0, 24.0, 23.0 },
  { 33.0, 30.0, 27.0, 24.0, 21.0, 18.0, 15.0, 12.0, 9.0, 6.0 },
  { 20.0, 15.0, 10.0, 12.0, 14.0, 20.0, 24.0, 28.0, 30.0, 32.0 },
  { 16.0, 15.0, 23.0, 17.0, 24.0, 20.0, 18.0, 13.0, 28.0, 16.0 }
};
for (int i = 0; i < 5; i++)
{
  // Add each data group (data groups are one-based).
  chart->AddDataGroup(i + 1);

  // Add each data point in the data group.
  for (int j = 0; j < 10; j++)
    chart->AddDataPoint(i + 1, chartData[i][j]);
}

// Add the chart to the window.
window->Add(chart);
```

Destructor

`virtual ~`**`ZafChart`**`(void);`

The destructor is used to free the memory associated with a ZafChart object. It chains to the ZafChartStub, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafChart object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

ActiveModel

`cf_ChartModel *`**`ActiveModel`**`(void);`

ActiveModel() returns a pointer to the active ChartFolio chart model object associated with this ZafChart. ActiveModel() is an advanced routine and should normally not be called by the programmer. Consult ChartFolio documentation for detailed information on the use of a cf_ChartModel.

AddDataGroup

`ZafError `**`AddDataGroup`**`(int groupIndex);`

AddDataGroup() creates a new data group, referenced by one-based *groupIndex*. The first data group that should be allocated is 1, then 2, and so on. Failure to create new data groups sequentially will cause undefined results by the ChartFolio library. AddDataGroup() returns ZAF_ERROR_INVALID if an error occurred; otherwise ZAF_ERROR_NONE is returned.

AddDataPoint

`ZafError `**`AddDataPoint`**`(int groupIndex, double dDataValue);`

AddDataPoint() creates a new data point in the previously-created data group referenced by one-based *groupIndex*. *dDataValue* is the value used by the new data point. AddDataPoint() returns ZAF_ERROR_INVALID if an error occurred; otherwise ZAF_ERROR_NONE is returned.

AxisColor

```
ZafLogicalColor AxisColor(ZafLogicalColor *mono =
   ZAF_NULLP(ZafLogicalColor));
ZafLogicalColor SetAxisColor(ZafLogicalColor color,
   ZafLogicalColor mono = ZAF_MONO_NULL);
```

AxisColor() specifies the logical color used when drawing the axes and the tick marks of the chart. AxisColor() defaults to ZAF_CLR_BLACK, but may be changed by calling SetAxisColor(). *color* specifies the logical color to be used when drawing the axes and the tick marks of the chart, but both routines ignore *mono* since black and white charts are not supported by the ChartFolio library.

ChartType

```
int ChartType(void) const;
int SetChartType(int chartTypeID);
```

ChartType() specifies the chart display type. SetChartType() may be used to change the chart display type. Any of the following values defined by the ChartFolio library may be used for the ChartType(). Note that 3-D charts are not supported by the limited version of ChartFolio supplied with ZAF 5, but are available in the add-on product:

ChartType()	**Description**
`CF_ID_AREA_2D`	Displays the data in a 2-D area chart
`CF_ID_BAR_2D`	Displays the data in a 2-D horizontal bar chart
`CF_ID_COL_2D`	Displays the data in a 2-D vertical (column) bar chart
`CF_ID_LINE_2D`	Displays the data in a 2-D line chart
`CF_ID_PIE_2D`	Displays the data in a 2-D pie chart
`CF_ID_POINTS_2D`	Displays the data in a 2-D point series chart
`CF_ID_STACK_2D`	Displays the data in a 2-D vertical stack chart

ClearDataAll

```
ZafError ClearDataAll(void);
```

ClearDataAll() deletes all the data points in all data groups currently used by the chart. The data groups themselves are not deleted. ClearDataAll() returns ZAF_ERROR_INVALID if an error occurred; otherwise ZAF_ERROR_NONE is returned.

ClearDataGroup

```
ZafError ClearDataGroup(int groupIndex);
```

ClearDataGroup() deletes all the data points in the data group referred to by one-based index *groupIndex*. The data group itself is not deleted. ClearDataGroup() returns ZAF_ERROR_INVALID if an error occurred; otherwise ZAF_ERROR_NONE is returned.

DataGroup

```
cf_DataGroup *DataGroup(int groupIndex);
```

DataGroup() returns a pointer to the ChartFolio data group object referred to by one-based index *groupIndex*. DataGroup() is an advanced routine and should normally not be called by the programmer. Consult ChartFolio documentation for detailed information on the use of a cf_DataGroup.

DataGroupBackgroundColor

```
ZafLogicalColor DataGroupBackgroundColor(int groupIndex,
   ZafLogicalColor *mono = ZAF_NULLP(ZafLogicalColor));
ZafLogicalColor SetDataGroupBackgroundColor(int
   groupIndex, ZafLogicalColor color, ZafLogicalColor
   mono = ZAF_MONO_NULL);
```

DataGroupBackgroundColor() specifies the logical color used when drawing the background pieces of the data group referred to by one-based index *groupIndex*. Each data group's DataGroupBackgroundColor() is initially set by the ChartFolio library, but may be changed by calling SetDataGroupBackgroundColor(). *color* specifies the logical color to be used when drawing the background pieces of the data group, but both routines ignore *mono* since black and white charts are not supported by the ChartFolio library.

DataGroupFillPattern

```
ZafLogicalFillPattern DataGroupFillPattern(int
   groupIndex) const;
ZafLogicalFillPattern SetDataGroupFillPattern(int
   groupIndex, ZafLogicalFillPattern fillPattern);
```

DataGroupFillPattern() specifies the logical fill pattern used when drawing the data group referred to by one-based index *groupIndex*. Each data group's DataGroupFillPattern() is initially set by the ChartFolio library, but may be changed by calling SetDataGroupFillPattern(). *fillPattern* specifies the logical fill pattern to be used when drawing the data group.

DataGroupFont

```
ZafLogicalFont DataGroupFont(int groupIndex) const;
ZafLogicalFont SetDataGroupFont(int groupIndex,
   ZafLogicalFont font);
```

DataGroupFont() specifies the logical font used when drawing the textual information of the data group referred to by one-based index *groupIndex*. Each data group's DataGroupFont() is initially set by the ChartFolio library, but may be changed by calling SetDataGroupFont(). *font* specifies the logical font to be used when drawing the textual information of the data group.

DataGroup-ForegroundColor

```
ZafLogicalColor DataGroupForegroundColor(int groupIndex,
   ZafLogicalColor *mono = ZAF_NULLP(ZafLogicalColor));
ZafLogicalColor SetDataGroupForegroundColor(int
   groupIndex, ZafLogicalColor color, ZafLogicalColor
   mono = ZAF_MONO_NULL);
```

DataGroupForegroundColor() specifies the logical color used when drawing the foreground pieces of the data group referred to by one-based index *groupIndex*. Each data group's DataGroupForegroundColor() is initially set by the ChartFolio library, but may be changed by calling SetDataGroupFore-groundColor(). *color* specifies the logical color to be used when drawing the foreground pieces of the data group, but both routines ignore *mono* since black and white charts are not supported by the ChartFolio library.

DataGroupLineStyle

```
ZafLogicalLineStyle DataGroupLineStyle(int groupIndex)
   const;
ZafLogicalLineStyle SetDataGroupLineStyle(int
   groupIndex, ZafLogicalLineStyle lineStyle);
```

DataGroupLineStyle() specifies the logical line style used when drawing the data group referred to by one-based index *groupIndex*. Each data group's Dat-aGroupLineStyle() is initially set by the ChartFolio library, but may be changed by calling SetDataGroupLineStyle(). *lineStyle* specifies the logical line style to be used when drawing the data group.

DataPoint

```
cf_XYZ *DataPoint(int groupIndex, int dataIndex);
```

DataPoint() returns a pointer to the ChartFolio data point object referred to by one-based data group index *groupIndex* and one-based data point index *dataIndex*. DataPoint() is an advanced routine and should normally not be called by the programmer. Consult ChartFolio documentation for detailed information on the use of a cf_XYZ.

IndexMethod

```
int IndexMethod(void) const;
```

`int SetIndexMethod(int indexMethodID);`

IndexMethod() specifies the index method used by the domain axis of the chart. SetIndexMethod() may be used to change the domain index method. Any of the following values defined by the ChartFolio library may be used for the IndexMethod(). Note that extended indexing modes, including real number value indexing, are available in the add-on product:

ChartType()	Description
CF_ID_YVALS_AT_INT_IS	Uses non-negative integral values for the domain
CF_ID_YVALS_ON_NAT_NS	Uses natural (counting) values for the domain

MarksXAxis

```
bool MarksXAxis(void) const;
bool SetMarksXAxis(bool xAxisMarks);
```

If MarksXAxis() is true, the x-axis of the chart is drawn with tick marks and incremental values (if applicable according to the ChartType()). MarksXAxis() defaults to true, but may be changed by calling SetMarksXAxis().

MarksYAxis

```
bool MarksYAxis(void) const;
bool SetMarksYAxis(bool yAxisMarks);
```

If MarksYAxis() is true, the y-axis of the chart is drawn with tick marks and incremental values (if applicable according to the ChartType()). MarksYAxis() defaults to true, but may be changed by calling SetMarksYAxis().

TextTitle

```
const ZafIChar *TextTitle(void);
const ZafIChar *SetTextTitle(const ZafIChar *text);
```

TextTitle() specifies the text used when drawing the title of the chart. TextTitle() defaults to null (in which case no title is drawn with the chart), but may be changed by calling SetTextTitle().

TextXAxis

```
const ZafIChar *TextXAxis(void);
const ZafIChar *SetTextXAxis(const ZafIChar *text);
```

TextXAxis() specifies the text used when drawing the x-axis label for the chart (if applicable according to the ChartType()). TextXAxis() defaults to null (in which case no label is drawn with the x-axis), but may be changed by calling SetTextXAxis().

TextYAxis

```
const ZafIChar *TextYAxis(void);
const ZafIChar *SetTextYAxis(const ZafIChar *text);
```

TextYAxis() specifies the text used when drawing the y-axis label for the chart (if applicable according to the ChartType()). TextYAxis() defaults to null (in which case no label is drawn with the y-axis), but may be changed by calling SetTextYAxis().

ZafChartStub

Inheritance `ZafChartStub : ZafWindowObject : ZafElement`

Declaration `#include <z_chart.hpp>`

Description ZafChartStub serves solely as a base class for ZafChart, so that ZafChart—and the third-party ChartFolio library it relies on—are not linked into a program that does not make use of it. Zinc Designer uses this class to allow editing of a ZafChart persistent object without the need to link in the overhead. The programmer should normally not derive from this class. See ZafChart for more information.

ZafCodeSetData

Clear	ConvertToOSWChar	IsoToUnicode
CodeSetAllocate	ConvertToOSWString	mblen
CodeSetFree	ConvertToZafChar	mbstowcs
CodeSetName	ConvertToZafString	NativeMapping
ConvertToOSChar	DefaultLeadByte	UnicodeToISO
ConvertToOSString	DirSepStr	wcstombs

Inheritance

```
ZafCodeSetData : ZafI18nData : ZafData :
   ZafNotification, ZafElement
```

Declaration

```
#include <z_cset.hpp>
```

Description

Different environments use different character sets to represent characters and strings internally. For example, some environments use Unicode as the native character set, and others use multi-byte strings. ZAF provides support for ISO 8859-1 and Unicode character mapping. By default, the ZAF libraries support ISO 8859-1, but the programmer may uncomment the ZAF_UNICODE macro definition in the header file z_env.hpp and recompile the libraries to support Unicode character mapping.

Though ISO 8859-1 characters are all single-byte characters and Unicode characters are all double-byte characters, some systems may use multi-byte characters, which may use any number of bytes for a single character. ZAF provides transparent support for all these systems by using the ZafCodeSetData methods when passing information to and from the native environment. The ZAF programmer simply has to use ZafIChar characters and strings, which always use ISO 8859-1 or Unicode character mapping. By commenting out both ZAF_ISO8859_1 and ZAF_UNICODE macros in the header file z_env.hpp, no mapping will occur, and the programmer may use native characters and strings, albeit unportably.

ZafCodeSetData provides support for mapping characters and strings between ISO 8859-1 or Unicode character sets (depending on the mode of the application) and the native environment's character set. For example, before calling a native API, a ZafIChar character or string must at times be converted to the native environment's format so the API will be able to utilize it correctly. Internally to the ZAF library, ZafCodeSetData is utilized when appropriate, since all ZAF interfaces use ZafIChar characters and strings.

The programmer should never construct a ZafCodeSetData object, since one is created by ZafApplication which may be accessed via the global zafCodeSet. And normally, the programmer will not need to call these routines. However, advanced programmers may call a native API, and may be required to call the routines in ZafCodeSetData to convert values passed to the native API.

Constructors

All ZafCodeSetData constructors initialize the member variables associated with an instantiated ZafCodeSetData object. The default values set by the ZafCodeSetData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafCodeSetData	
`CodeSetName()`	`environment-specific`
`DefaultLeadByte()`	`0`
`dirSepStr[2]`	`environment-specific`
`NativeMapping()`	`false (Unicode mode only)`
ZafElement	
`ClassID()`	`ID_ZAF_CODE_SET_DATA`
`ClassName()`	`"ZafCodeSetData"`

```
ZafCodeSetData(ZafIChar *isoToLocal, ZafIChar
    *localToIso);
```

These constructors allocate a ZafCodeSetData instance. *isoToLocal* specifies the table used to map ISO 8859-1 characters to native characters, and *localToIso* specifies the table used to map native characters to ISO 8859-1 characters.

```
ZafCodeSetData(const ZafCodeSetData &copy);
```

The copy constructor creates a new ZafCodeSetData object and initializes its data from *copy*.

```
ZafCodeSetData(const ZafIChar *name, ZafDataPersistence
    &persist);
```

The final constructor is used for persistence. Refer to `ZafWindow` for more information, since most persistence is done at the ZafWindow level.

Destructor

```
virtual ~ZafCodeSetData(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafCodeSetData object.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Clear

```
virtual void Clear(void);
```

Clear() does nothing, but provides a definition for the base class ZafData pure virtual function.

CodeSetAllocate

```
static void CodeSetAllocate(const ZafIChar *name =
    ZAF_NULLP(ZafIChar));
```

CodeSetAllocate() is called at application startup, and creates the global ZafCodeSetData instance zafCodeSet. CodeSetAllocate() allocates the lookup tables used to convert between ISO 8859-1 or Unicode characters and native characters. If *name* is null, the default lookup tables are used for each environment; otherwise, *name* specifies the name of the code set data object to be loaded by the data manager.

CodeSetFree

```
static void CodeSetFree(bool globalRequest = false);
```

If *globalRequest* is true, CodeSetFree() deletes the global ZafCodeSetData instance zafCodeSet; otherwise it does nothing. CodeSetFree() is called as an application shuts down, and should normally not be called by the programmer.

CodeSetName

```
static const ZafIChar *CodeSetName(void);
static ZafError SetCodeSetName(const ZafIChar
    *codeSetName);
```

CodeSetName() specifies the name of the code set being used to map characters. For example, a straight mapping for ISO 8859-1 would specify a code set name of "ISO8859-1", a straight mapping for Unicode would specify "UNICODE", a MS-DOS code page 437 would specify "437", and the Macintosh character set would specify "MACINTOSH". The default for this attribute is different for each environment, and may be changed by calling SetCodeSetName(). The programmer should not call SetCodeSetName(), since this attribute is set internally by the ZAF libraries.

ConvertToOSChar

```
int ConvertToOSChar(ZafIChar zafChar, char *osChar);
```

ConvertToOSChar() converts the ISO 8859-1 or Unicode character *zafChar* to the native equivalent. Systems that require multi-byte strings may return a character that is more than a single byte (char), so the return buffer *osChar* must be large enough to hold the resulting character. The number of bytes (chars) required for *osChar* is returned.

ConvertToOSString

```
char *ConvertToOSString(const ZafIChar *zafString, char
    *osString = ZAF_NULLP(char), bool allocate = true);
```

ConvertToOSString() converts the ISO 8859-1 or Unicode string *zafString* to the native equivalent and returns the result. Systems that require multi-byte strings may return a string that requires a different size buffer than the source string, so the return buffer *osString* may be a different size than *zafString*. If *allocate* is true, ConvertToOSString() will allocate a buffer in which the resulting string will be placed, and the programmer must delete the buffer when appropriate. If *allocate* is false and *osString* is null, a static buffer will be used in which the resulting string will be placed, and the programmer should not delete the buffer.

ConvertToOSW-Char

```
int ConvertToOSWChar(ZafIChar zafChar, wchar_t *osChar);
```

Unicode only. ConvertToOSWChar() converts the Unicode character *zafChar* to the native wide character equivalent, if supported by the environment. The return buffer *osChar* must be allocated by the programmer before calling ConvertToOSWChar(). The number of wchar_ts required for *osChar* is returned, which is always 1 according to the portable definition of wchar_t.

ConvertToOSW-String

```
wchar_t *ConvertToOSWString(const ZafIChar *zafString,
    wchar_t *osString = ZAF_NULLP(wchar_t), bool allocate
    = true);
```

Unicode only. ConvertToOSWString() converts the Unicode string *zafString* to the native wide character string equivalent and returns the result both as the return value for the function and in *osString*. If *allocate* is true, ConvertToOSWString() will allocate a buffer in which the resulting string will be placed, and the programmer must delete the buffer when appropriate. If *allocate* is false and *osString* is null, a static buffer will be used in which the resulting string will be placed, and the programmer should not delete the buffer.

ConvertToZafChar

```
int ConvertToZafChar(const char *osChar, ZafIChar
   &zafChar);
```

ISO only. ConvertToZafChar() converts the native character *osChar* to the ISO 8859-1 or Unicode equivalent, which is returned in *zafChar*. The number of bytes (chars) required for *osChar* is returned.

```
int ConvertToZafChar(const wchar_t *osChar, ZafIChar
   &zafChar);
```

Unicode only. This overloaded ConvertToZafChar() converts the native wide character *osChar* to the Unicode equivalent, which is returned in *zafChar*. The number of ZafIChars required for *zafChar* is returned, which is always 1, since ZafIChar is ZAF's portable character type no matter what mode the application is running in.

ConvertToZafString

```
ZafIChar *ConvertToZafString(const char *osString,
   ZafIChar *zafString = ZAF_NULLP(ZafIChar), bool
   allocate = true);
```

ISO only. ConvertToZafString() converts the native string *osString* to the ISO 8859-1 or Unicode equivalent and returns the result. Systems that require multi-byte strings may return a string that requires a different size buffer than the source string, so the return buffer *zafString* may be a different size than *osString*. If *allocate* is true, ConvertToZafString() will allocate a buffer in which the resulting string will be placed, and the programmer must delete the buffer when appropriate. If *allocate* is false and *zafString* is null, a static buffer will be used in which the resulting string will be placed, and the programmer should not delete the buffer.

```
ZafIChar *ConvertToZafString(const wchar_t *osString,
   ZafIChar *zafString = ZAF_NULLP(ZafIChar), bool
   allocate = true);
```

Unicode only. This overloaded ConvertToZafString() converts the native wide character string *osString* to the Unicode equivalent and returns the result both as the return value for the function and in *zafString*. If *allocate* is true, ConvertToZafString() will allocate a buffer in which the resulting string will be placed, and the programmer must delete the buffer when appropriate. If *allocate* is false and *zafString* is null, a static buffer will be used in which the resulting string will be placed, and the programmer should not delete the buffer.

DefaultLeadByte

```
ZafUInt8 DefaultLeadByte(void) const;
ZafUInt8 SetDefaultLeadByte(ZafUInt8 defaultLeadByte);
```

When mapping a character from ISO 8859-1 to Unicode, DefaultLeadByte() is used as the high byte. DefaultLeadByte() is analogous to the Unicode page that corresponds to a language. For example, the Unicode page for English and other similar languages is 0. DefaultLeadByte() defaults to 0, but the programmer may call SetDefaultLeadByte() to change it.

DirSepStr

```
ZafIChar dirSepStr[2];
```

dirSepStr is a null-terminated string that includes the character used to separate directory names in a pathname for each environment. It is initialized at application startup.

IsoToUnicode

```
ZafIChar *IsoToUnicode(const char *isoText, ZafIChar
    *unicodeText = ZAF_NULLP(ZafIChar));
```

Unicode only. IsoToUnicode() converts the single-byte ISO 8859-1 string *isoText* to a double-byte Unicode string and returns the Unicode string both as the return value for the function and in *unicodeText*. Since the first 256 Unicode characters are also ISO 8859-1 characters, IsoToUnicode() simply pads the high byte of each resulting character with DefaultLeadByte(), which corresponds to the Unicode page that a language uses. If *unicodeText* is null, IsoToUnicode() allocates the return buffer, and the programmer must delete the buffer when appropriate.

mblen

```
int mblen(const char *hardware);
```

Unicode only. mblen() returns the number of bytes (chars) of the multi-byte character that *hardware* points to.

mbstowcs

```
int mbstowcs(ZafIChar *pwcs, const char *s, int n = -1);
```

Unicode only. mbstowcs() converts the multi-byte string *s* to the native wide character string equivalent and returns the result in *pwcs*. *pwcs* must point to a buffer sufficiently large to hold the resulting string. If *n* is less than zero, mbstowcs() will convert the entire string; otherwise *n* characters of the string will be converted. The number of ZafIChars required for *pwcs* is returned.

NativeMapping

```
bool NativeMapping(void) const;
bool SetNativeMapping(bool mapping);
```

Unicode only. If NativeMapping() is true, then the native environment uses the Unicode code set internally, so no mapping is necessary; otherwise, mapping between the native code set and Unicode is necessary. This attribute may be changed using SetNativeMapping(), but should normally not be changed by the programmer, since it is initialized at application startup according to the native environment.

UnicodeToISO

```
char *UnicodeToIso(const ZafIChar *unicodeText, char
    *isoText = ZAF_NULLP(char));
```

Unicode only. UnicodeToIso() converts the double-byte Unicode string *unicodeText* to a single-byte ISO 8859-1 string and returns the ISO 8859-1 string both as the return value for the function and in *isoText*. The Unicode string should not include any characters beyond the first 256 Unicode characters. Since the first 256 Unicode characters are also ISO 8859-1 characters, UnicodeToIso() simply copies the low byte of each Unicode character into the resulting string. If *isoText* is null, UnicodeToIso() allocates the return buffer, and the programmer must delete the buffer when appropriate.

wcstombs

```
int wcstombs(char *s, const ZafIChar *pwcs, int n = -1);
```

Unicode only. wcstombs() converts the native wide character string *pwcs* to the multi-byte string equivalent and returns the result in *s*. *s* must point to a buffer sufficiently large to hold the resulting string. If *n* is less than zero, wcstombs() will convert the entire string; otherwise *n* characters of the string will be converted. The number of bytes (chars) required for *s* is returned.

ZafComboBox

AutoSortData	SetBackgroundColor	SetTextColor
list	SetFont	ViewOnly

Inheritance

```
ZafComboBox : ZafWindow : (ZafWindowObject :
   ZafElement), ZafList
```

Declaration

```
#include <z_combo.hpp>
```

Description

The ZafComboBox object provides support for a list of items, where one item at a time is selected and visible. When the user selects the ZafComboBox object, the list of items becomes visible, and the user may select another of the items. When an item is selected, the list closes, and the ZafComboBox object displays the newly-selected item. Any item may be selected programmatically by calling SetSelected(true) for the item. In fact, if the programmer doesn't call SetSelected(true) on one of the children, the ZafComboBox object initially appears empty. See ZafWindowObject::Selected() for more information on selecting child objects.

A ZafComboBox object may be editable (see ViewOnly() for more information), in which case the user may type one of the items to select it without bringing up the list. The first list item beginning with the characters typed by the user is selected. If the ZafComboBox object is ViewOnly(), then the first item beginning with a key typed is selected.

A ZafComboBox object may contain children that display more than textual information, such as ZafButton objects with bitmap information. For the children's bitmap information to be displayed, the ZafComboBox object's OSDraw() attribute must not be true; otherwise only the text of the children will be displayed.

Like other ZAF classes, ZafComboBox utilizes the native API when available, so the look-and-feel is what the end user expects. ZafComboBox by its very nature implies a relatively small number of items to choose from, since it only takes up as much space as a single item in its list. Though there is programmatically not a limit to the number of items allowable in a ZafComboBox object, no more than approximately 100 items should be placed in a single ZafComboBox object. For a large number of items, consider using ZafVtList for better usability.

Constructors

All ZafComboBox constructors initialize the member variables associated with an instantiated ZafComboBox object. The default values set by the ZafComboBox and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafComboBox. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafComboBox	
`AutoSortData()`	`false`
`ViewOnly()`	`false`
ZafWindow	
`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_SINGLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafWindowObject	
`Bordered()`	`true`†
`ZafElement`	
`ClassID()`	`ID_ZAF_COMBO_BOX`
`ClassName()`	`"ZafComboBox"`

ZafComboBox`(int left, int top, int width, int height);`

This constructor is useful in straight-code situations. *left* and *top* specify the left and top of the object, while *width* and *height* specify the width and height of the drop down list. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

ZafComboBox`(const ZafComboBox &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafComboBox object and copies the object's information.

```
ZafComboBox(const ZafIChar *name, ZafObjectPersistence
    &persist);
```

The final constructor is used for persistence. Refer to `ZafWindow` for more information, since most persistence is done at the ZafWindow level.

An example of how to create a combo-box with strings follows:

```
// Create a sample window with an editable combo-box with
    strings.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);
ZafComboBox *comboBox = new ZafComboBox(0, 0, 20, 5);
// Children are automatically positioned by the combo-box.
comboBox->Add(new ZafString(0, 0, 20, "Black", -1));
comboBox->Add(new ZafString(0, 0, 20, "Blue", -1));
comboBox->Add(new ZafString(0, 0, 20, "Green", -1));
comboBox->Add(new ZafString(0, 0, 20, "Red", -1));
comboBox->Add(new ZafString(0, 0, 20, "White", -1));
// Add the combo-box to the window.
window1->Add(comboBox);
```

Destructor

```
virtual ~ZafComboBox(void);
```

The destructor is used to free the memory associated with a ZafComboBox object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafComboBox object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoSortData

```
bool AutoSortData(void) const;
virtual bool SetAutoSortData(bool autoSortData);
```

If AutoSortData() is true, the combo-box will automatically sort its children as they are added to the combo-box. The function returned by CompareFunction() is used to sort the children. By default, sorting is done in alphabetical order, but SetCompareFunction() may be called to provide a custom sorting function. See ZafList::CompareFunction() for more information about sorting list children. The default value of this attribute is false, but the user may call SetAutoSortData() to make changes.

SetBackground-Color

```
virtual ZafLogicalColor
   SetBackgroundColor(ZafLogicalColor color,
   ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of combo-box children, the ZafComboBox object sets the ParentPalette() attribute on each of its children (see ZafWindowObject::ParentPalette()). In conjunction with this attribute, this overloaded function provides functionality for setting the background color for all the children in the combo-box.

SetFont

```
virtual ZafLogicalFont SetFont(ZafLogicalFont font);
```

To provide consistency in the appearance of combo-box children, the ZafComboBox object sets the ParentPalette() attribute on each of its children (see ZafWindowObject::ParentPalette()). In conjunction with this attribute, this overloaded function provides functionality for setting the font for all the children in the combo-box.

list

```
ZafVtList *list;
```

The list member is used internally by ZAF to house the children of a combo-box. The programmer should never need to access this member, since it is maintained by the ZafComboBox class.

SetTextColor

```
virtual ZafLogicalColor SetTextColor(ZafLogicalColor
   color, ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of combo-box children, the ZafComboBox object sets the ParentPalette() attribute on each of its children (see ZafWindowObject::ParentPalette()). In conjunction with this attribute, this overloaded function provides functionality for setting the text color for all the children in the combo-box.

ViewOnly

```
bool ViewOnly(void) const;
virtual bool SetViewOnly(bool viewOnly);
```

A ViewOnly() ZafComboBox object may not be edited, but may be the current object of a window, and arrow keys may be used to navigate it. If a ViewOnly() ZafComboBox object is OSDraw(), text may be selected and copied to the clipboard, but it may not be modified. ViewOnly() is false by default, but the user may call SetViewOnly() to make changes.

A common use of a ZafComboBox object with ViewOnly() false is to allow the end user to type a new value that is to be dynamically added as a new child when <Enter> or <Return> is typed, such as with a selection of font sizes. This behavior may be implemented by adding a new child to the ZafComboBox object using the Add() function. See ZafWindow::Add() for more information on adding child objects.

ZafConstraint

Event	Object	SetObjNumberID

Inheritance `ZafConstraint : ZafElement`

Declaration `#include <z_gmgr.hpp>`

Description ZafConstraint is provided solely as a base class for all geometry management constraint classes to be used with ZafGeometryManager (see ZafGeometry-Manager for more information). ZafConstraint is an abstract class, since it defines a pure virtual function. ZAF provides three superclasses of ZafConstraint: ZafAttachment, ZafDimensionConstraint, and ZafRelativeConstraint.

Since ZafConstraint is the abstract base class for all constraint classes, the information presented in this chapter applies to all the superclasses.

Constructors All ZafConstraint constructors initialize the member variables associated with an instantiated ZafConstraint object. The default values set by the ZafConstraint and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafConstraint	
`Object()`	`user-supplied parameter`
ZafElement	
`ClassID()`	`ID_ZAF_CONSTRAINT`
`ClassName()`	`"ZafConstraint"`

ZafConstraint`(ZafWindowObject *object);`

This constructor is called by superclass constructors to create a ZafConstraint, attached to *object*. (See Object() for more information.)

ZafConstraint`(const ZafConstraint &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It is provided solely so that superclass instances may be copied via a ZafConstraint pointer.

```
ZafConstraint(const ZafIChar *name, ZafObjectPersistence
    &persist);
```

The final constructor is used for persistence. Refer to `ZafWindow` for more information, since most persistence is done at the ZafWindow level.

An example of how to create a constraint follows:

```
// Create a status bar with geometry-managed children.
ZafStatusBar *stat = new ZafStatusBar(0, 0, 0, 1);
ZafString *string = new ZafString(0, 0, 15, new
    ZafStringData("String"));
stat->Add(string);
ZafTime *time = new ZafTime(15, 0, 15, new ZafTimeData);
stat->Add(time);

// Time field will remain at the right side of status bar.
ZafAttachment *attach = new ZafAttachment(time, ZAF_ATCF_RIGHT);
attach->SetOffset(0);

// Create the geometry manager and add the first constraint.
ZafGeometryManager *geo = new ZafGeometryManager;
geo->Add(attach);

// String field will occupy the remaining space.
attach = new ZafAttachment(string, ZAF_ATCF_RIGHT);
attach->SetStretch(true);
attach->SetReference(time);
attach->SetOppositeSide(true);
attach->SetOffset(1);

// Add the second constraint to the geometry manager.
geo->Add(attach);

// Add the geometry manager to the status bar.
stat->Add(geo);
```

Destructor

```
virtual ~ZafConstraint(void);
```

The destructor is used to free the memory associated with a ZafConstraint object. It chains to the ZafElement destructor.

Generally, the programmer will not directly destroy a ZafConstraint object, since it is automatically destroyed when its parent geometry manager is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Event

`virtual ZafEventType` **`Event`**`(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafConstraint object. The only event handled by ZafConstraint is S_INITIALIZE, which causes the constraint to initialize its numberID, stringID, and Object().

Object

`ZafWindowObject *`**`Object`**`(void);`

Object() is the window object to which the constraint applies. There may be many constraints that apply to a single object, but a constraint applies to exactly one window object.

SetObjNumberID

`void` **`SetObjNumberID`**`(ZafNumberID tObjNumberID);`

SetObjNumberID() specifies to the constraint the numberID of the window object to which it applies. When reading a constraint from a persistent data file, the constraint is tied to its window object via the numberID. *tObjNumberID* is the numberID of the window object.

ZafCoordinateStruct

cellHeight	ConvertYValue	miniNumeratorY
cellWidth	miniDenominatorX	pixelsPerInchX
coordinateType	miniDenominatorY	pixelsPerInchY
ConvertXValue	miniNumeratorX	

Inheritance

```
Root structure
```

Declaration

```
#include <z_coord.hpp>
```

Description

ZafCoordinateStruct provides support for various coordinate systems in ZAF. ZAF_CELL is the default coordinate system based on the size of the system font on each environment. Since this system is fully portable to all environments (including non-graphical character-based environments) the programmer should use coordinate systems other than ZAF_CELL only when greater precision is needed. ZAF_MINICELL coordinates are fractional ZAF_CELLs and are portable between graphical environments only. ZAF_PIXEL coordinates are not portable. Other coordinate systems are available as well and are discussed in coordinateType below. ZafCoordinateStruct provides conversion values and functions for converting between the different supported coordinate systems in ZAF.

Members

cellHeight	`static int` **`cellHeight`**`;`
cellWidth	`static int` **`cellWidth`**`;`
miniDenominatorX	`static long` **`miniDenominatorX`**`;`
miniDenominatorY	`static long` **`miniDenominatorY`**`;`
miniNumeratorX	`static long` **`miniNumeratorX`**`;`
miniNumeratorY	`static long` **`miniNumeratorY`**`;`
pixelsPerInchX	`static long` **`pixelsPerInchX`**`;`
pixelsPerInchY	`static long` **`pixelsPerInchY`**`;`

These members are all initialized by each environment in the ZafDisplay constructor. *cellHeight* and *cellWidth* depend on the system font, and correspond to the number of pixels per cell in the ZAF_CELL coordinate system.

A mini-cell corresponds to the ZAF_MINICELL coordinate system, and is calculated using the pixel values of a cell. *cellWidth* multiplied by *miniNumeratorX* divided by *miniDenominatorX* specifies the number of pixels per mini-cell along the x-axis. *cellHeight* multiplied by *miniNumeratorY* divided by *miniDenominatorY* specifies the number of pixels per mini-cell along the y-axis.

pixelsPerInchX specifies the number of pixels in an inch along the x-axis, and *pixelsPerInchY* specifies the number of pixels in an inch along the y-axis.

coordinateType

```
ZafCoordinateType coordinateType;
```

coordinateType specifies the coordinate system used by the object. The coordinate systems defined in ZAF are as follows:

coordinateType	Description
`ZAF_CELL`	Specifies the cell coordinate system, based on the system font, and the only coordinate system portable to both graphical and character-based environments.
`ZAF_MINICELL`	Specifies the mini-cell coordinate system, based on fractional cells calculated as specified above. Mini-cells are portable between graphical environments.
`ZAF_PIXEL`	Specifies the pixel coordinate system using native display values. Pixels are not portable.
`ZAF_POINTS`	Specifies the point coordinate system commonly used in typography. There are 72 points in an inch, but inches are not rigidly defined on a display. Points are not fully portable but may be appropriate for internal calculations requiring greater precision.
`ZAF_TWIPS`	Specifies the twip coordinate system. There are 20 twips in a point, or 1440 twips in an inch, but inches are not rigidly defined on a display. Twips are not fully portable but may be appropriate for internal calculations requiring greater precision.

ConvertXValue

```
long ConvertXValue(long value, ZafCoordinateType typeIn,
   ZafCoordinateType ZafCoordinateType typeOut);
```

ConvertXValue() converts *value*, specified along the x-axis in the *typeIn* coordinate system to the *typeOut* coordinate system, and returns the result.

ConvertYValue

```
long ConvertYValue(long value, ZafCoordinateType typeIn,
   ZafCoordinateType ZafCoordinateType typeOut);
```

ConvertYValue() converts *value*, specified along the y-axis in the *typeIn* coordinate system to the *typeOut* coordinate system, and returns the result.

ZafCursor

BlinkRate	ImageType
Event	Poll

Inheritance `ZafCursor : ZafDevice : ZafElement`

Declaration `#include <z_cursor.hpp>`

Description ZafCursor is the class that defines cursor device support. A cursor shows the end user where keyboard focus is, and usually blinks for noticability. Any keys typed will be inserted where the cursor is.

Constructors All ZafCursor constructors initialize the member variables associated with an instantiated ZafCursor object. Default values set by the ZafCursor follow, as well as base class values when overridden by ZafCursor.

Member Initializations

ZafCursor

`BlinkRate()`	`environment-specific`
`ImageType()`	`user-supplied parameter`

ZafDevice

`DeviceType()`	`E_CURSOR`

ZafElement

`ClassID()`	`ID_ZAF_CURSOR`
`ClassName()`	`"ZafCursor"`
`NumberID()`	`ID_ZAF_CURSOR`
`StringID()`	`"ZafCursor"`

```
ZafCursor(ZafDeviceState state = D_ON, ZafDeviceImage
   imageType = DC_INSERT);
```

This constructor is used to instantiate a ZafCursor object to be added to a ZafEventManager object. *state* specifies the initial state of the device, and *imageType* specifies the initial image type displayed by the device (see ImageType() for more information).

```
ZafCursor(const ZafCursor &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafCursor object and copies the object's information. An example of how to create a ZafCursor object follows:

```
// Instantiate the input devices.
ZafEventManager *eventManager = new ZafEventManager;
eventManager->Add(new ZafKeyboard);
eventManager->Add(new ZafMouse);
eventManager->Add(new ZafCursor);
```

Destructor

```
virtual ~ZafCursor(void);
```

The destructor is used to free the memory associated with a ZafCursor object. It chains to the ZafDevice and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafCursor object, since it is automatically destroyed when the event manager is destroyed. For more information on device object deletion, see ZafEventManager::~ZafEventManager().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

BlinkRate

```
static int BlinkRate(void);
static int SetBlinkRate(int blinkRate);
```

BlinkRate() is a static member used by environments that don't automatically blink the cursor device. It should normally not be referred to by the programmer.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events sent to the ZafCursor object. ZafCursor handles all the DC_* messages discussed in ImageType(), as well as D_STATE, which causes a device to return its state.

ImageType

```
ZafDeviceImage ImageType(void) const;
virtual ZafDeviceImage SetImageType(ZafDeviceImage
    imageType);
```

ImageType() returns a constant that indicates the cursor's current image type. SetImageType() may be called to change a cursor's image type, if supported by the environment. The different image types supported by ZafCursor are as follows:

ImageType()	**Description**
DC_INSERT	causes the cursor to show the insert image
DC_OVERSTRIKE	causes the cursor to show the overstrike image

Poll

```
virtual void Poll(void);
```

In some environments, the Poll() function checks the cursor device for any input events and posts them on the event manager's queue, if the ZafCursor's state is not D_OFF. In other environments where cursor events are handled automatically by the native environment's event queue, Poll() simply blocks cursor events from coming through ZAF's event manager queue if the ZafCursor's state is D_OFF.

ZafData

Clear	Duplicate	Event
Destroyable	Error	GetObject

Inheritance `ZafData : ZafElement, ZafNotification`

Declaration `#include <z_data.hpp>`

Description

ZafData is the base class for all low-level data types such as dates, times, strings, bitmaps, etc. This class is derived from both the ZafElement and ZafNotification base classes, giving it the inherited capabilities associated with list elements and data notification objects. These inherited features include string and number identifications, notification to window objects when a particular data value changes, and notification when the contents of an associated user interface object is modified.

ZafData is an abstract class since it has some pure virtual functions and a protected constructor. Since you cannot directly instantiate a ZafData class, you must instantiate a publicly available derived class. There are three types of data objects that are supported by Zinc:

- data objects that allow formatted text
- data objects that have image information
- data objects that maintain internationalization information

These ZAF classes are listed below, presented under their data category.

Formatted	Images	Internationalization
`ZafBignumData`	`ZafBitmapData`	`ZafCharMapData`
`ZafDateData`	`ZafIconData`	`ZafLanguageData`
`ZafIntegerData`	`ZafMouseData`	`ZafLocaleData`
`ZafStringData`	`ZafScrollData`	
`ZafRealData`		
`ZafTimeData`		
`ZafUTimeData`		

Constructors

The ZafData class constructor can only be instantiated from a derived class's constructor such as ZafDateData, ZafStringData, ZafIconData, or ZafLanguageData.

The primary purpose of this constructor is to initialize the ZafElement and ZafNotification portions of the class and to clear the error value

(ZAF_ERROR_NONE) associated with the data object. The default values set by ZafData are listed below, as well as values overridden from those set by base class constructors.

Member Initializations

ZafData	
`Destroyable()`	`true`
`Error()`	`ZAF_ERROR_NONE`
ZafElement	
`ClassID()`	`ID_ZAF_DATA`
`ClassName()`	`"ZafData"`

`**ZafData**(void);`

All other aspects of this class constructor are deferred to the appropriate derived class definition. Please refer to the specific data object you are using for complete information about the object's construction.

```
ZafData(const ZafIChar *name, ZafDataPersistence
    &persist);
```

This constructor is used for persistence. The parameters and values of this constructor are deferred to the `ZafWindow` section of this manual, since most persistence is done at the ZafWindow level.

Destructor

```
virtual ~ZafData(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafData object. The ZafData portion of the destructor performs no internal operations because no memory is allocated for ZafData members. It simply provides a chain from the derived object's destructor up to the ZafElement and ZafNotification class destructors.

A ZafData pointer may be deleted even though the class definition is abstract. This is done by allocating a derived object and by setting the returned object to a ZafData pointer.

The following code shows the correct use of the ZafData destructor under these conditions.

```
// Create a string data object.
ZafData *string = new ZafStringData("string", 100);
...
// Free the string.
```

```
delete string;
```

The pointer assignment, shown above, is permitted because ZafData is a base class to ZafStringData. When the string object's destructor is called, the actual contents of the ZafStringData instance are freed because the base class destructor is declared virtual.

For complete information on the type of memory that is freed as a result of a call to the destructor, see the reference chapter on the particular object you created.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Clear

`virtual void **Clear**(void) = 0;`

This is a pure virtual function that abstractly defines "clearing" functionality for a derived object. The Clear() function operates differently on various derived objects. For example:

Derived class	**Description of Clear()**
`ZafBitmapData`	Destroys the original bitmap array associated with the object and also any environment specific bitmap handles that were created during the application's run-time operation.
`ZafIntegerData`	Sets the integer value of the object to be 0.
`ZafLocaleData`	Resets the locale information based on a set of information known as the canonical locale.
`ZafStringData`	Sets the string value of the object to be a blank string, but does not destroy the string buffer.

The following code shows how to use this method.

```
// Create an integer.
ZafData *data = new ZafIntegerData(100);
...
// Clear the data object's contents.
data->Clear();
```

If data notification is active, and the integer data is associated with a window object, then a call to Clear() will not only clear the internal value of the data, but will also make a request to the associated window object to re-display its screen information.

Destroyable

```
bool Destroyable(void) const;
bool SetDestroyable(bool destroyable);
```

If Destroyable() is true, then the data object is considered non-static, and is maintained by the corresponding window object. In other words, when the corresponding window object is destroyed, then the data object is also destroyed, usually by the window object's destructor. On the other hand, if Destroyable() is false, ZAF will not destroy the data object, and the programmer assumes responsibility for the data object. The default value of this attribute is true, but it may be changed by calling SetDestroyable().

Duplicate

```
virtual ZafData *Duplicate(void) = 0;
```

Duplicate() abstractly defines functionality for duplicating a derived object. A derived class must provide a Duplicate() function, since it is declared pure virtual. Generally, Duplicate() simply calls the copy constructor for the derived class. Duplicate() may be called correctly with a ZafData pointer, since it is declared virtual. For example, the following code correctly creates two string data objects:

```
// Create an integer.
ZafData *data = new ZafIntegerData(100);
...
// Create a duplicate of the integer data object.
ZafData *dataCopy = data->Duplicate();
```

Error

```
ZafError Error(void) const;
ZafError SetError(ZafError error);
```

Error() stores the last error that occurred with the object. The default value of Error() is ZAF_ERROR_NONE, but it may be set internally by the library whenever an error occurs, and SetError() may be called to change it. Note that the programmer is responsible for setting this attribute back to ZAF_ERROR_NONE when appropriate. The types of errors that can be set are defined in the header file z_env.hpp. Generally, however, only the following error values will be used by a ZafData object:

Error()	Description
`ZAF_ERROR_NONE`	No error exists.
`ZAF_ERROR_INVALID`	The contents of the data object are invalid, meaning the data object's value can be shown on the screen and used in calculations, but that the value is incorrect in the context of the application. For instance, the value 45 is a legitimate integer, but is invalid when used to describe the number of days in the month of February.
`ZAF_ERROR_OUT_OF_RANGE`	An error occurred while trying to convert data from one type to another or where the argument was too big or too small for the return value. For example, a value of 1000 does not fit into a "%c" sprintf() style argument.
`ZAF_ERROR_INVALID_TARGET`	The target data could not accept the source value being presented. Such an error would occur while trying to set an integer value from a large floating point number.
`ZAF_ERROR_INVALID_SOURCE`	The source data is either of an incorrect type, or the data cannot be converted by the target object. This error is similar to the invalid target error, except that the error occurred in the information being passed by the source, rather than by an error in the target.

In addition to the error types described above, error values greater than or equal to 10,000 are reserved for use on user-defined objects.

The following code fragments show how to define and use an error value with a derived data object.

```
// Define the class and constant.
const ZafError CARTESIAN_ERROR = 10000;
class Cartesian : public ZafData
...
// Create a new coordinate.
```

```
Cartesian coordinate(120, 100);
...
// Check for coordinate error.
if (coordinate > point1 || coordinate < point2)
  coordinate.SetError(CARTESIAN_ERROR);
...
// Check the error status.
if (coordinate.Error())
  break;
```

Event

`virtual ZafEventType` **`Event`**`(const ZafEventStruct &event);`

Event() processes all the events that come to the data object. At this level, no events are handled. Derived classes must handle events in overloaded Event() functions.

GetObject

`virtual ZafData *`**`GetObject`**`(ZafNumberID numberID);`
`virtual ZafData *`**`GetObject`**`(ZafIChar *stringID);`

At the data level, the GetObject() functions simply check the parameter against the data object's identification. The *numberID* parameter is checked against NumberID(), and the *stringID* parameter is checked against StringID(). If they match, GetObject() returns a pointer to the data object, or null otherwise.

ZafDataManager

AllocateData

Inheritance `ZafDataManager : ZafDataRecord : ZafData : (ZafNotification, ZafElement), ZafList`

Declaration `#include <z_data.hpp>`

Description ZafDataManager cooperates with ZafDataPersistence through the zafDataPersistence global in maintaining ZafData objects to be used in an application. By calling AllocateData(), the programmer can ask the ZafDataManager to load a particular data object out of persistence, or simply return the data object if it has already been loaded.

Constructor The ZafDataManager constructor initializes the member variables associated with an instantiated ZafDataManager object. The default values set by the ZafDataManager and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafElement

`ClassID()`	`ID_ZAF_DATA_MANAGER`
`ClassName()`	`"ZafDataManager"`

ZafDataManager(void);

The constructor allocates a ZafDataManager instance.

The following code snippet shows how to use the global zafDataManager:

```
// Ask the data manager for a bitmap data object
// whose stringID is "MyBitmap".
// AllocateData() will load the bitmap data object
// from persistence if necessary.
ZafBitmapData *bitmapData = DynamicPtrCast(zafDataManager-
    >AllocateData("MyBitmap", ZafBitmapData::className,
    ZafBitmapData::classID), ZafBitmapData);
```

Destructor

```
virtual ~ZafDataManager(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafDataManager object. All ZafData objects associated with the ZafDataManager are destroyed.

Members

```
virtual ZafData *AllocateData(const ZafIChar *stringID,
   ZafClassName className, ZafClassID classID);
```

AllocateData

AllocateData() returns a pointer to the object identified by a stringID of *stringID*. If it hasn't been loaded yet, AllocateData() asks ZafDataPersistence through the global zafDataPersistence to load the object using GetDataConstructor(). If the object cannot be found, null is returned. *className* specifies the constant string identifier for the class of the object to be loaded, and *classID* specifies the constant number identifier for the class of the object to be loaded.

ZafDataPersistence

AddDataConstructor	CurrentFile	PopLanguage
AddFileSystem	CurrentFileSystem	PushLanguage
AllocateFile	CurrentLanguage	PopLevel
ClearDataConstructors	Error	PushLevel
ClearFileSystems	FirstFileSystem	SetDataConstructors
CurrentClassID	LastFileSystem	SubtractDataConstructor
CurrentClassName	Merge	SubtractFileSystem

Inheritance

```
Root class
```

Declaration

```
#include <z_data.hpp>
```

Description

ZafDataPersistence allows objects derived from ZafData to be written to, and/or read from a storage object—usually a persistent data file.

Using ZafDataPersistence, a ZafData object can be constructed directly from information stored in the data file, or stored there for later use. A table of persistent data objects is maintained by this class and is used to reference each object's Read() function during construction. All ZAF-supplied data classes are included in this table by default and the programmer may add support for derived classes. See AddDataConstructor().

ZafData constructors (and thereby ZafDataPersistence members) are often called by ZafWindowObject constructors, or by ZafDataManager::Allocate-Data(). ZafDataPersistence uses ZafFileSystem and ZafFile to maintain and manipulate one or more persistent object data files. See ZafStorage for more information.

Constructors

ZafDataPersistence initializes its members to the following default values:

Member Initializations

ZafDataPersistence	
`CurrentLanguage()`	`0`
`Error()`	`ZAF_ERROR_NONE`

```
ZafDataPersistence(ZafFileSystem *fileSystem,
   DataConstructor *dataConstructor);
```

The ZafDataPersistence class constructor creates a ZafDataPersistence object based on the open file *fileSystem* and the persistent data constructor table *dataConstructor*.

Below is the definition of ZafDataPersistence::DataConstructor.

```
struct DataConstructor
{
  ZafClassID classID;
  ZafClassName className;
  ZafDataConstructor constructor;
};
```

classID is the numeric class identification constant for the data class, *className* is the string class identification constant for the data class, and *constructor* is a pointer to the function used to construct an instance of the data class. The *className* identifier is used by ZafDataPersistence to locate the correct persistent constructor for a data class. The definition of ZafDataConstructor follows:

```
typedef ZafElement *(*ZafDataConstructor)(const ZafIChar *,
    ZafDataPersistence &);
```

ZafDataPersistence`(const DataConstructor &copy);`
ZafDataPersistence`(const ZafDataPersistence &copy);`

The copy constructors create a new ZafDataPersistence object and initialize its data from *copy*.

The following code snippet shows how to create a ZafDataPersistence object and use it to load a data object from storage:

```
  // Create a storage object, which opens the data file.
  ZafStorage *storage = new ZafStorage("test.znc",
    ZAF_FILE_READ);

  // Create a persistence object for loading the data object.
  zafDataPersistence = new ZafDataPersistence(storage,
    zafDefaultDataConstructor);

  // Load the data object from the data file.
  ZafBignumData *bignumData = new ZafBignumData("BignumData1",
    *zafDataPersistence);
```

Often it is useful to derive a ZafData class and store custom information to the persistent file. The following code snippet shows how to derive a class that stores its own data in addition to information normally stored by base classes:

```
// Define the static members of MyStringData.
```

```
ZafClassID MyStringData::classID = 3500;
ZafClassNameChar MyStringData::className[] ="MyStringData";

// Persistent constructor of MyStringData.
// PushLevel() before reading the base class information.
MyStringData::MyStringData(const ZafIChar *name,
    ZafDataPersistence &persist) : ZafStringData(name,
    persist.PushLevel(className, classID, ZAF_PERSIST_FILE))
{
  if (persist.Error() == ZAF_ERROR_NONE)
  {
    // Read the MyStringData class information.
    ZafFile *file = persist.CurrentFile();
    *file >> MyStringData::member;
  }
  // PopLevel() after the class information has been read.
  persist.PopLevel();

  // Save the error into the object if the data couldn't be read.
  if (persist.Error() != ZAF_ERROR_NONE)
    SetError(persist.Error());
}

// Define Read(), since ZafData must add it to the
// ZafDataPersistence data constructor table.
ZafElement *MyStringData::Read(const ZafIChar *name,
    ZafDataPersistence &persist)
{
  return (new MyStringData(name, persist));
}

// Write() stores the class information in the data file.
// Base class info is stored first followed by custom info.
void MyStringData::Write(ZafDataPersistence &persist)
{
  // Write the base class information.
  // PushLevel() before writing the base class information.
  // (AllocateFile() is called internally to prep the file.
  ZafStringData::Write(persist.PushLevel(className, classID,
    ZAF_PERSIST_FILE));

  if (persist.Error() == ZAF_ERROR_NONE)
  {
    // Write the MyStringData class information.
    ZafFile *file = persist.CurrentFile();
    *file << MyStringData::member;
  }

  // PopLevel() after writing the class information.
  persist.PopLevel();

  // Save the error into the object if data couldn't be written.
  if (persist.Error() != ZAF_ERROR_NONE)
    SetError(persist.Error());
}
```

Destructor

`virtual ~`**`ZafDataPersistence`**`(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafDataPersistence object. Generally, the programmer will not directly destroy a ZafDataPersistence object, since it is destroyed when the application is closed.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AddData-Constructor

```
virtual DataConstructor *AddDataConstructor(ZafClassName
    className, ZafClassID classID, ZafDataConstructor
    constructor);
```

AddDataConstructor() adds a data class constructor to ZafDataPersistence's table of constructors. *className* is the string class identification constant for the data class, *classID* is the numeric class identification constant for the data class, and *constructor* is a pointer to the function used to construct an instance of the data class. If an entry with the same class identification constants is already present in the table, its constructor is updated to *constructor*. A pointer to the DataConstructor element in the table is returned. Internally, ZAF uses *className* for all lookups.

AddFileSystem

```
ZafFileSystem *AddFileSystem(ZafFileSystem *fileSystem,
    ZafFileSystem *position = ZAF_NULLP(ZafFileSystem));
```

AddFileSystem() adds a data file to a table (list) of data files to search when trying to load a data object. *fileSystem* specifies the data file to add to the table. If *position* is null, the data file is added to the end of the table, in effect becoming the last data file to search. If *position* is non-null, *fileSystem* is added to the table before the data file specified by *position*, causing *fileSystem* to be searched before *position*. *fileSystem* is returned.

When ZafDataPersistence reads data it first calls AllocateFile() to search for the data in each of the file systems in its list, moving from first to last. The read is successful when the first matching entry is found and read, and fails if all file systems are searched unsuccessfully.

AllocateFile

```
ZafError AllocateFile(const ZafIChar *name, ZafFileMode
    mode);
```

AllocateFile() finds the object specified by the stringID *name* in the data files that have been added to the data file table by AddFileSystem(). CurrentFile() then points to the object.

If *mode* is ZAF_FILE_READ and the object was not found, Error() is set to either ZAF_ERROR_INVALID_ID (meaning the object wasn't found), or ZAF_ERROR_FILE_OPEN (meaning the file was not open); otherwise, Error() is set to ZAF_ERROR_NONE.

If *mode* is ZAF_FILE_READWRITE, ZAF_FILE_CREATE, or ZAF_FILE_OPENCREATE and the object wasn't found, the file is prepared for the object to be written. The value Error() is returned.

ClearData-Constructors

```
virtual void ClearDataConstructors(void);
```

ClearDataConstructors() clears the table of data constructors and destroys the memory associated with the table, so that no data constructor is associated with the ZafDataPersistence object.

ClearFileSystems

```
virtual void ClearFileSystems(void);
```

ClearFileSystems() clears the table of file systems, so that no file is associated with the ZafDataPersistence object.

CurrentClassID

```
virtual ZafClassID CurrentClassID(void);
```

CurrentClassID() returns the numeric class identification constant for the object currently being accessed.

CurrentClassName

```
virtual ZafClassName CurrentClassName(void);
```

CurrentClassName() returns the string class identification constant for the object currently being accessed.

CurrentFile

```
ZafFile *CurrentFile(void) const;
```

CurrentFile() returns the location in the file system where the object was found or created by a previous call to AllocateFile(). CurrentFile() is called before reading or writing an object's data in a data file.

CurrentFileSystem

```
ZafFileSystem *CurrentFileSystem(void) const;
```

CurrentFileSystem() returns the file system in which the object was found or created by a previous call to AllocateFile().

CurrentLanguage

```
const ZafIChar *CurrentLanguage(void) const;
```

CurrentLanguage() returns the current language of the object being read or written, specified by a two-character ISO code. This language ID is appended to the file name when a language has been specified using PushLanguage(). (see ZafI18nData for more information).

Error

```
ZafError Error (void) const;
ZafError SetError(ZafError error);
```

Error() stores the last error that occurred with the ZafDataPersistence object. The default value of Error() is ZAF_ERROR_NONE, but it may be set internally by the library whenever an error occurs, and SetError() may be called to change it. Note that the programmer is responsible for setting this attribute back to ZAF_ERROR_NONE when appropriate. The types of errors that can be set are defined in the header file z_env.hpp. Generally, however, only the following error values will be used by a ZafDataPersistence object:

Error()	**Description**
ZAF_ERROR_NONE	No error exists.
ZAF_ERROR_INVALID_ID	No object with the ID given was found in the table.
ZAF_ERROR_FILE_OPEN	The file to be searched was not open.

FirstFileSystem

```
ZafFileSystem *FirstFileSystem(void) const;
```

FirstFileSystem() returns the first file system added to the search table by AddFileSystem().

GetDataConstructor

```
virtual ZafDataConstructor GetDataConstructor(ZafClassID
    classID, ZafClassName className = 0);
```

GetDataConstructor() finds and returns a data class constructor in ZafDataPersistence's table of constructors according to the class identification constants. *classID* is the numeric class identification constant for the data class and *className* is the string class identification constant for the data class. If no matching class is found, null is returned.

LastFileSystem

```
ZafFileSystem *LastFileSystem(void) const;
```

LastFileSystem() returns the last file system added to the search table by AddFileSystem().

Merge

```
bool Merge(ZafDataPersistence &copy);
```

Merge() merges *copy* and all its data (including tables and file systems) into this ZafDataPersistence object and returns true. The merged object's tables and file systems are removed from *copy* and added to this ZafDataPersistence object, so *copy* is in effect empty after calling this function.

PopLanguage
PushLanguage

```
int PopLanguage(void);
int PushLanguage(const ZafIChar *language);
```

To support multilingual application data (multiple languages in a single data file), PushLanguage() must be called with the two-character ISO code that specifies the language before reading or writing the data. (See ZafI18nData for more information.)

PushLanguage() causes the object data to be stored in a different location using the *language* specifier. After the data is read or written, PopLanguage() must be called to finalize the operation.

Both functions return a zero-based index into ZafDataPersistence's internal language table. The following code snippet shows how to use these functions:

```
// Get the Spanish version of the data.
zafDataPersistence->PushLanguage("es");

// Load Spanish messages from data file.
ZafLanguage esMessages("MyMessages", *zafDataPersistence);

// Finalize the read operation.
zafDataPersistence->PopLanguage();
```

PopLevel
PushLevel

```
ZafDataPersistence &PopLevel(void);
ZafDataPersistence &PushLevel(ZafClassName className,
   ZafClassID classID, ZafPersistEntryType type);
```

Since each class may write its own data and chain to other objects to write data pieces, these methods maintain a stack to facilitate the opening and closing of the object in the file system. Each time a derived class calls its base class to read or write information, it calls PushLevel(). The root class calls Allocate-File() to find the object and open it for reading or writing. Then after each class reads or writes its information, it calls PopLevel(). The last PopLevel() causes the object to be closed in the file system.

Using PushLevel() and PopLevel() the programmer can preserve a file system state and return to it later. For example, one object may cause another object to be written into a different directory and file (a change in file system state). To ensure that the file system state is not destroyed by the secondary write, Push-Level() and PopLevel() are called before and after the secondary operation.

className specifies the string class identification constant for the class. Only the derived-most class name is important when reading and writing the object. *classID* specifies the numeric class identification constant for the class, and only the derived-most class ID is important when reading and writing the object. *type* specifies where to look for the object in the file system. The possible values of *type* are as follows:

ZafPersistEntryType	**Description**
`ZAF_PERSIST_DATA`	Directs AllocateFile() to look for the object in the data section of the file system
`ZAF_PERSIST_DIRECTORY`	Directs AllocateFile() to look for the object in the file system's directory specified by the persistent constructor's *name* parameter
`ZAF_PERSIST_FILE`	Directs AllocateFile() to look for the object in the current directory of the file system
`ZAF_PERSIST_ROOT_DIRECTORY`	Directs AllocateFile() to look for the object in the *className* directory in the root of the file system
`ZAF_PERSIST_ROOT_FILE`	Directs AllocateFile() to look for the object in the root directory of the file system

SetData-Constructors

```
virtual bool SetDataConstructors(DataConstructor
    *dataConstructor);
```

SetDataConstructors() clears ZafDataPersistence's table of constructors, then creates a new table of constructors based on the pre-built *dataConstructor* table. SetDataConstructors() is an internal routine, and is normally not called by the programmer.

SubtractData-Constructor

```
virtual bool SubtractDataConstructor(ZafClassID classID,
    ZafClassName className = 0);
```

SubtractDataConstructor() removes a data class constructor from ZafDataPersistence's table of constructors. *classID* is the numeric class identification constant for the data class and *className* is the string class identification constant for the data class. If the entry was successfully removed, true is returned; otherwise, false is returned.

SubtractFileSystem

```
ZafFileSystem *SubtractFileSystem(ZafFileSystem
    *fileSystem);
```

SubtractFileSystem() removes a data file from the table of data files to search when trying to load a data object. *fileSystem* specifies the data file to remove from the table. If an error occurs, null is returned; otherwise a pointer to *fileSystem* is returned.

ZafDataRecord

Clear	GetObject

Inheritance

```
ZafDataRecord : ZafData : (ZafNotification,
   ZafElement), ZafList
```

Declaration

```
#include <z_data.hpp>
```

Description

ZafDataRecord is provided strictly as a base class for ZafDataManager. ZafDataRecord provides service routines used by ZafDataManager to maintain its list of ZafData objects. Please refer to ZafDataManager for more information.

Constructors

The ZafDataRecord constructors initialize the member variables associated with an instantiated ZafDataRecord object. The default values set by the ZafDataRecord and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafElement	
`ClassID()`	`ID_ZAF_DATA_RECORD`
`ClassName()`	`"ZafDataRecord"`

```
ZafDataRecord(void);
```

This constructor allocates a ZafDataRecord instance.

```
ZafDataRecord(const ZafIChar *name, ZafDataPersistence
   &persist);
```

This constructor is used for persistence. Refer to `ZafWindow` for more information, since most persistence is done at the ZafWindow level.

Destructor

```
virtual ~ZafDataRecord(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafDataRecord object. All ZafData objects associated with the ZafDataRecord are destroyed.

Members

Clear

```
virtual void Clear(void);
```

Clear() provides a hook for clearing the data associated with the ZafDataRecord object. This is an advanced routine, and should not be used by the programmer.

GetObject

```
virtual ZafData *GetObject(ZafNumberID numberID);
virtual ZafData *GetObject(const ZafIChar *stringID);
```

These functions return a pointer to the ZafData object in the ZafDataRecord object's list with either the identifier *numberID* or the identifier *stringID*. If a data object cannot be found with the identifier provided, null is returned. See ZafElement for more information on these identifiers.

ZafDate

DateData Event

Inheritance

`ZafDate : ZafString : ZafWindowObject : ZafElement`

Declaration

```
#include <z_date1.hpp>
```

Description

ZafDate is a single-line date object that allows user input through the keyboard. ZafDate is fully internationalized to display and input using any format.

All ZafDate objects refer to data contained in a ZafDateData object (refer to this class for additional essential information). ZafDate includes "year 2000 compliance," meaning that through the underlying ZafDateData object, a ZafDate object keeps track of the exact year, rather than just the last two digits.

Formats

ZafString and derived classes parse input and display output based on default or programmer-defined input and output formats. Programmers may use the SetInputFormat() and SetOutputFormat() families of functions to change the default format. The functions are documented in the ZafString reference.

Each class derived from ZafFormatData handles a different set of formatting arguments, in addition to those supported by its base classes. ZafDateData (and therefore ZafDate) handles the following "date" subset of the arguments supported by ZafUTimeData (the parent class to ZafDateData):

Format Argument	Substitution
%%	'%' character
%a	Locale-specific abbreviated weekday name
%A	Locale-specific full weekday name
%b	Locale-specific abbreviated month name
%B	Locale-specific full month name
%C	Century number (the year divided by 100 and truncated to an integer) as a decimal number [00-99]
%d	Day of month as a decimal number [01, 31]
%D	Same as %m/%d/%y
%e	Day of the month as a decimal number [1, 31]; a single digit is preceded by a space
%EC	Number of the base year (period) in the locale's alternative representation

Format Argument	Substitution
%Ey	The offset from %EC (year only) in the locale's alternative representation
%EY	The full alternative year representation
%g	Month as an abbreviated month name
%G	Day as an abbreviated day name
%j	Day of the year as a decimal number [01, 366]
%m	Month as a decimal number [01, 12]
%M	Minute as a decimal number [00, 59]
%u	Weekday as a decimal number [1, 7], with 1 representing Monday
%U	Week number of the year (Sunday as the first day of the week) as a decimal number [00, 53]
%v	Month number as a decimal [1, 12]
%V	Week number of the year (Monday as the first day of the week) as a decimal number [01, 53]; if the week containing 1 January has four or more days in the new year then it is considered week 1; otherwise, it is week 53 of the previous year, and the next week is week 1
%w	Replaced by the weekday as a decimal number [0, 6], with 0 representing Sunday
%W	Week number of the year (Monday as the first day of the week) as a decimal number [00, 53]; all days in a new year preceding the first Sunday are considered to be in week 0
%x	Locale-specific date representation
%y	Year without century as a decimal number [00, 99]
%Y	Year with century as a decimal number

Constructors

All ZafDate constructors initialize the member variables associated with an instantiated ZafDate object. The default values set by the ZafDate and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafDate. "†"Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafDate

`DateData()`	`null`

Member Initializations

ZafString	
`LowerCase()`	`false`†
`Password()`	`false`†
`StringData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†

ZafElement	
`ClassID()`	`ID_ZAF_DATE`
`ClassName()`	`"ZafDate"`

```
ZafDate(int left, int top, int width, int year, int month,
   int day);
```

This constructor is useful in straight-code situations, particularly if the ZafDate object is to create, maintain and destroy its own ZafDateData object automatically. *left*, *top*, and *width* specify the position and size of the object on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

year, *month*, and *day* specify the date values that initially appear in the new ZafDate object.

```
ZafDate(int left, int top, int width, ZafDateData
   *dateData = ZAF_NULLP(ZafDateData));
```

This constructor is useful in straight-code situations where a ZafDateData object has already been created. This constructor could be used when manually maintaining a ZafDateData object, rather than having the ZafDate class create and maintain the data object automatically. For more information on using ZafDateData objects, see the chapter on ZafDateData. See the previous constructor for a description of *left*, *top*, and *width* parameters.

```
ZafDate(const ZafDate &copy);
```

The copy constructor calls the overloaded Duplicate() to create a new ZafDate object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafDate object simply points to the original data, otherwise copies are made.

```
ZafDate(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafDate creation techniques follow:

```
// Create a sample window with date objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);

// Create date objects and pass in the values directly.
window1->Add(new ZafDate(0, 1, 25, 1984, 1, 22));
window1->Add(new ZafDate(0, 2, 25, 2000, 1, 1));
...
// Create a sample window with date objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);

// Create date data objects.
ZafDateData *dateData1 = new ZafDateData(1984, 1, 22);
ZafDateData *dateData2 = new ZafDateData(2000, 1, 1);

// Create dates that use the data previously created.
window2->Add(new ZafDate(0, 1, 25, dateData1));
window2->Add(new ZafDate(0, 2, 25, dateData2));
```

Destructor

virtual ~**ZafDate**(void);

The destructor is used to free the memory associated with a ZafDate object, including all the data objects that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafDate object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

DateData

```
ZafDateData *DateData(void) const;
virtual ZafError SetDateData(ZafDateData *dateData);
```

*DateData() contains the actual information used by ZafDate. The DateData() object may be used by one or more ZafDate objects, or other objects. If shared, all associated ZafDate objects will be notified when the DateData() changes. For more information on data sharing in ZAF, see ZafDataManager. SetDate-Data() may be called to change the date data object used by the ZafDate object. SetDateData() will delete the previous DateData() object if it is Destroyable() and no other object uses it.

DateData() returns a pointer to the DateData() object associated with the ZafDate object. The return value for SetDateData() is normally

ZAF_ERROR_NONE. See the Constructors code snippet for an example using ZafDateData objects with ZafDate.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function receives all events that get sent to the ZafDate object and either handles them or passes them to ZafString, its immediate base class. See ZafWindowObject for more information.

ZafDate specifically handles the following events:

Event	**Description**
`N_RESET_I18N`	causes the object to redisplay its data according to the new internationalization values
`S_COPY_DATA`	causes the object to copy event.windowObject's Date-Data() if event.windowObject is a ZafDate object
`S_SET_DATA`	causes the object to create a new DateData() object, then copy into it event.windowObject's DateData() if event.windowObject is non-null and is a ZafDate object

ZafDateData

Clear	FormattedText	SetDate

Inheritance

`ZafDateData : ZafUTimeData : ZafFormatData : ZafData : ZafElement, ZafNotification`

Declaration

`#include <z_date.hpp>`

Description

ZafDateData combines date encapsulation with data notification and object notification from ZafData. It is most often used in conjunction with the ZafDate user interface object but may be used as a stand-alone object if desired. Refer to the ZafUTimeData documentation for a discussion of member methods, inherited by ZafDateData, used to retrieve and set date-specific information (e.g., day, month, year, etc.).

All ZafData objects may make use of printf-style formatting and parsing arguments during string operations. In addition, all ZafUTimeData objects may make use of strftime- and strptime-style formatting and parsing arguments during string operations. Refer to standard library documentation for detailed information on printf, strftime, and strptime functions as well as their corresponding conversion characters.

Constructors

ZafDateData constructors initialize the member variables associated with a new ZafDateData object and allocate space to hold the date data. The default values set by ZafDateData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafUTimeData

BasisYear()	(varies by constructor)
Day()	(varies by constructor)
DayName()	(varies by constructor)
DayOfWeek()	(varies by constructor)
DaysInMonth()	(varies by constructor)
DaysInYear()	(varies by constructor)
LeapYear()	(varies by constructor)
Month()	(varies by constructor)
MonthName()	(varies by constructor)
Value()	(varies by constructor)
Year()	(varies by constructor)

Member Initializations

ZafElement

`ClassID()`	`ID_ZAF_DATE_DATA`
`ClassName()`	`"ZafDateData"`

`ZafDateData``(void);`

The basic constructor allocates a ZafDateData instance and initializes its value to the current system date.

`ZafDateData``(int year, int month, int day);`

This constructor allocates a ZafDateData instance and initializes its contents to the date corresponding to *year, month* and *day*.

`ZafDateData``(const ZafIChar *string, const ZafIChar *format = ZAF_NULLP(ZafIChar));`

This constructor allocates a ZafDateData instance and initializes its contents to the date equivalent of *string*. The conversion uses the strptime-style specifier format to interpret the string. If format is null ZafDateData uses its locale-specific default format.

`ZafDateData``(const ZafDateData &copy);`

This constructor is the copy constructor. It allocates a new ZafDateData instance and copies all member data from *copy*.

`ZafDateData``(const ZafIChar *name, ZafDataPersistence &persist);`

This constructor is the persistent constructor. It allocates a new ZafDateData instance and reads most member data from the *name* directory of the persistent data file referred to by *persist*. The StringID() of the new data is name.

```
// Sample ZafDateData creation techniques.
ZafDateData date1(1997, 3, 20);
ZafDateData copyDate = date1;
ZafDateData date2("1997 2 14", "%y %m %d");
ZafDateData systemDate;
```

Destructor

virtual ~**ZafDateData**(void);

The destructor is used to free the memory associated with an instantiated ZafDateData object. Unless StaticData() is true a ZafDateData object is usually destroyed automatically when all ZafDate objects that refer to it are destroyed.

Members

Clear

`virtual void **Clear**(void);`

Clear() sets the value of a ZafDateData object to the current system date.

FormattedText

```
virtual int FormattedText(ZafIChar *buffer, int
   maxLength, const ZafIChar *format = 0) const;
```

FormattedText() fills *buffer* with a string representation of the ZafDateData using the strftime-style specifier *format* to build the string. A locale-specific default format is used if *format* is not included. Buffer contents will be truncated if they exceed *maxLength* characters. FormattedText() returns the integer value it receives from its call to strftime().

```
// Show various results of FormattedText().
ZafIChar buffer[256];

ZafDateData date(1997, 7, 4);
date.FormattedText(buffer, 256, "%y/%m/%d");
printf("date - %s\n", buffer);

date.FormattedText(buffer, 256, "%B%e, %Y");
printf("date - %s\n", buffer);

date.FormattedText(buffer, 256, "%A,%e %B %Y");
printf("date - %s\n", buffer);

==========
date - 97/07/04
date - July 4, 1997
date - Friday, 4 July 1997
```

SetDate

```
virtual ZafError SetDate(int year, int month, int day);
virtual ZafError SetDate(const ZafIChar *buffer, const
   ZafIChar *format);
virtual ZafError SetDate(const ZafDateData &number);
```

SetDate() functions set the value of the ZafDateData object from numeric input, another date, or an interpreted string. Refer to FormattedText() for more information on date/string conversions.

ZafDevice

display	Event	Poll
DeviceState	Installed	Previous
DeviceType	Next	

Inheritance `ZafDevice : ZafElement`

Declaration `#include <z_device.hpp>`

Description ZafDevice is an abstract class that defines the basic functionality necessary to support input devices such as a mouse, a keyboard, or a cursor. All ZAF input device classes derive from this class.

ZAF device classes share certain characteristics in common. For example, all device objects are added to the ZafEventManager object. Device object input is packaged into events and placed on the event manager's event queue. Frequently, device objects handle events dispatched to them such as activation and deactivation.

In this section, examples are used that apply to ZafDevice, but also may apply to the creation and use of all device objects. Also refer to ZafEventManager for information regarding the general operation of device objects.

Constructor The ZafDevice constructor initializes the member variables associated with an instantiated ZafDevice object. The default values set by ZafDevice and its base class constructor follow, if they override values set by the base class constructor.

Member Initializations

ZafDevice	
`DeviceState()`	`user-supplied parameter`
`DeviceType()`	`user-supplied parameter`
`display`	`null`
`eventManager`	`null`
`Installed()`	`false`
ZafElement	
`ClassID()`	`ID_ZAF_DEVICE`
`ClassName()`	`"ZafDevice"`

`ZafDevice(ZafDeviceType type, ZafDeviceState state);`

This constructor is used to instantiate a ZafDevice object to be added to a ZafEventManager object. *type* specifies the type of the device, such as E_MOUSE. *state* specifies the initial state of the device, such as DM_VIEW. This constructor should not normally be called by the programmer, since the constructors of classes derived from ZafDevice chain to this constructor.

Sample ZafDevice object creation techniques follow:

```
// Instantiate the input devices.
ZafEventManager *eventManager = new ZafEventManager;
eventManager->Add(new ZafKeyboard);
eventManager->Add(new ZafMouse);
eventManager->Add(new ZafCursor);
```

Destructor

`virtual ~ZafDevice(void);`

The destructor is used to free the memory associated with a ZafDevice object. It chains to the ZafElement destructor.

Generally, the programmer will not directly destroy a ZafDevice object, since it is automatically destroyed when the event manager is destroyed. For more information on device object deletion, see ZafEventManager::~ZafEventManager().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

display

`static ZafDisplay *display;`

The display member of this class is a static pointer to the display object instantiated by the ZafApplication constructor. This member is useful since most device objects have direct interaction with the display.

DeviceState

```
ZafDeviceState DeviceState(void) const;
virtual ZafDeviceState SetDeviceState(ZafDeviceState
   deviceState);
```

DeviceState() returns a constant that indicates a device object’s current state. For example, DeviceState() returns DM_VIEW for a mouse device that currently displays the default pointer image. SetDeviceState() may be called to change a device's state.

An example of device state manipulation follows:

```
// Indicate that a lengthy operation is in process.
mouse->SetDeviceState(DM_WAIT);
DoLotsOfWork();
mouse->SetDeviceState(DM_VIEW);
```

DeviceType

`ZafDeviceType **DeviceType**(void) const;`

DeviceType() returns the constant that identifies a device object's type. For example, E_MOUSE is returned for a mouse device, E_KEY is returned for a keyboard device, and E_CURSOR is returned for a cursor device.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event) =
    0;
```

This function is pure virtual. Any device class using ZafDevice as a base class must overload the Event() function to handle events passed to it.

Classes deriving from ZafDevice must handle the event D_STATE, which causes a device to return its state.

Installed

`bool Installed(void) const;`

This function returns true if the device object has been successfully installed in the event manager. If an error occurred during device object initialization, this function will return false.

Next
Previous

```
ZafDevice *Next(void) const;
ZafDevice *Previous(void) const;
```

These overloaded functions add a type-safe cast of "ZafDevice *" to the object while accessing the next or previous sibling in the event manager's list of devices. This allows initialization and manipulation of a list of associated device objects with the proper base type declaration. For example:

```
// Find the mouse device.
for (ZafDevice *device = eventManager->First(); device; device =
    device->Next())
  if (device->DeviceType() == E_MOUSE)
    break;
```

Poll

```
virtual void Poll(void) = 0;
```

This function is pure virtual. Any device class using ZafDevice as a base class must overload the Poll() function to post events on the event manager queue. For more information on device object polling, see ZafEventManager::Get().

ZafDialogWindow

Control

Inheritance

`ZafDialogWindow : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_dlgwin.hpp>`

Description

ZafDialogWindow supports the native look and feel of a dialog window. Usually, this includes a border or title bar appearing different than those of a regular window. A dialog window is not sizeable by nature, since its border indicates a dialog window rather than sizability and since a dialog's contents should promote understandability. A dialog window is also by its nature not a temporary window, since the end user is expected to dismiss the dialog after interacting with it.

Constructors

All ZafDialogWindow constructors initialize the member variables associated with an instantiated ZafDialogWindow object. The default values set by the ZafDialogWindow and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafDialogWindow. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindow	
`Destroyable()`	`false`
`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`Disabled()`	`false`†
`Noncurrent()`	`false`†
`ParentPalette()`	`false`†
`RegionType()`	`ZAF_INSIDE_REGION`†
ZafElement	
`ClassID()`	`ID_ZAF_DIALOG_WINDOW`
`ClassName()`	`"ZafDialogWindow"`

ZafDialogWindow(int left, int top, int width, int height);

This constructor is useful in straight-code situations. *left* and *top* specify the position where the left and top of the object will be placed on the window manager. *width* and *height* specify the width and height of the client region of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

ZafDialogWindow(const ZafDialogWindow &copy);

The copy constructor creates a new ZafDialogWindow object and initializes its data from *copy*.

ZafDialogWindow(const ZafIChar *name,
   ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a dialog window follows:

```
// Create a modal dialog window.
ZafDialogWindow *window = new ZafDialogWindow(1, 1, 60, 16);
window->AddGenericObjects(new ZafStringData("Modal Dialog"));
window->SetModal(true);

// Add a message to the dialog.
window->Add(new ZafString(18, 1, 24, "Continue?", -1));

// Add OK and Cancel buttons to cause Control() to return.
ZafButton *ok = new ZafButton(18, 4, 10, 1, "OK");
ok->SetSendMessageWhenSelected(true);
ok->SetValue(S_DLG_OK);
window->Add(ok);
ZafButton *cancel = new ZafButton(32, 4, 10, 1, "Cancel");
cancel->SetSendMessageWhenSelected(true);
cancel->SetValue(S_DLG_CANCEL);
window->Add(cancel);

// Add the dialog to the window manager.
// Use Control() only if Modal() is true.
// Control() returns only when the user has made a selection.
if (window->Control() != S_DLG_OK)
  break;
```

Destructor

```
virtual ~ZafDialogWindow(void);
```

The destructor is used to free the memory associated with a ZafDialogWindow object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Control

```
ZafDialogEvent Control(ZafQFlags flags = Q_NORMAL);
```

Control() causes the dialog to appear on the screen. Control() doesn't return control to the caller until the end user has made a selection, after which the dialog is removed from the screen. When any button with a Value() between S_DIALOG_FIRST and S_DIALOG_LAST is selected, Control() will return. The following such values are predefined in ZAF:

- S_DLG_OK
- S_DLG_CANCEL
- S_DLG_YES
- S_DLG_NO
- S_DLG_ABORT
- S_DLG_RETRY
- S_DLG_IGNORE.

When one these event messages is handled in a derived class Event() method, the programmer must return the value from the derived Event() method to cause the dialog to close.

Control() should only be called if Destroyable() is false and Modal() is true; otherwise, simply add the dialog to the window manager via the Add() function or the + operator. If Control() is called on a dialog when Destroyable() is true, S_ERROR is returned.

ZafDimensionConstraint

Event	Minimum
Maximum	Type

Inheritance `ZafDimensionConstraint : ZafConstraint : ZafElement`

Declaration #include <z_gmgr.hpp>

Description ZafDimensionConstraint allows a window object to be constrained to a maximum or minimum height or width (see Maximum() and Minimum() for more information). ZafDimensionConstraint objects must be added to the ZafGeometryManager object that has been added to the managed object's parent (see ZafGeometryManager for more information).

Constructors All ZafDimensionConstraint constructors initialize the member variables associated with an instantiated ZafDimensionConstraint object. The default values set by the ZafDimensionConstraint and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafDimensionConstraint	
`Maximum()`	`0`
`Minimum()`	`0`
`Type()`	`user-supplied parameter`
ZafElement	
`ClassID()`	`ID_ZAF_DIMENSION_CONSTRAINT`
`ClassName()`	`"ZafDimensionConstraint"`

```
ZafDimensionConstraint(ZafWindowObject *object,
   ZafDimensionConstraintType type);
```

This constructor is useful in straight-code situations to create a ZafDimensionConstraint object. *object* specifies the window object the constraint applies to, and *type* specifies the type of dimension constraint. See ZafConstraint::Object() and ZafDimensionConstraint::Type() for more information.

ZafDimensionConstraint(const ZafDimensionConstraint
   &copy);

The copy constructor creates a new ZafDimensionConstraint object and initializes its data from *copy*.

ZafDimensionConstraint(const ZafIChar *name,
   ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a dimension constraint follows:

```
// Create a status bar with geometry-managed children.
ZafStatusBar *stat = new ZafStatusBar(0, 0, 0, 1);
ZafString *string = new ZafString(0, 0, 15, new
   ZafStringData("String"));
stat->Add(string);
ZafTime *time = new ZafTime(15, 0, 15, new ZafTimeData);
stat->Add(time);

// Time field will remain at the right side.
ZafAttachment *attach = new ZafAttachment(time, ZAF_ATCF_RIGHT);
attach->SetOffset(0);

// Create geometry manager and add the first constraint.
ZafGeometryManager *geo->Add(attach);

// The string field will occupy
// the remaining space of the status bar.
attach = new ZafAttachment(string, ZAF_ATCF_RIGHT);
attach->SetStretch(true);
attach->SetReference(time);
attach->SetOppositeSide(true);
attach->SetOffset(1);

// Add the second constraint to the geometry manager.
geo->Add(attach);

// The string field will never be
// smaller than 5 cells wide.
ZafDimensionConstraint *dim = new ZafDimensionConstraint(string,
   ZAF_DNCF_WIDTH);
dim->SetMinimum(5);

// Add the third constraint to the geometry manager.
geo->Add(dim);
```

```
// Add the geometry manager to the status bar.
stat->Add(geo);
```

Destructor

`virtual ~`**`ZafDimensionConstraint`**`(void);`

The destructor is used to free the memory associated with a ZafDimensionConstraint object. It chains to the ZafConstraint and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafDimensionConstraint object, since it is automatically destroyed when its parent geometry manager is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Event

`virtual ZafEventType `**`Event`**`(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafDimensionConstraint object. The events handled by ZafDimensionConstraint are as follows:

ZafEventType	Description
S_COMPUTE_SIZE	causes the constraint to compute and modify the size of its window object
S_INITIALIZE	causes the constraint to initialize its numberID, stringID, and Object()

Maximum

`int `**`Maximum`**`(void) const;`
`int `**`SetMaximum`**`(int hzMaximum);`

Maximum() specifies the maximum size Object() may be, and is specified in the same coordinate type as Object()->Region(). For example, if Type() is ZAF_DNCF_HEIGHT and Maximum() is 20, then the maximum height of Object() is 20. If Maximum() is 0, this constraint does not impose a maximum size. This attribute defaults to 0, but the programmer may change it with Set-Maximum().

Minimum

```
int Minimum(void) const;
int SetMinimum(int hzMinimum);
```

Minimum() specifies the minimum size Object() may be, and is specified in the same coordinate type as Object()->Region(). For example, if Type() is ZAF_DNCF_WIDTH and Minimum() is 5, then the minimum width of Object() is 5. If Minimum() is 0, this constraint does not impose a minimum size. This attribute defaults to 0, but the programmer may change it with SetMinimum().

Type

```
ZafDimensionConstraintType Type(void) const;
ZafDimensionConstraintType
   SetType(ZafDimensionConstraintType type);
```

Type() is the dimension constraint's type, which specifies the dimension (height or width) of Object() used when calculating its maximum and minimum size. The programmer may use SetType() to change this attribute. The possible values for Type() follow:

Type()	**Description**
ZAF_DNCF_HEIGHT	causes the constraint to affect the height of Object()
ZAF_DNCF_WIDTH	causes the constraint to affect the width of Object()

ZafDiskFile

fileCreator	ReadData	WriteData
fileType	Seek	
Length	Tell	

Inheritance `ZafDiskFile : ZafFile : ZafElement`

Declaration `#include <z_dskfil.hpp>`

Description ZafDiskFile and ZafDiskFileSystem provide support for file access on a disk drive, and may be used portably on any environment. ZafDiskFile encapsulates information for a single file on disk. See ZafDiskFileSystem for more information.

Constructor

```
ZafDiskFile(const ZafIChar *pathName, ZafFileMode mode);
```

This constructor initializes the members associated with a ZafDiskFile object, and chains to the ZafFile and ZafElement constructors. *pathName* specifies the file to be opened, and may be a full pathname, partial pathname, or just the name of the file if it is in the current directory. *mode* specifies the mode in which the file is opened (see the ZafFile constructor for more information).

Destructor

```
virtual ~ZafDiskFile(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafDiskFile object and chains to the ZafFile and ZafElement destructors.

Members

fileCreator
fileType

```
static OSType fileCreator;
static OSType fileType;
```

Used only on the Macintosh, these public static members provide a way for the programmer to specify the Macintosh file creator and file type of a disk file created by ZafDiskFile. *fileCreator* defaults to 'Anon' and *fileType* defaults to 'TEXT', but the programmer may set them to any desired value.

Length

```
virtual ZafOffset Length(void) const;
```

Length() returns the length of the disk file, or it returns -1 if an error occurs.

ReadData

```
virtual int ReadData(void *buffer, int size);
```

ReadData() reads data from the disk file. The data is read into *buffer*, which must have already been allocated by the programmer, and *size* specifies the number of bytes to read. On success, ReadData() returns the number of bytes read into *buffer*; otherwise zero is returned. Error() is also set to an appropriate value.

Seek

```
virtual int Seek(ZafOffset offset, ZafSeek location);
```

Seek() moves the file pointer of the disk file. *location* specifies the position in the file from where *offset* specifies. Possible values of *location* and what they mean follow:

ZafSeek	**ZafOffset**
ZAF_SEEK_START	the offset is measured from the beginning of the file toward the end of the file
ZAF_SEEK_CURRENT	a positive offset is measured from the current file pointer, and a negative offset is measured toward the beginning of the file.
ZAF_SEEK_END	the offset is measured from the end of the file toward the beginning of the file

Seek() returns 0 if successful, and -1 if an error occurs (in which case Error() is also set appropriately).

Tell

```
virtual ZafOffset Tell(void) const;
```

Tell() returns the current offset of the file pointer in the disk file, or it returns -1 if an error occurs.

WriteData

```
virtual int WriteData(const void *buffer, int size);
```

WriteData() writes data to a derived file object. *buffer* is a pointer to the data to be written, and *size* specifies the number of bytes to write. On success, WriteData() returns the number of bytes written; otherwise zero is returned. Error() is also set to an appropriate value.

ZafDiskFileSystem

ChangeExtension	GetCWD	RmDir
ChDir	GetDriveNames	SetDrive
Close	MakeFullPath	StripFullPath
DeleteDriveNames	MkDir	TempName
FindClose	Open	ValidName
FindFirst	Remove	
FindNext	Rename	

Inheritance

`ZafDiskFileSystem : ZafFileSystem : ZafElement`

Declaration

`#include <z_dskfil.hpp>`

Description

ZafDiskFileSystem and ZafDiskFile provide support for file access on a disk drive, and may be used portably on any environment. ZafDiskFileSystem provides support for accessing the individual ZafDiskFiles. See ZafDiskFile for more information.

Constructor

`ZafDiskFileSystem(void);`

This constructor initializes the members associated with a ZafDiskFileSystem object, and chains to the ZafFileSystem and ZafElement constructors.

Destructor

virtual ~**ZafDiskFileSystem**(void);

This virtual destructor is used to free the memory associated with an instantiated ZafDiskFileSystem object and chains to the ZafFileSystem and ZafElement destructors.

Members

static void **ChangeExtension**(ZafIChar *name, const ZafIChar *newExtension);

ChangeExtension

ChangeExtension() changes the file extension (the part of the name after the period, if there is one) of the file on disk specified by *name* to *newExtension*.

ChDir

virtual int **ChDir**(const ZafIChar *newPath, ZafStringID stringID = ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);

ChDir() changes the current directory on disk to *newPath*. *stringID* and *numberID* are ignored in this class since they are used only by Zinc file systems (such as ZafStorage), but are included in the prototype in order to provide the correct method signature inherited from ZafFileSystem::ChDir(). ChDir()

returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Close

```
virtual void Close(ZafFile *file);
```

Close() closes file, which is a file previously opened with Open().

DeleteDriveNames

```
void DeleteDriveNames(ZafIChar *driveName[]);
```

DeleteDriveNames() deletes the array of drive names created by GetDrive-Names().

FindClose

```
virtual int FindClose(ZafFileInfoStruct &fileInfo);
```

FindClose() finalizes a find operation begun with FindFirst(). *fileInfo* is the same ZafFileInfoStruct object used by FindFirst() and FindNext(), and memory allocated in *fileInfo* is deleted by FindClose(). FindClose() returns 0 if the operation was successful; otherwise it returns -1.

FindFirst

```
virtual int FindFirst(ZafFileInfoStruct &fileInfo, const
   ZafIChar *searchName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

FindFirst() initializes a find operation. FindFirst() searches for a file with the search pattern specified by *searchName*. *searchName* may contain wildcards appropriate to the system. *fileInfo* is a ZafFileInfoStruct object allocated by the programmer, and fileInfo is initialized by FindFirst(). *stringID* and *numberID* are ignored. FindFirst() returns 0 if a file was found; otherwise it returns -1.

FindNext

```
virtual int FindNext(ZafFileInfoStruct &fileInfo, const
   ZafIChar *searchName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

FindNext() continues a find operation initiated by FindFirst(). FindNext() searches for the next file with the same *searchName* as was specified in the call to FindFirst(). *fileInfo* is the same ZafFileInfoStruct object passed to Find-First(). *stringID* and *numberID* are ignored. FindNext() returns 0 if a file was found; otherwise it returns -1.

GetCWD

```
virtual int GetCWD(ZafIChar *pathName, int pathLength);
```

GetCWD() copies the path name of the current directory of the disk file system (without a terminating path separating character) into the buffer specified by *pathName*. *pathName* must be allocated by the programmer, and *pathLength* specifies the number of ZafIChar characters in *pathName*. GetCWD() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

GetDriveNames

```
int GetDriveNames(ZafIChar **driveName[]);
```

GetDriveNames() finds all the drives mounted on the system and allocates an array where their names are copied. The array is returned in *driveName*. *driveName* must be passed to DeleteDriveNames() to delete the memory when it is no longer needed. GetDriveNames() returns -1 if no drive names were found (and *driveName* is null); otherwise, the number of drive names found is returned.

MakeFullPath

```
static void MakeFullPath(ZafIChar *fullPath, const
   ZafIChar *pathName, const ZafIChar *fileName, const
   ZafIChar *extension = ZAF_NULLP(ZafIChar));
```

MakeFullPath() creates a full pathname for the file specified in the parameters and returns the full pathname in *fullPath*. *pathName* specifies the directory, *fileName* specifies the name of the file, and *extension* specifies the file name extension (the characters after the dot).

MkDir

```
virtual int MkDir(const ZafIChar *pathName, ZafStringID
   stringID = ZAF_NULLP(ZafIChar), ZafNumberID numberID =
   0);
```

MkDir() creates a new directory on disk. *pathName* specifies the path name of the directory to be created. *stringID* and *numberID* are ignored. MkDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Open

```
virtual ZafFile *Open(const ZafIChar *fileName, const
   ZafFileMode mode, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

Open() opens the disk file specified by *fileName*. *mode* specifies the mode the file is opened with (see the ZafFile constructor for more information). *stringID* and *numberID* are ignored. A pointer to the file opened is returned.

Remove

```
virtual int Remove(const ZafIChar *name);
```

Remove() deletes the file on disk specified by *name*. Remove() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Rename

```
virtual int Rename(const ZafIChar *oldName, const
   ZafIChar *newName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

Rename() renames the disk file or directory specified by *oldName* to *newName*. *stringID* and *numberID* are ignored. Rename() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

RmDir

```
virtual int RmDir(const ZafIChar *pathName, bool
   deleteContents = false);
```

RmDir() deletes the directory specified by *pathName*. If *deleteContents* is false, RmDir() will only delete the directory if it is empty; otherwise, RmDir() will delete the contents of the directory along with the directory itself. RmDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

SetDrive

```
int SetDrive(const ZafIChar *driveName);
```

On systems that support it, SetDrive() sets the current drive to the drive whose name is passed in *driveName*. SetDrive() returns 0 on success, and -1 on failure.

StripFullPath

```
static void StripFullPath(const ZafIChar *fullPath,
   ZafIChar *pathName = ZAF_NULLP(ZafIChar), ZafIChar
   *fileName = ZAF_NULLP(ZafIChar), ZafIChar *objectName
   = ZAF_NULLP(ZafIChar), ZafIChar *objectPathName =
   ZAF_NULLP(ZafIChar));
```

StripFullPath() does the opposite of MakeFullPath(). StripFullPath() returns the pieces of a full pathname specified by *fullPath*. The directory is returned in *pathName* and the name of the file is returned in *fileName*. If the file is a ZAF storage file and it specifies an object's ZafStorageFile path, the object's name is returned in *objectName* and the object's storage pathname is returned in *objectPathName*. If any of the return parameters is null, that piece is not returned.

TempName

```
static void TempName(ZafIChar *tempname);
```

TempName() returns in *tempname* a unique file name generated by the system that may be used to create a temporary file. If *tempname* contains a path name on entry, the returned file name is unique for that path and the full path name for the file is returned; otherwise the file name returned will be unique for the current directory, and the returned file name is returned without any path information. *tempname* must be allocated by the programmer before calling TempName().

ValidName

```
static bool ValidName(const ZafIChar *name, bool create =
   false);
```

ValidName() returns true if *name* specifies the name of an existing disk file. If the file doesn't exist and *create* is true, ValidName() tries to create the file and returns true if it was successful. If ValidName() creates the file, it also deletes it. Otherwise, false is returned.

ZafDisplay

AddColor	DestroyZafMouse	MonoForeground
AddFont	DisplayContext	monoTable
Background	DisplayMode	Mouse
BeginDraw	DrawContext	Palette
Bitmap	Ellipse	patternTable
ClipRegion	EndDraw	Pixel
colorTable	FillPattern	Polygon
columns	Font	preSpace
ConvertToOSBitmap	fontTable	postSpace
ConvertToOSIcon	Foreground	Rectangle
ConvertToOSMouse	Icon	RectangleXORDiff
ConvertToZafBitmap	InitializeOSBitmap	RegionCopy
ConvertToZafIcon	InitializeOSIcon	ResetOSBitmap
ConvertToZafMouse	InitializeOSMouse	ResetOSIcon
DestroyColor	Line	ResetOSMouse
DestroyFont	lines	RestoreDisplayContext
DestroyOSBitmap	LineStyle	RestoreDrawContext
DestroyOSIcon	lineTable	Text
DestroyOSMouse	Mode	TextSize
DestroyZafBitmap	modeTable	
DestroyZafIcon	MonoBackground	

Inheritance `ZafDisplay : ZafCoordinateStruct`

Declaration `#include <z_dsp.hpp>`

Description ZafDisplay defines the basic functionality necessary to interface with the screen. ZafDisplay provides many useful graphic display primitives for use in a ZAF application, such as Line(), Rectangle() and Text(). It also provides methods for interfacing with images, such as bitmaps and icons.

ZafDisplay is important to displayable ZAF classes because it provides the interface necessary to interact with the screen. A ZafDisplay object is instantiated by the ZafApplication class, and should not be instantiated by the programmer. When needed, the member ZafWindowObject::display should be used to access the ZafDisplay object instantiated automatically by the ZafApplication class.

Constructor The ZafDisplay constructor initializes the member variables associated with an instantiated ZafDisplay object. The default values set by the ZafDisplay constructor and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafDisplay

`colorTable[]`	`environment-specific`
`columns`	`screen-dependent`
`fontTable[]`	`environment-specific`
`lines`	`screen-dependent`
`lineTable[]`	`environment-specific`
`modeTable[]`	`environment-specific`
`monoTable[]`	`environment-specific`
`patternTable[]`	`environment-specific`
`postSpace`	`environment-specific`
`preSpace`	`environment-specific`

ZafCoordinateStruct

`cellHeight`	`environment-specific`
`cellWidth`	`environment-specific`
`miniDenominatorX`	`10`
`miniDenominatorY`	`10`
`miniNumeratorY`	`1`
`miniNumeratorX`	`1`
`pixelsPerInchX`	`environment-specific`
`pixelsPerInchY`	`environment-specific`

```
ZafDisplay(int argc, char **argv);
```

The constructor is useful in straight-code situations. The *argc* and *argv* parameters are simply the argc and argv parameters passed into the application, and are used to find the application's name in environments that require the application name to be registered with the system. This constructor will not normally be called by the programmer, since it is automatically called by ZafApplication.

Destructor

```
virtual ~ZafDisplay(void);
```

The destructor is used to free the memory associated with a ZafDisplay object. Generally, the programmer will not directly destroy a ZafDisplay object since it is automatically destroyed when the ZafApplication object is destroyed.

Members

AddColor

```
ZafLogicalColor AddColor(ZafLogicalColor index, ZafUInt8
    red, ZafUInt8 green, ZafUInt8 blue);
```

DestroyColor

```
ZafError DestroyColor(ZafLogicalColor color);
```

ZafDisplay allows the use of up to 127 colors. In order to save execution time and memory, however, ZafDisplay automatically registers just the most common 16 colors with the environment.

The 16 colors registered by ZafDisplay, and usable in any ZAF program are:

- ZAF_CLR_BLACK
- ZAF_CLR_BLUE
- ZAF_CLR_GREEN
- ZAF_CLR_CYAN
- ZAF_CLR_RED
- ZAF_CLR_MAGENTA
- ZAF_CLR_BROWN
- ZAF_CLR_LIGHTGRAY
- ZAF_CLR_DARKGRAY
- ZAF_CLR_LIGHTBLUE
- ZAF_CLR_LIGHTGREEN
- ZAF_CLR_LIGHTCYAN
- ZAF_CLR_LIGHTRED
- ZAF_CLR_LIGHTMAGENTA
- ZAF_CLR_YELLOW
- ZAF_CLR_WHITE

Run-time support for any RGB color may be added via AddColor(). *index* specifies the zero-based index (or logical color) into the ZAF internal color table where the color is to be inserted. The 16 colors preloaded by ZAF occupy indices 0-15. Zinc also reserves indices 16-31 for internal use. For convenience, the ZAF_CLR_USER_FIRST constant is defined to be 32, indicating the first index not reserved by Zinc. The programmer may add colors with indices 32-126. If ZAF_CLR_NULL is passed into *index*, the new color is loaded into the next unused ZafLogicalColor index (beginning with 32). *red*, *green*, and *blue* specify the 8-bit RGB values of the new color. DestroyColor() causes the associated internal color table entry to be cleared.

The ZafLogicalColor to be used in referencing the new color is returned. If ZAF_CLR_NULL is passed in, but there are no unused indices, then ZAF_CLR_NULL is returned. Also, if *index* is out of range or already used, or some other error occurs, ZAF_CLR_NULL is returned.

Below is an example using these functions:

```
// Add Antique White to the color table.
ZafLogicalColor antiqueWhite = display->AddColor(ZAF_CLR_NULL,
    250, 235, 215);
SetForeground(antiqueWhite);
DrawSomethingWithColor(antiqueWhite);
...
// Remove Antique White from the color table.
display->DestroyColor(antiqueWhite);
```

AddFont

```
ZafLogicalFont AddFont(ZafLogicalFont index, char
    *fontFamily, int pointSize, ZafFontWeight weight =
    ZAF_FNT_WEIGHT_NORMAL, ZafFontSlant slant =
    ZAF_FNT_SLANT_NORMAL);
```

DestroyFont

```
ZafError DestroyFont(ZafLogicalFont font);
```

ZafDisplay allows the use of up to 10 fonts. However, in order to save execution time and memory, ZafDisplay automatically registers just the most common 5 fonts with the environment.

The 5 fonts registered by ZafDisplay, and usable in any ZAF program are as follows:

Logical font	Description
ZAF_FNT_SMALL	Small font, commonly used in icons
ZAF_FNT_DIALOG	Dialog font, commonly used in dialog windows
ZAF_FNT_APPLICATION	Application font, commonly used in multi-line text fields
ZAF_FNT_SYSTEM	System font, commonly used in buttons and menus
ZAF_FNT_FIXED	Fixed-width font, commonly used in code snippets

Run-time support for any available font may be added via AddFont(). *index* specifies the zero-based index (or logical font) into the ZAF internal font table where the color is to be inserted. The 5 fonts preloaded by ZAF occupy indices 0-4. If ZAF_FNT_NULL is passed into *index*, the new font is loaded into the next available ZafLogicalFont index. *fontFamily* specifies the name of the font family, and *pointSize* specifies the desired point size of the font to be supported.

weight specifies the desired weight of the font, and may be one of the following:

- ZAF_FNT_WEIGHT_NORMAL
- ZAF_FNT_WEIGHT_BOLD

slant specifies the desired slant of the font, and may be one of the following:

- ZAF_FNT_SLANT_NORMAL
- ZAF_FNT_SLANT_ITALIC

The ZafLogicalFont to be used in referencing the new font is returned. If ZAF_FNT_NULL is passed in, but there are no unused indices, then ZAF_FNT_NULL is returned. Also, if *index* is out of range or already used, or some other error occurs, ZAF_FNT_NULL is returned.

It is important to note that AddFont() is provided for limited use and may need to be called differently on different environments, according to the font families available on different environments. DestroyFont() causes a font to be unregistered with the environment, and the associated internal font table entry to be cleared.

The following shows how to use these functions:

```
// Add 10 point Helvetica to the font table.
ZafLogicalFont helvetica10Font = display->AddFont(ZAF_FNT_NULL,
    "helvetica", 10);
SetFont(helvetica10Font);
DrawSomethingWithFont(helvetica10Font);
...
// Remove Helvetica from the font table.
display->DestroyFont(helvetica10Font);
```

Background

```
ZafLogicalColor Background(void) const;
ZafLogicalColor SetBackground(ZafLogicalColor color);
```

Background() specifies the color used by any drawing operation requiring a background color. When drawing shapes or textual information, the background color is used as the fill color. See Rectangle() and Text() for more information on the fill color. The default value for Background() is ZAF_CLR_WHITE, but it may be changed by calling SetBackground().

BeginDraw

```
ZafError BeginDraw(OSDisplayContext displayContext,
    OSDrawContext drawContext, const ZafRegionStruct
    &draw, const ZafRegionStruct &clip);
```

All actual drawing operations must occur between calls to BeginDraw() and EndDraw(). BeginDraw() sets up the environment's display to accept drawing operations, and EndDraw() finalizes the drawing operation. The *displayContext* parameter specifies the display context to use for the drawing operation (see DisplayContext() for an explanation of display contexts). The *drawContext* parameter specifies the draw context to use (see DrawContext() for an explanation of draw contexts). The *draw* parameter specifies the region where drawing is to occur, and the *clip* parameter specifies the region (usually inside *draw*) where clipping will occur. These functions are advanced, and should not normally be called by the programmer. They are called internally in the Zinc libraries. ZafWindowObject::BeginDraw() and ZafWindowObject::EndDraw() should be used to properly encapsulate drawing operations. See ZafWindowObject::BeginDraw() for a description of performing draw operations for an object.

Bitmap

```
virtual ZafError Bitmap(int column, int line,
   ZafBitmapStruct &bitmap);
```

Bitmap() is used to display the bitmap specified by *bitmap*, with its left top corner specified by the *column* and *line* parameters. This function is optimized for bitmaps that have already been converted to the environment's native format, using ConvertToOSBitmap(). If the bitmap has not yet been converted, Bitmap() calls ConvertToOSBitmap() automatically. See ZafBitmapStruct for more information on bitmaps. Normally, Bitmap() returns ZAF_ERROR_NONE.

Normally, *bitmap* should be a ZafBitmapData object, so that the OS bitmap created by ConvertToOSBitmap() will be deleted by the ZafBitmapData destructor when the ZafBitmapData object is deleted. If *bitmap* is a ZafBitmapStruct, the programmer is responsible for deleting the OS bitmap created by ConvertToOSBitmap().

ClipRegion

```
ZafRegionStruct ClipRegion(void) const;
ZafRegionStruct SetClipRegion(const ZafRegionStruct
   &region);
```

ClipRegion() specifies the region (usually inside the current drawing region) that drawing operations will be clipped to. ClipRegion() defaults to the entire drawing region, but it may be changed by calling SetClipRegion(). ClipRegion() returns the current clipping region, and SetClipRegion() returns the clipping region before it was changed.

For example, when drawing a 3-D button object whose text is longer than will fit inside the button's region, it is not desirable for the text to be drawn over the shadow portion of the button. Calling SetClipRegion() with the region inside the button's shadow will cause Text() to clip its drawing operation inside the shadow's region, as shown below:

```
// Begin the drawing operation.
ZafRegionStruct drawRegion = BeginDraw();
// Draw a one pixel border.
DrawBorder(drawRegion, ccode);
// Draw the 3-D shadow.
DrawShadow(drawRegion, depth, ccode);
// Erase the background.
DrawBackground(drawRegion, ccode);
// Set the clipping region.
display->SetClipRegion(drawRegion);
// Set the text palette.
display->SetPalette(LogicalPalette(ZAF_PM_TEXT,
    PaletteState()));
// Draw the text.
display->Text(drawRegion, "Long button name", -1);
// End the drawing operation.
EndDraw();
```

colorTable

`static OSColor ZAF_FARDATA` **`colorTable`**`[ZAF_MAXCOLORS];`

The static array colorTable is the internal ZAF color table that stores environment-specific information for each ZAF logical color. It is used internally by the Zinc libraries, and should normally not be modified by the programmer. See AddColor() for a description of adding support for RGB colors.

columns
lines

`int` **`columns`**`;`
`int` **`lines`**`;`

The columns and lines members are initialized in the ZafDisplay constructor, and contain the width and height in pixels, respectively, of the main monitor or display that the application is running on. On multiple-monitor systems such as the Apple Macintosh, the main monitor is the display that contains the menu bar.

ConvertToOS-Bitmap
ConvertToOSIcon
ConvertToOS-Mouse

```
virtual ZafError ConvertToOSBitmap(ZafBitmapStruct
    &bitmap);
virtual ZafError ConvertToOSIcon(ZafIconStruct &icon);
virtual ZafError ConvertToOSMouse(ZafMouseStruct &mouse);
```

ConvertToOSBitmap(), ConvertToOSIcon() and ConvertToOSMouse() convert ZAF platform-independent images to completely native versions of the images that may be passed to native API routines. The ZAF image is passed into the routine, and the converted image is stored within the same structure. Normally, ZAF_ERROR_NONE is returned, but one of the following may be returned in special cases:

Return value	Description
ZAF_ERROR_INVALID_SOURCE	Indicates that the ZAF source image is empty or invalid
ZAF_ERROR_INVALID_TARGET	Indicates that the native image already exists and is StaticHandle(), and may not be re-converted

ConvertToZaf-Bitmap

ConvertToZafIcon

ConvertToZaf-Mouse

```
virtual ZafError ConvertToZafBitmap(ZafBitmapStruct
   &bitmap);
virtual ZafError ConvertToZafIcon(ZafIconStruct &icon);
virtual ZafError ConvertToZafMouse(ZafMouseStruct
   &mouse);
```

ConvertToZafBitmap(), ConvertToZafIcon() and ConvertToZafMouse() convert the native versions of images to ZAF platform-independent versions of the images that may be stored and retrieved independent of the particular environment. The ZAF image structure containing the native image is passed into the routine, and the converted image is stored within the same structure. Normally, ZAF_ERROR_NONE is returned, but one of the following may be returned in special cases:

Return value	Description
ZAF_ERROR_INVALID_SOURCE	Indicates that the native source image is empty or invalid
ZAF_ERROR_INVALID_TARGET	Indicates that the ZAF image already exists and is StaticArray(), and may not be re-converted

DestroyColor

```
ZafError DestroyColor(ZafLogicalColor color);
```

See AddColor().

DestroyFont

```
ZafError DestroyFont(ZafLogicalFont font);
```

See AddFont().

DestroyOSBitmap
DestroyOSIcon
DestroyOSMouse

```
virtual ZafError DestroyOSBitmap(ZafBitmapStruct
   &bitmap);
virtual ZafError DestroyOSIcon(ZafIconStruct &icon);
virtual ZafError DestroyOSMouse(ZafMouseStruct &mouse);
```

DestroyOSBitmap(), DestroyOSIcon() and DestroyOSMouse() destroy the native versions of the images contained in the ZAF image structures passed into the functions. The ZAF image is untouched. If the native version of the image is StaticHandle(), it is not destroyed. Normally, ZAF_ERROR_NONE is returned.

DestroyZafBitmap
DestroyZafIcon
DestroyZafMouse

```
virtual ZafError DestroyZafBitmap(ZafBitmapStruct
   &bitmap);
virtual ZafError DestroyZafIcon(ZafIconStruct &icon);
virtual ZafError DestroyZafMouse(ZafMouseStruct &mouse);
```

DestroyZafBitmap(), DestroyZafIcon() and DestroyZafMouse() destroy the ZAF versions of the images contained in the ZAF image structures passed into the functions. The native image is untouched. If the ZAF version of the image is StaticArray(), it is not destroyed. Normally, ZAF_ERROR_NONE is returned.

DisplayContext
RestoreDisplay-Context

```
OSDisplayContext DisplayContext(void) const;
OSDisplayContext SetDisplayContext(OSDisplayContext
   context);
OSDisplayContext RestoreDisplayContext(void);
```

The display context is environment-specific, and usually specifies the device context used in display operations (for example, either a window's or printer's logical port). These functions are advanced, and should not normally be called by the programmer. They are called internally in the Zinc libraries to get, set and restore a display context. See ZafWindowObject::BeginDraw() for a description of performing draw operations for an object.

DrawContext
RestoreDraw-Context

```
OSDrawContext DrawContext(void) const;
OSDrawContext SetDrawContext(OSDrawContext context);
OSDrawContext RestoreDrawContext(void);
```

The draw context is environment-specific, and usually specifies the logical drawing port used in display operations. These functions are advanced, and should not normally be called by the programmer. They are called internally in the Zinc libraries to get, set and restore a draw context. See

ZafWindowObject::BeginDraw() for a description of performing draw operations for an object.

DisplayMode

```
ZafDisplayMode DisplayMode(void) const;
```

DisplayMode() returns whether the run-time system supports color or black and white. On multiple-monitor systems such as is supported by the Macintosh, DisplayMode() may be misleading, since it does not indicate what mode each monitor connected to the system supports. In this case, though a system supports color, it may have only a black and white monitor connected to it; so DisplayMode() returns ZAF_DISPLAY_COLOR, even though there are no displays connected to the system that support color.

One of the following may be returned by DisplayMode():

Return value	Description
`ZAF_DISPLAY_COLOR`	Indicates that the run-time system supports color or grayscale
`ZAF_DISPLAY_MONO`	Indicates that the run-time system supports only black and white

Ellipse

```
virtual ZafError Ellipse(int left, int top, int right, int
    bottom, int startAngle, int endAngle, int width = 1,
    bool fill = false);
```

Ellipse() is used to display an elliptical shape specified by the parameters. The shape is contained by the *left*, *top*, *right* and *bottom* parameters. The *startAngle* and *endAngle* parameters are specified in degrees, beginning with the positive x-axis and moving counter-clockwise (using the polar model). If *startAngle* and *endAngle* are the same, a closed elliptical shape is drawn; otherwise a wedge is drawn beginning at startAngle and ending at endAngle. The *width* parameter specifies the width in pixels of the shape's outline, and the outline is drawn with the Foreground() color, using LineStyle(). The *fill* parameter specifies whether or not the inside of the shape should be filled with the Background() color, using FillPattern(). SetForeground(), SetBackground(), SetFillPattern(), and SetLineStyle() (or just SetPalette()) must be called before calling Ellipse(), to ensure that the correct settings are used when the ellipse is drawn; otherwise, the palette information used may have been previously set by some other object. Normally, Ellipse() returns ZAF_ERROR_NONE.

The following shows how to use Ellipse():

```
void MyObject::Draw(void)
{
  ZafRegionStruct drawRegion = BeginDraw();
  // Draw a yellow ellipse with a blue border.
  SetBackground(ZAF_CLR_YELLOW);
  SetForeground(ZAF_CLR_BLUE);
  display->Ellipse(drawRegion.left, drawRegion.top,
    drawRegion.right, drawRegion.bottom, 0, 360, 1, true);
  EndDraw();
}
```

EndDraw

`ZafError` **`EndDraw`**`(void);`

See BeginDraw().

FillPattern

`ZafLogicalFillPattern` **`FillPattern`**`(void) const;`

`ZafLogicalFillPattern`
   `SetFillPattern``(ZafLogicalFillPattern pattern);`

FillPattern() specifies the fill pattern used by any drawing operation that specifies filling. When drawing shapes or textual information, the fill pattern is used when filling the shape or text. The default value for FillPattern() is ZAF_PTN_SOLID_FILL, but it may be changed by calling SetFillPattern(). The fill patterns defined for use in ZAF are as follows:

Logical fill pattern	**Description**
`ZAF_PTN_SOLID_FILL`	Fills the entire area with the Background() color
`ZAF_PTN_INTERLEAVE_FILL`	Fills the area with an 50% interleave pattern of the Background() and Foreground() colors

Font

`ZafLogicalFont` **`Font`**`(void) const;`

`ZafLogicalFont` **`SetFont`**`(ZafLogicalFont font);`

Font() specifies the logical font used by any textual drawing or sizing operation. When drawing or specifying textual information, the environment's font corresponding to the ZAF logical font is used. The ZafDisplay constructor initializes 5 fonts automatically, but support for additional fonts may be added. See AddFont() for more information on the 5 default fonts and how to add support for additional fonts. The default value for Font() is ZAF_FNT_DIALOG, but it may be changed by calling SetFont().

fontTable

```
static OSFont ZAF_FARDATA fontTable[ZAF_MAXFONTS];
```

The static array fontTable is the internal ZAF font table that stores environment-specific information for each ZAF logical font. It is used internally by the Zinc libraries, and should normally not be modified by the programmer. See AddFont() for a description of adding support for available fonts.

Foreground

```
ZafLogicalColor Foreground(void) const;
ZafLogicalColor SetForeground(ZafLogicalColor color);
```

Foreground() specifies the color used by any drawing operation requiring a foreground color. When drawing shapes or textual information, the foreground color is used as the outline or text color. See Rectangle() and Text() for more information on the outline or text color. The default value for Foreground() is ZAF_CLR_BLACK, but it may be changed by calling SetForeground().

Icon

```
virtual ZafError Icon(int column, int line, ZafIconStruct
   &icon);
```

Icon() is used to display the icon specified by *icon*, with its left top corner specified by the column and line parameters. This function is optimized for icons that have already been converted to the environment's native format, using ConvertToOSIcon(). If the icon has not yet been converted, Icon() calls ConvertToOSIcon() automatically. See ZafIconStruct for more information on icons. Normally, Icon() returns ZAF_ERROR_NONE.

Normally, *icon* should be a ZafIconData object, so that the OS icon created by ConvertToOSIcon() will be deleted by the ZafIconData destructor when the ZafIconData object is deleted. If *icon* is a ZafIconStruct, the programmer is responsible for deleting the OS icon created by ConvertToOSIcon().

InitializeOSBitmap
InitializeOSIcon
InitializeOSMouse

```
static ZafError InitializeOSBitmap(ZafBitmapStruct
   &bitmap);
static ZafError InitializeOSIcon(ZafIconStruct &icon);
static ZafError InitializeOSMouse(ZafMouseStruct &mouse);
```

InitializeOSBitmap(), InitializeOSIcon() and InitializeOSMouse() initialize the native versions of the images contained in the ZAF image structures passed into the functions. The ZAF image is untouched. These functions are advanced, and should normally not be called by the programmer. They are used internally by the Zinc libraries to initialize image structures during construction. Normally, ZAF_ERROR_NONE is returned.

Line

```
virtual ZafError Line(int column1, int line1, int column2,
   int line2, int width = 1);
```

Line() is used to display a line specified by the parameters. The line is drawn between the point (*column1*, *line1*) and (*column2*, *line2*). The *width* parameter specifies the line's width in pixels, and the line is drawn with the Foreground() color, using LineStyle(). SetForeground() and SetLineStyle() (or just SetPalette()) must be called before calling Line(), to ensure that the correct settings are used when the line is drawn; otherwise, the palette information used may have been previously set by some other object. Normally, Line() returns ZAF_ERROR_NONE.

lines

```
int lines;
```

See columns.

LineStyle

```
ZafLogicalLineStyle LineStyle(void) const;
ZafLogicalLineStyle SetLineStyle(ZafLogicalLineStyle
   line);
```

LineStyle() specifies the line style used by any drawing operation. When drawing shapes, the line style is used when drawing the shape's outline. The line styles defined for use in ZAF are ZAF_LINE_SOLID and ZAF_LINE_DOTTED. The default value for LineStyle() is ZAF_LINE_SOLID, but it may be changed by calling SetLineStyle().

lineTable

```
static OSLineStyle ZAF_FARDATA lineTable[ZAF_MAXLINES];
```

The static array lineTable is the internal ZAF line style table that stores environment-specific information for each ZAF logical line style. It is used internally by the Zinc libraries, and should normally not be modified by the programmer.

Mode

```
ZafLogicalMode Mode(void) const;
ZafLogicalMode SetMode(ZafLogicalMode mode);
```

Mode() specifies the drawing mode used by any drawing operation. The default value for Mode() is ZAF_MODE_COPY, but it may be changed by calling SetMode(). The drawing modes defined for use in ZAF are as follows:

Logical drawing mode	Description
ZAF_MODE_COPY	Draws normally, regardless of what was previously in the same position
ZAF_MODE_XOR	Performs a logical exclusive OR between the pixels being drawn, and the pixels that were already in the same position

modeTable

```
static OSMode ZAF_FARDATA modeTable[ZAF_MAXMODES];
```

The static array modeTable is the internal ZAF drawing mode table that stores environment-specific information for each ZAF logical drawing mode. It is used internally by the Zinc libraries, and should normally not be modified by the programmer.

MonoBackground

```
ZafLogicalColor MonoBackground(void) const;
ZafLogicalColor SetMonoBackground(ZafLogicalColor color);
```

MonoBackground() specifies the color used by any drawing operation requiring a background color on a black and white display. When drawing shapes or textual information, the background color is used as the fill color. See Rectangle() and Text() for more information on the fill color. The default value for MonoBackground() is ZAF_MONO_WHITE, but it may be changed by calling Set MonoBackground().

MonoForeground

```
ZafLogicalColor MonoForeground(void) const;
ZafLogicalColor SetMonoForeground(ZafLogicalColor color);
```

MonoForeground() specifies the color used by any drawing operation requiring a foreground color on a black and white display. When drawing shapes or textual information, the foreground color is used as the outline or text color. See Rectangle() and Text() for more information on the outline or text color. The default value for MonoForeground() is ZAF_MONO_BLACK, but it may be changed by calling Set MonoForeground().

monoTable

```
static OSMono ZAF_FARDATA monoTable[ZAF_MAXCOLORS];
```

The static array monoTable is the internal ZAF black and white color table that stores environment-specific information for each ZAF logical black and white color. It is used internally by the Zinc libraries, and should normally not be modified by the programmer.

Mouse

```
virtual ZafError Mouse(int column, int line,
   ZafMouseStruct &mouse);
```

Mouse() is used to display the mouse cursor specified by *mouse*, with its hot spot specified by the column and line parameters. The column and line parameters are relative to the screen. This function is optimized for mouse cursors that have already been converted to the environment's native format, using ConvertToOSMouse(). If the mouse cursor has not yet been converted, Mouse() calls ConvertToOSMouse() automatically. See ZafMouseStruct for more information on mouse cursors. Normally, Mouse() returns ZAF_ERROR_NONE.

Normally, *mouse* should be a ZafMouseData object, so that the OS mouse cursor created by ConvertToOSMouse() will be deleted by the ZafMouseData destructor when the ZafMouseData object is deleted. If *mouse* is a ZafMouseStruct, the programmer is responsible for deleting the OS mouse cursor created by ConvertToOSMouse().

Palette

```
ZafPaletteStruct Palette(void) const;
ZafPaletteStruct SetPalette(ZafPaletteStruct palette);
```

Palette() specifies the drawing palette used by any drawing operation. The palette encases all the drawing properties in one structure. See ZafPaletteStruct for more information on palettes. The default values for Palette() are as follows, but may be changed by calling SetPalette():

Palette() fields	Default values
palette.lineStyle	ZAF_LINE_SOLID
palette.fillPattern	ZAF_PTN_SOLID_FILL
palette.colorForeground	ZAF_CLR_BLACK
palette.colorBackground	ZAF_CLR_WHITE
palette.monoForeground	ZAF_MONO_BLACK
palette.monoBackground	ZAF_MONO_WHITE
palette.font	ZAF_FNT_DIALOG

patternTable

```
static OSFillPattern ZAF_FARDATA
   patternTable[ZAF_MAXPATTERNS];
```

The static array patternTable is the internal ZAF fill pattern table that stores environment-specific information for each ZAF logical fill pattern. It is used internally by the Zinc libraries, and should normally not be modified by the programmer.

Pixel

```
virtual ZafError Pixel(int column, int line,
   ZafLogicalColor color = ZAF_CLR_DEFAULT,
   ZafLogicalColor mono = ZAF_MONO_DEFAULT);
```

Pixel() is used to display a single pixel at the position (*column*, *line*). The *color* and *mono* parameters specify logical colors for the pixel. If the screen on which the pixel appears supports color or grayscale, then the pixel will use the logical color *color*. Otherwise, the pixel will use the logical black and white color *mono*. Normally, Pixel() returns ZAF_ERROR_NONE.

Polygon

```
virtual ZafError Polygon(int numPoints, const int
   *polygonPoints, int width = 1, bool fill = false, bool
   close = false);
```

Polygon() is used to display a polygon specified by the parameters. The parameter *numPoints* specifies the number of points in the parameter polygonPoints, and *polygonPoints* is a list of points that specify the vertices of the polygon. The *width* parameter specifies the width in pixels of the shape's outline, and the outline is drawn with the Foreground() color, using Line-Style(). The *fill* parameter specifies whether or not the inside of the shape should be filled with the Background() color, using FillPattern(). The *close* parameter specifies whether the polygon should be closed. For example, a polygon specified by three points will have only two sides if close is false; but it will have three sides if close is true, since Polygon() will draw the third side by joining the last point with the first point. SetForeground(), SetBack-ground(), SetFillPattern(), and SetLineStyle() (or just SetPalette()) must be called before calling Polygon(), to ensure that the correct settings are used when the polygon is drawn; otherwise, the palette information used may have been previously set by some other object. Normally, Polygon() returns ZAF_ERROR_NONE.

The following shows how to use Polygon():

```
void MyObject::Draw(void)
{
  ZafRegionStruct drawRegion = BeginDraw();
  // Set up the array of vertices for the triangle.
  int points[6];
  points[0] = drawRegion.left; // (x1, y1)
  points[1] = drawRegion.bottom;
  points[2] = drawRegion.left + drawRegion.Width() / 2; // (x2,
    y2)
points[3] = drawRegion.top;
points[4] = drawRegion.right; // (x3, y3)
points[5] = drawRegion.bottom;
// Draw a magenta triangle with a red border.
SetBackground(ZAF_CLR_MAGENTA);
SetForeground(ZAF_CLR_RED);
display->Polygon(3, points, 1, true, true);
EndDraw();
}
```

preSpace
postSpace

`int` **`preSpace`**`,` **`postSpace`**`;`

The preSpace and postSpace members are initialized in the ZafDisplay constructor, and contain the space above and below a window object in pixels, respectively. They are used in positioning window objects on their parents in such a way as to avoid crowding by adding a small amount of whitespace between them. These members are advanced, and should normally not be accessed by the programmer. They are used internally by the Zinc libraries.

Rectangle

```
ZafError Rectangle(const ZafRegionStruct &region, int
   width = 1, bool fill = false);
virtual ZafError Rectangle(int left, int top, int right,
   int bottom, int width = 1, bool fill = false);
```

These overloaded functions display a rectangle specified by the parameters. With the first function, the region parameter specifies the region of the rectangle; with the second, the same information is passed into the left, top, right and bottom parameters. The width parameter specifies the width in pixels of the shape's outline, and the outline is drawn with the Foreground() color, using LineStyle(). The fill parameter specifies whether or not the inside of the shape should be filled with the Background() color, using FillPattern(). SetForeground(), SetBackground(), SetFillPattern(), and SetLineStyle() (or just SetPalette()) must be called before calling Rectangle(), to ensure that the correct settings are used when the rectangle is drawn; otherwise, the palette information used may have been previously set by some other object. Normally, Rectangle() returns ZAF_ERROR_NONE.

RectangleXORDiff

```
virtual ZafError RectangleXORDiff(const ZafRegionStruct
   *oldRegion, const ZafRegionStruct *newRegion);
```

RectangleXORDiff() is useful in implementing a rectangle that appears to be moved around. An example of this operation can be seen in Zinc Designer, when an object is dragged around on the parent window. During this drag operation, a rectangle the size of the object being dragged follows the mouse until it is dropped.

The *oldRegion* parameter specifies the rectangle to be erased, and the *newRegion* parameter specifies the rectangle to be drawn. The first time RectangleXORDiff() is called, null should be passed for oldRegion, and the first region specifying the rectangle to be drawn should be passed for newRegion. Then during the rectangle's movement, the region previously passed to newRegion should be passed to oldRegion, and the region specifying where the rectangle should be drawn next should be passed to newRegion. The final call to RectangleXORDiff() should be passed null for newRegion. Normally, RectangleXORDiff() returns ZAF_ERROR_NONE.

The following is an example of how to use RectangleXORDiff():

```
void MyWindow::DrawRubberBand(ZafPositionStruct
    downClickPosition)
{
  // Prepare for drawing operations.
  ZafRegionStruct drawRegion = BeginDraw();
  SetBackground(ZAF_CLR_WHITE);
  SetForeground(ZAF_CLR_BLACK);
  // Draw a sizing rubber-band following the mouse.
  ZafRegionStruct newRegion, oldRegion;
  oldRegion.left = oldRegion.right = drawRegion.left +
    downClickPosition.column;
  oldRegion.top = oldRegion.bottom = drawRegion.top +
    downClickPosition.line;
  newRegion = oldRegion;
  RectangleXORDiff(ZAF_NULLP(ZafRegionStruct), &newRegion);
  ZafEventStruct event;
  ZafEventType ccode = L_BEGIN_SELECT;
  do
  {
    // Get the mouse movement events.
    eventManager->Get(event, Q_NORMAL);
    // LogicalEvent() normalizes the mouse position.
    ccode = LogicalEvent(event);
    // Put the new mouse position into the region.
    newRegion.right = drawRegion.left + event.position.column;
    newRegion.bottom = drawRegion.bottom + event.position.line;
    RectangleXORDiff(&oldRegion, &newRegion);
    oldRegion = newRegion;
  } while (ccode != L_END_SELECT);
  // Erase the rubber-band and clean up.
  RectangleXORDiff(&oldRegion, ZAF_NULLP(ZafRegionStruct));
  EndDraw();
}
```

RegionCopy

```
virtual ZafError RegionCopy(const ZafRegionStruct
   &oldRegion, int newColumn, int newLine);
```

RegionCopy() visually copies whatever appears in *oldRegion* to the new position (*newColumn*, *newLine*). Since RegionCopy() performs a copy operation instead of a move operation, the original pixels copied are not erased. Whatever appears at (newColumn, newLine) will be overwritten by the copy. The position (newColumn, newLine) may be inside oldRegion, in which case some (or all) of the pixels in oldRegion will be overwritten. This type of operation is commonly used in scrolling the client region associated with a scroll bar (such as in a scrollable text object). Normally, RegionCopy() returns ZAF_ERROR_NONE.

ResetOSBitmap

ResetOSIcon

ResetOSMouse

```
static ZafError ResetOSBitmap(ZafBitmapStruct &bitmap,
   const ZafBitmapStruct &copy);
static ZafError ResetOSIcon(ZafIconStruct &icon, const
   ZafIconStruct &copy);
static ZafError ResetOSMouse(ZafMouseStruct &mouse, const
   ZafMouseStruct &copy);
```

ResetOSBitmap(), ResetOSIcon() and ResetOSMouse() reset the native versions of the images contained in the ZAF image structures passed into the functions to the values stored in the copy parameters. The ZAF image is untouched. These functions are advanced, and should normally not be called by the programmer. They are used internally by the Zinc libraries to reset image structures. Normally, ZAF_ERROR_NONE is returned.

RestoreDisplayContext

```
OSDisplayContext RestoreDisplayContext(void);
```

See DisplayContext().

RestoreDrawContext

```
OSDrawContext RestoreDrawContext(void);
```

See DrawContext().

Text

```
ZafError Text(int left, int top, const ZafIChar *text, int
   length = -1, int hotKeyIndex = -1, bool fill = false);
ZafError Text(const ZafRegionStruct &region, const
   ZafIChar *text, int length = -1, ZafHzJustify
   hzJustify = ZAF_HZ_LEFT, ZafVtJustify vtJustify =
   ZAF_VT_CENTER, int hotKeyIndex = -1, bool fill =
   false);
```

```
virtual ZafError Text(int left, int top, int right, int
   bottom, const ZafIChar *text, int length = -1,
   ZafHzJustify hzJustify = ZAF_HZ_LEFT, ZafVtJustify
   vtJustify = ZAF_VT_CENTER, int hotKeyIndex = -1, bool
   fill = false);
```

These overloaded functions display the text specified by the text parameter. With the first function, the left top corner of the text is drawn at the position (*left*, *top*). If *length* is -1, the entire string is drawn, and is assumed to be null-terminated; otherwise, only length characters (as opposed to bytes) are drawn. If *hotKeyIndex* is -1, none of the characters in the string is drawn as a hot key character; otherwise, the character at the position hotKeyIndex (zero-based) is drawn as a hot key character. A hot key character is usually presented with an underline. The *fill* parameter specifies whether or not the background of the text should be filled with the Background() color, using FillPattern(). SetForeground(), SetBackground(), SetFillPattern(), SetFont(), and SetLineStyle() (or just SetPalette()) must be called before calling Text(), to ensure that the correct settings are used when the text is drawn; otherwise, the palette information used may have been previously set by some other object. Normally, Text() returns ZAF_ERROR_NONE.

The second and third functions are like the first, but provide additional functionality for justifying the text within a region. With the second function, the *region* parameter specifies the region of the rectangle; with the third, the same information is passed into the *left*, *top*, *right* and *bottom* parameters. The *hzJustify* parameter specifies the horizontal justification of the text within the specified region, and the *vtJustify* parameter specifies its vertical justification. Possible values for hzJustify are ZAF_HZ_LEFT, ZAF_HZ_CENTER and ZAF_HZ_RIGHT. Possible values for vtJustify are ZAF_VT_TOP, ZAF_VT_CENTER and ZAF_VT_BOTTOM. If true is passed as the *fill* parameter into these two functions, the background of the entire region specified will be filled, whether or not the text occupies the entire region.

TextSize

```
virtual ZafRegionStruct TextSize(const ZafIChar *text,
   int length = -1);
```

TextSize() calculates the width and height of the text being passed in, using the current Font(). The *text* parameter specifies the string to be measured. If *length* is -1, the entire string is calculated, and is assumed to be null-terminated; otherwise, only length characters (as opposed to bytes) are calculated. The region returned contains the string's width in its right field, and the string's height in its bottom field. The region returned also returns its Width() and Height() attributes correctly.

ZafElement

ClassID	IsA	NumberID
ClassName	ListIndex	StringID
EvaluateIsA	Next	
Find	Previous	

Inheritance Root class

Declaration `#include <z_list.hpp>`

Description ZafElement, the ultimate base class for most ZAF classes, provides member variables and functions for list participation, class identification, and object identification. Almost all ZAF classes act as list heads and/or list elements. For example, windows, menus, vertical lists, horizontal lists, notebooks, tables, the event manager, the window manager, the data manager, and many other classes act as list heads, maintaining lists of ZAF objects. Other classes like strings, buttons, devices, and data act as list elements. All list elements derive from ZafElement, which provides previous and next member variables.

In addition to providing list element functionality, ZafElement also provides member variables and functions for class and object identification.

ZafElement is important as a base class, providing list and identification characteristics to a substantial number of derived classes. You will probably never instantiate this class directly, but you may want to derive your own classes from ZafElement. Many ZAF classes derive directly from ZafElement. Following are important examples:

- ZafData: low-level data such as dates, numbers, and bitmaps
- ZafConstraint: places size and location constraints on window objects
- ZafWindowObject: graphical user interface objects
- ZafRegionElement: region that reserves portions of the screen
- ZafQueueElement: stores run-time event information
- ZafDevice: input devices such as keyboard and mouse

Constructor ZafElement initializes its members to the following default values:

Member Initializations

ZafElement	
`ClassID()`	`ID_ZAF_ELEMENT`
`ClassName()`	`"ZafElement"`
`Next()`	`null`

Member Initializations

`NumberID()`	`0`
`Previous()`	`null`
`StringID()`	`null`

`ZafElement``(void);`

The ZafElement class constructor should only be instantiated from a derived class's constructor such as ZafButton, ZafStringData, or ZafKeyboard.

`ZafElement``(const ZafElement &copy);`

The copy constructor creates a new ZafElement object and initializes its data from *copy*.

Destructor

`virtual ~`**`ZafElement`**`(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafElement object. The ZafElement portion of the destructor destroys the StringID() associated with the object, if one has been specified.

Generally, the programmer will not directly destroy a ZafElement object, but rather the derived object. The following code shows how this destruction is accomplished:

```
// Create a string data object.
ZafElement *string = new ZafStringData("Hello World!");
...
// Free the string.
delete string;
```

The pointer assignment shown above is permitted because ZafElement is a base class to ZafStringData. When the object's destructor is called, the actual contents of the ZafStringData instance are freed because the base class destructor is declared virtual.

For complete information on the type of memory that is freed as a result of a call to the destructor, see the reference chapter on the particular object you instantiated.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*()

function does not successfully change the state as requested, it will instead return the current state.

ClassID
ClassName

```
virtual ZafClassID ClassID(void) const;
virtual ZafClassNameChar ClassName(void) const;
```

These two functions return the class identification and name for the object. The const value ID_ZAF_ELEMENT and string "ZafElement" are the identifiers associated with the ZafElement class, but each Zinc Application Framework class has a unique class identification. For example, here is a partial list of classes and their associated identifications:

Class	ClassID()	ClassName()
ZafWindowObject	`ID_ZAF_WINDOW_OBJECT`	`"ZafWindowObject"`
ZafButton	`ID_ZAF_BUTTON`	`"ZafButton"`
ZafDateData	`ID_ZAF_DATE_DATA`	`"ZafDateData"`
ZafKeyboard	`ID_ZAF_KEYBOARD`	`"ZafKeyboard"`

The identification associated with the class is always a const declaration, found in the source file gbl_def.cpp, that is the class name with an "ID_" prefix (e.g., ZafButton -> ID_ZAF_BUTTON). The associated name is a string equivalent to the actual class declaration (e.g., ZafKeyboard -> "ZafKeyboard").

The use of ClassName() is preferred over the use of ClassID(). Every class in ZAF has a unique ClassID(), but classes that the programmer derives from ZAF classes are all assigned the same ClassID() unless specifically set to another value by the programmer.

Class identifications are normally used in conjunction with the IsA() member function to indicate if an object is derived from a particular class. For instance, the following code shows how the ClassName() and ClassID() functions can be used with the IsA() function to determine the matching identification of a given window object.

```
// Check for an exact match.
if (object1->ClassID() == object2->ClassID())
  printf("Objects are of the same class!\n");

// Look for inheritance relationships.
if (object1->IsA(object2->ClassID())
  printf(Object1 (%s) is derived from object2 (%s).\n",
    object1->ClassName(), object2->ClassName());
else if (object2->IsA(object1->ClassID())
  printf(Object2 (%s) is derived from object1 (%s).\n",
    object2->ClassName(), object1->ClassName());
```

Since ClassID() and ClassName() are virtual functions, you will only receive the most derived name or identification of the object (most derived meaning the lowest derivation in the Zinc Application Framework hierarchy, or the exact type of class that was instantiated). For example, a ClassName() call to an instantiated ZafButton will result in the return value of “ZafButton”, not “ZafWindowObject” or “ZafElement”, even though you may have stored the contents of the new operation into a ZafElement pointer.

```
// Print the type of object we just created.
ZafElement *element = new ZafButton(0, 0, 10, 1,
    ZAF_NULLP(ZafIChar), myBitmap);
printf("The element is: %s\n", element->ClassName());
==========
The element is: ZafButton
```

The only way to override these return values is to scope the ClassID() call:

```
// Print the type of object we just created.
ZafElement *element = new ZafButton(0, 0, 10, 1,
    ZAF_NULLP(ZafIChar), myBitmap);
printf("The element is: %s\n", element->
    ZafWindowObject::ClassName());
==========
The element is: ZafWindowObject
```

EvaluateIsA

static ZafElement ***EvaluateIsA**(ZafElement *element,
    ZafClassID compareID);

If a compiler doesn’t support RTTI via dynamic_cast(), ZAF provides similar functionality for classes derived from ZafElement with a DynamicPtrCast() macro. DynamicPtrCast() calls EvaluateIsA(), which in turn calls IsA(). The intermediate step of EvaluateIsA() is necessary in order to avoid calling IsA() twice in the macro DynamicPtrCast(). It is important to note that for compilers that support RTTI, DynamicPtrCast() simply calls dynamic_cast().

EvaluateIsA() simply passes its parameters to IsA(). The *element* parameter specifies a pointer to the object to be checked, and the *compareID* parameter specifies the class identification to be checked against. See IsA() for more information.

Find

```
virtual ZafElement *Find(ZafNumberID numberID);
virtual ZafElement *Find(ZafStringID stringID);
```

Find() provides a base for doing searches in lists of ZafElement objects. ZafElement::Find() returns null if *numberID* or *stringID* do not match this object, and it returns "this" if it is a match.

Though Find() returns a ZafElement pointer, the programmer may use the overloaded function GetObject() in classes derived from ZafList to get a pointer of the same type.

IsA

```
virtual bool IsA(ZafClassID compareID) const;
virtual bool IsA(ZafClassName compareName) const;
```

These overloaded functions provide the base definition for the hierarchical chain of inheritance relationships used in Zinc Application Framework. A particular instantiation of an element will not only match IsA() queries for ZafElement, but also for the derived class. These functions return true if one of the following two conditions is met:

- the object is an instantiation of the specified class
- the object is derived from the specified class

Otherwise, the function returns false.

Pre-defined Zinc Application Framework values and strings can be passed to the IsA function. Following are examples of these values:

Class	**ClassID()**	**ClassName()**
ZafElement	`ID_ZAF_ELEMENT`	`"ZafElement"`
ZafWindow	`ID_ZAF_WINDOW`	`"ZafWindow"`
ZafKeyboard	`ID_ZAF_KEYBOARD`	`"ZafKeyboard"`
ZafStringData	`ID_ZAF_STRING_DATA`	`"ZafStringData"`
ZafButton	`ID_ZAF_BUTTON`	`"ZafButton"`

In addition to ZAF pre-defined values and strings, new values and strings can be defined for objects derived from a Zinc Application Framework class. Consider the following code that defines a new class called MyClass:

```
const ZafClassID ID_MY_CLASS = 10000;

ZafClassID MyClass::classID = ID_MY_CLASS;
ZafClassNameChar MyClass::className[] = "MyClass";
```

Zinc reserves the values 0 through 9,999 for their class identifications and the "Zaf" and "Zdc" prefix for their class names ("Zdc" is reserved for the Zinc DataConnect product). All other values and prefixes can be used by developers in their applications.

For up-to-date information on these constant declarations, refer to the source file gbl_def.cpp and the full Zinc Application Framework class hierarchy.

The following code shows the proper use of the IsA function with various argument methods:

```
// Check for a string object using the identifier.
if (object->IsA(ID_ZAF_STRING))
  break;

// Check for a main window using the class name.
if (object->IsA("ZafWindow"))
  eventManager->Put(S_EXIT);

// Check for a mouse using the mouse classID.
if (device->IsA(ZafMouse::classID))
  device->SetDeviceState(DM_VIEW);

// Check for a date data class.
ZafDateData *date;
if (data->IsA(ZafDateData::className))
  date = DynamicPtrCast(data, ZafDateData);
```

ListIndex

`int` **`ListIndex`**`(void);`

This function is an element level method (as opposed to the list method ZafList::Index()) used to determine an object's position in a list. It returns a zero-based value representing the position. Consider the following code:

```
ZafElement element1, element2;

ZafList list;
list.Add(&element1);
list.Add(&element2);

printf("List position of element2 = %d\n",
    element2.ListIndex());
printf("List position of element1 = %d\n",
    list.Index(element1));
==========
List position of element2 = 1
List position of element1 = 0
```

As a special warning, in addition to a 0 value representing the first position in a list, if the ZafElement is not a member of a list, this function also returns zero. If you are not sure that the element is indeed attached to a list, you should use the ZafList::Index() function instead of this function, since the list function returns -1 when the element is not found in the list.

Next
Previous

```
ZafElement *Next(void) const;
ZafElement *Previous(void) const;
```

These functions return a pointer to the next/previous element in the list. If the ZafElement is not a member of a list, or if the element is the first member of a list and the Previous() function is called, or the last member in a list and the Next() function is called, the return value is null. Consider the following code:

```
// Initialize all my children.
for (ZafWindowObject *object = window->First(); object; object =
    object->Next())
  object->Event(S_INITIALIZE);

// Find the previous object in the list.
if (element->Previous())
  printf("previous sibling %s\n", element->Previous()->
    StringID());
```

In addition to the ZafElement class, the following classes overload the Next() and Previous() functions:

Class	Return value	Used by
ZafData	`ZafData *`	ZafDataManager
ZafDevice	`ZafDevice *`	ZafEventManager
ZafWindowObject	`ZafWindowObject *`	derived ZafWindows
ZafConstraint	`ZafConstraint *`	ZafGeometryManager
ZafRegionElement	`ZafRegionElement *`	ZafDisplay
ZafQueueElement	`ZafQueueElement *`	ZafEventManager
ZafTableRecord	`ZafTableRecord *`	ZafTable

These functions are overloaded to enable you to obtain the proper type of class pointer for a given parent object. The code shown above showed a common use for the overloaded ZafWindowObject::Next() function, as used with the ZafWindow::First() function. For more information on these overloads, see the appropriate class object's definition.

NumberID

```
ZafNumberID NumberID(void) const;
ZafNumberID SetNumberID(ZafNumberID numberID);
```

These functions are used to associate a number identification with an instantiated Zinc Application Framework object. The base element constructor sets the number identification to 0, and in general, you are responsible for changing this value if you want a unique identifier for your object. There are several occasions, however, where the number identification is automatically set by Zinc Application Framework:

- If you instantiate a window object and attach it to a root window without a number identification, the ZafWindowObject::Event() function will automatically create an ascending identifier for each child object when the S_INITIALIZE message is processed (such as when the object's root window is added to the window manager). For example, the following code would create a window whose children had number identifications of 0 and 1:

```
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
window->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
  ZAF_NULLP(ZafBitmapData)));
window->Add(new ZafString(0, 1, 20,
  ZAF_NULLP(ZafStringData)));
windowManager->Add(window);
```

- If you instantiate any of a number of special support window objects (there will only be one of these objects per window hierarchy). The following support objects have default number identifications (the const declarations are given in z_numid.hpp):

Class	**NumberID()**
ZafBorder	ZAF_NUMID_BORDER
ZafGeometryManager	ZAF_NUMID_GEOMETRY_MANAGER
ZafMaximizeButton	ZAF_NUMID_MAXIMIZE
ZafMinimizeButton	ZAF_NUMID_MINIMIZE
ZafIcon (minimize)	ZAF_NUMID_MIN_ICON
ZafPullDownMenu	ZAF_NUMID_PULL_DOWN_MENU
ZafSystemButton	ZAF_NUMID_SYSTEM
ZafSystemButton::menu	ZAF_NUMID_SYSTEM_BUTTON_MENU
ZafScrollBar (corner)	ZAF_NUMID_C_SCROLL
ZafScrollBar (horizontal)	ZAF_NUMID_HZ_SCROLL
ZafScrollBar (vertical)	ZAF_NUMID_VT_SCROLL

Class	NumberID()
ZafTitle	`ZAF_NUMID_TITLE`

- If you instantiate special pop-up items that use the special ZafPopUpItemType enumeration value defined in z_popup.hpp (the const declarations are given in z_numid.hpp):

Enumeration	NumberID()
`ZAF_CLOSE_OPTION`	`ZAF_NUMID_OPT_CLOSE`
`ZAF_MAXIMIZE_OPTION`	`ZAF_NUMID_OPT_MAXIMIZE`
`ZAF_MINIMIZE_OPTION`	`ZAF_NUMID_OPT_MINIMIZE`
`ZAF_MOVE_OPTION`	`ZAF_NUMID_OPT_MOVE`
`ZAF_RESTORE_OPTION`	`ZAF_NUMID_OPT_RESTORE`
`ZAF_SIZE_OPTION`	`ZAF_NUMID_OPT_SIZE`
`ZAF_SWITCH_OPTION`	`ZAF_NUMID_OPT_SWITCH`

StringID

```
const ZafStringID StringID(void) const;
ZafStringID SetStringID(const ZafStringID stringID);
```

These functions are used to associate a string identification with an instantiated Zinc Application Framework object. The base element constructor sets the string identification to null, and in general, you are responsible for changing this value if you want a unique identifier for your object. There are several occasions, however, where the string identification is automatically set by Zinc Application Framework:

- If you instantiate a window object and attach it to a root window, without a string identification, the ZafWindowObject::Event() function will automatically create an incremented field identifier when the S_INITIALIZE message is processed (such as when the object's root window is added to the window manager). For example, the following code would create a window whose children had string identifications of "FIELD_0" and "FIELD_1":

```
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
window->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
  ZAF_NULLP(ZafBitmapData)));
window->Add(new ZafString(0, 1, 20,
  ZAF_NULLP(ZafStringData)));
windowManager->Add(window);
```

- If you instantiate any of a number of special support window objects (there will only be one of these objects per window hierarchy). The following support objects have default string identifications:

Class	**StringID()**
ZafBorder	`"ZAF_NUMID_BORDER"`
ZafGeometryManager	`"ZAF_NUMID_GEOMETRY"`
ZafMaximumButton	`"ZAF_NUMID_MAXIMIZE"`
ZafMinimizeButton	`"ZAF_NUMID_MINIMIZE"`
ZafIcon (minimize)	`"ZAF_NUMID_MIN_ICON"`
ZafPullDownMenu	`"ZAF_NUMID_PULL_DOWN_MENU"`
ZafSystemButton	`"ZAF_NUMID_SYSTEM"`
ZafSystemButton::menu	`"ZAF_NUMID_SYSTEM_BUTTON_MENU"`

ZafEraStruct

direction	eraFormat	offset
endDate	eraName	startDate

Inheritance

```
Root struct
```

Declaration

```
#include <z_loc.hpp>
```

Description

ZafEraStruct is used by ZafLocaleStruct to store information about an era of time. An array of ZafEraStruct objects is used for each locale, where each ZafEraStruct object stores information about a single era.

Members

direction

```
ZafUInt16 direction;
```

If direction is non-zero, the era begins on or after the year 1 AD, and the year value increases chronologically for the era; otherwise the year value decreases chronologically for the era, such as BC values.

endDate

```
ZafUInt32 endDate;
```

endDate is the Julian value of the era's last day.

eraFormat

```
ZafIChar eraFormat[8];
```

eraFormat is the output format string for the era when the format specifier "%E" is used. Follow source code in ZafUTime::OutputFormat() for details.

eraName

```
ZafIChar eraName[6];
```

eraName is the name of the era. For example, "BC" is the name of the era before the year 1 AD.

offset

```
ZafUInt16 offset;
```

offset specifies the local beginning year number of the era, usually 1 or 2 (or 4713 for the BC era). For example, the "AD" era has an offset of 1, meaning the first year of the era is 1 AD.

startDate

```
ZafUInt32 startDate;
```

startDate is the Julian value of the era's first day.

ZafErrorStub

Beep	ErrorMessage	ReportError

Inheritance

```
Root class
```

Declaration

```
#include <z_error.hpp>
```

Description

ZafErrorStub serves solely as a base class for ZafErrorSystem, so that ZafErrorSystem is not linked into a program that does not make use of it. ZafErrorStub provides a ReportError() function that formats a sscanf-style error message and calls the pure virtual function ErrorMessage() for ZafErrorSystem to display the error. The programmer should normally not derive from this class.

Constructor

```
ZafErrorStub(void);
```

This constructor creates a ZafErrorStub object. Since ZafErrorStub is a virtual class, the programmer will normally not call this constructor.

Destructor

```
virtual ~ZafErrorStub(void);
```

The destructor is used to free the memory associated with a ZafErrorStub object. Since ZafErrorStub is a virtual class, the programmer will not normally call this destructor.

Members

Beep

```
static void Beep(void);
```

Beep() causes the system to emit an audible alert appropriate to the system. On systems that allow the end user to modify the system's audible alert, Beep() emits the alert chosen by the end user.

ErrorMessage

```
virtual ZafDialogEvent ErrorMessage(ZafWindowObject
   *object, const ZafIChar *title, ZafDialogFlags
   dlgFlags, const ZafIChar *message) = 0;
```

ErrorMessage() is a pure virtual function. ZafErrorSystem overloads this function to provide basic error display functionality.

ReportError

```
ZafDialogEvent ReportError(ZafWindowObject *object,
   const ZafIChar *title, ZafDialogFlags dlgFlags, const
   ZafIChar *format, ...);
```

ReportError() formats a sscanf-style error message and calls the pure virtual function ErrorMessage() for ZafErrorSystem to display the error. *object* is the window object that generated the error message, *title* is the text to appear in the title bar of the error window, and *format* specifies the format string used to build the error message (along with the variable arguments) to appear in the window. *dlgFlags* specifies which buttons are to be placed on the error window, controlling what the user may respond. See ErrorMessage() for more information.

ZafErrorSystem

ErrorMessage

Inheritance `ZafErrorSystem : ZafErrorStub`

Declaration `#include <z_error.hpp>`

Description

ZafErrorSystem is ZAF's built-in support for error-reporting. If a ZafErrorSystem has been instantiated, the error system may be used to beep and present a modal error window. The user must respond by selecting one of the available buttons such as "OK" or "Cancel". As with other ZAF classes, ZafErrorSystem utilizes the native environment's API, if available.

Some classes have built-in error handling, and the programmer needn't do anything beyond instantiating a ZafErrorSystem for it to work. Some of these classes are ZafBignum, ZafDate, ZafInteger, ZafReal, ZafTime, and ZafUTime. The programmer may utilize ZafErrorSystem at any time.

Constructors

All ZafErrorSystem constructors initialize the member variables associated with an instantiated ZafErrorSystem object. The default values set by the ZafErrorSystem follow.

Member Initializations

ZafErrorSystem	
`ClassID()`	`ID_ZAF_ERROR_SYSTEM`
`ClassName()`	`"ZafErrorSystem"`

`ZafErrorSystem``(void);`

This constructor creates a ZafErrorSystem object, initializes information used by ZafErrorSystem, and sets the global zafErrorSystem. There should only be one ZafErrorSystem instantiated during the life of an application.

`ZafErrorSystem``(const ZafErrorSystem &copy);`

The copy constructor creates a new ZafErrorSystem object and initializes its data from copy.

Destructor

```
virtual ~ZafErrorSystem(void);
```

The destructor is used to free the memory associated with a ZafErrorSystem object. It chains to the ZafErrorStub destructor.

Members

ErrorMessage

```
virtual ZafDialogEvent ErrorMessage(ZafWindowObject
   *object, const ZafIChar *title, ZafDialogFlags
   dlgFlags, const ZafIChar *message);
```

ErrorMessage() causes the error system to present a modal error dialog window. *object* is the window object that generated the error message, *title* is the text to appear in the title bar of the error window, and *message* is the error message to appear in the window. The error window is sized such that the entire message is visible. *dlgFlags* specifies which buttons are to be placed on the error window, controlling what the user may respond. *dlgFlags* is made up of one or more of the following values, that may be logically OR'd together:

ZafDialogFlags	Description
ZAF_DIALOG_ABORT	Provides an "Abort" button
ZAF_DIALOG_CANCEL	Provides a "Cancel" button
ZAF_DIALOG_HELP	Provides a "Help" button for those environments that allow it
ZAF_DIALOG_IGNORE	Provides an "Ignore" button
ZAF_DIALOG_NO	Provides a "No" button
ZAF_DIALOG_OK	Provides an "OK" button
ZAF_DIALOG_RETRY	Provides a "Retry" button
ZAF_DIALOG_YES	Provides a "Yes" button

Since ZafErrorSystem may be used to indicate errors in ZAF itself, ErrorMessage() uses a native window when available to display the message instead of a ZafWindow.

ZafEventManager

Blocked	GetObject	ReadFromEnd
DestroyEvent	PollDevices	SetDeviceImage
Event	Put	SetDevicePosition
Get	ReadFromBeginning	SetDeviceState

Inheritance

```
ZafEventManager : ZafList
```

Declaration

```
#include <z_evtmgr.hpp>
```

Description

ZafEventManager is the top-level class used to manage all the events and supported devices on the system. Some systems have a native event manager that ZafEventManager monitors. In these cases, the ZafEventManager packages the native events into ZAF events and posts them on its event queue for processing by the ZAF system. Generally, native devices such as mice and keyboards are automatically polled by the native environment, so ZAF receives device events directly from the native event manager. Some environments such as DOS must poll each input device using its Poll() function (see ZafDevice for more information). The Poll() function posts any device events on the event manager's queue.

To cause the event manager to manage a device, simply add the device to the event manager's list with the Add() function.

Constructor

```
ZafEventManager(int noOfQueueEvents = 100);
```

This constructor should normally not be called by the programmer, since it is called by the ZafApplication constructor. The *noOfQueueEvents* parameter specifies the maximum number of events the internal event queue should hold. Static members of ZafDevice are initialized in this constructor. These include *display* and *eventManager*.

Destructor

```
virtual ~ZafEventManager(void);
```

This destructor is used to free the memory associated with a ZafEventManager object. It chains to the ZafList destructor.

Generally, the programmer will not directly destroy a ZafEventManager object, since it is automatically destroyed when the ZafApplication object is destroyed.

Members

Blocked

```
bool Blocked(ZafQFlags qFlags) const;
```

Blocked() returns false if *qFlags* contains the Q_NO_BLOCK flag. Otherwise, it returns true, reflecting the default of Q_BLOCK. See Get() for more information.

DestroyEvent

```
bool DestroyEvent(ZafQFlags qFlags) const;
```

DestroyEvent() returns false if *qFlags* contains the Q_NO_DESTROY flag. Otherwise, it returns true, reflecting the default of Q_DESTROY. See Get() for more information.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event,
    ZafDeviceType deviceType = E_DEVICE);
```

The Event() function passes an event to devices attached to the event manager. If *deviceType* is E_DEVICE, the event is passed to all the devices for processing. Otherwise, the event is passed only to the devices of type *deviceType*. Event() returns the return code from the last device that processed the event. See ZafDevice::Event() for more information.

Get

```
virtual int Get(ZafEventStruct &event, ZafQFlags flags =
    Q_NORMAL);
```

Get() returns the next available event in the ZafEventManager's queue, according to the *flags* passed into the flags parameter. The default behavior is specified with Q_NORMAL. The following are the flags that may be OR'd together and passed to Get():

Flag	Description
Q_END	Causes Get() to retrieve the event at the end of the queue (default is Q_BEGIN)
Q_NO_BLOCK	Causes Get() to always return, even if no event is available (default is Q_BLOCK)
Q_NO_DESTROY	Causes Get() to leave the event on the queue for retrieval later also (default is Q_DESTROY)
Q_NO_POLL	Causes Get() to not poll the devices (default is Q_POLL)

In environments that have native event managers, Get() looks at the native event manager's queue and puts the next available event packaged up as a ZAF event on the ZAF event queue. Native events packaged up as ZAF events have an event.type of E_OSEVENT, and must be processed by ZafWindowObject::LogicalEvent() before the ZAF event structure is fully initialized. See ZafWindowObject::Event() and ZafWindowObject::LogicalEvent() for more information.

During Get(), the ZafEventManager calls Poll() once for all the devices attached to its queue if the Q_NO_POLL flag is not set. If Q_NO_BLOCK was not passed into the *flags* parameter and no event is put on the queue during device polling, Get() will keep polling the devices (or looking at the native event manager's queue) until an event is posted.

Get() returns the next available event on the ZAF event queue, usually from the beginning of the queue, but if Q_END is passed into the *flags* parameter, it will return the event on the end of the queue. If a valid event was returned in the *event* parameter, Get() returns 0. Otherwise, some non-zero value is returned.

GetObject

```
virtual ZafDevice *GetObject(ZafNumberID numberID);
virtual ZafDevice *GetObject(const ZafIChar *stringID);
```

These overloaded functions return a pointer to the device attached to the event manager specified by *numberID* or *stringID*. If the device was not found, null is returned.

PollDevices

```
bool PollDevices(ZafQFlags qFlags) const;
```

PollDevices() returns false if *qFlags* contains the Q_NO_POLL flag. Otherwise, it returns true, reflecting the default of Q_POLL. See Get() for more information.

Put

```
virtual bool Put(const ZafEventStruct &event, ZafQFlags
    flags = Q_END);
```

Put() posts the event passed into the *event* parameter on the ZafEventManager's queue, according to the *flag* passed into the flags parameter. If Q_END is specified, the event is placed on the end of the queue. If Q_BEGIN is specified, the event is placed on the beginning of the queue. Put() returns true if the event was successfully added to the queue; otherwise Put() returns false.

ReadFromBeginning

```
bool ReadFromBeginning(ZafQFlags qFlags) const;
```

ReadFromBeginning() returns false if *qFlags* contains the Q_END flag. Otherwise, it returns true, reflecting the default of Q_BEGIN. See Get() and Put() for more information.

ReadFromEnd

```
bool ReadFromEnd(ZafQFlags qFlags) const;
```

ReadFromEnd() returns false if *qFlags* does not contain the Q_END flag. Otherwise, it returns true, reflecting the default of Q_BEGIN. See Get() and Put() for more information.

SetDeviceImage

```
ZafEventType SetDeviceImage(ZafDeviceType deviceType,
    ZafDeviceImage deviceImage);
```

The SetDeviceImage() function finds the first device of type *deviceType* attached to the event manager and changes its device image to *deviceImage*. The return value is usually *deviceImage*.

An example of calling this function follows:

```
// Change the mouse image to DM_WAIT.
eventManager->SetDeviceImage(E_MOUSE, DM_WAIT);
```

SetDevicePosition

```
ZafEventType SetDevicePosition(ZafDeviceType deviceType,
    int column, int line);
```

The SetDevicePosition() function finds the first device of type *deviceType* attached to the event manager and sends it a D_POSITION event, with event.position (*column*, *line*). The return value is D_POSITION for environments that allow the device to be programmatically positioned, or S_UNKNOWN for environments that disallow it.

An example of calling this function follows:

```
// Change the mouse image to the top left of the screen.
eventManager->SetDevicePosition(E_MOUSE, 0, 0);
```

SetDeviceState

```
ZafEventType SetDeviceState(ZafDeviceType deviceType,
    ZafDeviceState deviceState);
```

The SetDeviceState() function finds the first device of type *deviceType* attached to the event manager and changes its device state to *deviceState*. If *deviceState* is D_STATE, the current state of the device is not changed, but is returned. The return value is usually *deviceState*.

An example of calling this function follows:

```
// Find the mouse state.
ZafEventType mouseState = eventManager->SetDeviceState(E_MOUSE,
    D_STATE);
```

ZafEventMap

eventType	
logicalValue	rawCode

Inheritance

```
Root struct
```

Declaration

```
#include <z_win.hpp>
```

Description

ZafEventMap objects are used in tables to associate native events with ZAF logical events. For example, when the <Enter> key is typed, a ZafEventMap entry for a default button would specify the equivalent logical ZAF event L_SELECT. The last entry in a table of ZafEventMap entries should specify the special logical ZAF event L_NONE to terminate a table search. See ZafWindowObject::LogicalEvent() for more information.

Members

logicalValue

`ZafLogicalEvent` **`logicalValue`**`;`

logicalValue specifies the logical ZAF event to be associated with the native event. Possible values of this member are any of the logical event values defined in the header file z_logevt.hpp. This member should be L_NONE for the last entry in a table.

eventType

`ZafEventType` **`eventType`**`;`

eventType specifies the type of the native event. Possible values of this member are E_KEY (for keyboard events) and E_MOUSE (for mouse events).

rawCode

`ZafRawCode` **`rawCode`**`;`

rawCode specifies the raw value of the native event. For keyboard events (eventType == E_KEY), rawCode is the raw key value, such as ENTER or F1 (see the header file z_keymap.hpp for the possible values). For mouse events (eventType == E_MOUSE), rawCode is the raw mouse value, which may be any combination of the following bitwise values:

Raw Code	Description
`M_LEFT`	Indicates the left (or only) mouse button is down
`M_LEFT_CHANGE`	Indicates the left (or only) mouse button was just pressed or released
`M_MIDDLE`	Indicates the middle mouse button (if any) is down

Raw Code	Description
`M_MIDDLE_CHANGE`	Indicates the middle mouse button (if any) was just pressed or released
`M_RIGHT`	Indicates the right mouse button (if any) is down
`M_RIGHT_CHANGE`	Indicates the right mouse button (if any) was just pressed or released
S_DOUBLE_CLICK	Indicates the button was double-clicked

modifiers

`ZafRawCode` **`modifiers`**`;`

modifiers specifies modifier keys that were pressed at the time of the event. This member may be any combination of the following bitwise values:

Modifiers	Description
S_ALT	Indicates that the <alt> key was depressed
S_CAPS_LOCK	Indicates that the <caps lock> key was depressed
S_CMD	Indicates that the <command> key was depressed
S_CTRL	Indicates that the <control> key was depressed
S_INSERT	Indicates that the <insert> key was depressed
S_KEYDOWN	Indicates that the key was pressed
S_KEYUP	Indicates that the key was released
S_LEFT_SHIFT	Indicates that the left <shift> key was depressed
S_NUM_LOCK	Indicates that the <num lock> key was depressed
S_OPT	Indicates that the <option> key was depressed
S_RIGHT_SHIFT	Indicates that the right <shift> key was depressed
S_SCROLL_LOCK	Indicates that the <scroll lock> key was depressed
S_SHIFT	Indicates that either <shift> key was depressed

ZafEventStruct

converted	modifiers	Scroll
data	osEvent	text
Device	Position	type
Display	rawCode	VoidData
EventManager	Region	Window
InputType	route	WindowManager
Key	ScreenID	WindowObject

Inheritance `Root structure`

Declaration `#include <z_event.hpp>`

Description ZafEventStruct provides support for ZAF's portable event structure. Portable ZAF events and native events alike are sent via ZafEventStruct objects through the ZAF system. Native events are packaged up into ZafEventStruct objects for portable event passing.

Constructors All ZafEventStruct constructors initialize the member variables associated with an instantiated ZafEventStruct object. The default values set by the ZafEventStruct follow.

Member Initializations

ZafEventStruct	
`converted`	`null`
`data`	`null`
`modifiers`	`0`
`osEvent`	`user-supplied parameter`
`rawCode`	`0`
`route`	`null`
`text`	`null`
`type`	`0`

```
ZafEventStruct(void);
```

The default constructor creates a null event. This constructor is called when an event is declared but not defined, and should be used carefully. If this constructor is used, the programmer must initialize all event information necessary for the desired event before any object may try to evaluate it.

ZafEventStruct(ZafEventType type, OSEventStruct
    *osEvent);

This constructor initializes the event's type to *type* and copies all the native event information from *osEvent* into the event's osEvent.

ZafEventStruct(ZafEventType type, ZafRawCode rawCode =
    0);

This constructor initializes the event's type to *type* and the event's rawCode is copied from *rawCode*. Since *rawCode* is a default parameter, this constructor may be used to create an event whose type requires no additional event information.

ZafEventStruct(ZafEventType type, ZafRawCode rawCode,
    ZafKeyStruct key);

This constructor initializes the event's type to *type*, the event's rawCode to *rawCode*, and the key flavor of the event's union to *key*.

ZafEventStruct(ZafEventType type, ZafRawCode rawCode,
    ZafPositionStruct position);

This constructor initializes the event's type to *type*, the event's rawCode to *rawCode*, and the position flavor of the event's union to *position*.

ZafEventStruct(ZafEventType type, ZafRawCode rawCode,
    ZafRegionStruct region);

This constructor initializes the event's type to *type*, the event's rawCode to *rawCode*, and the region flavor of the event's union to *region*.

ZafEventStruct(ZafEventType type, ZafRawCode rawCode,
    ZafScrollStruct scroll);

This constructor initializes the event's type to *type*, the event's rawCode to *rawCode*, and the scroll flavor of the event's union to *scroll*.

An example of how to create and send an event follows:

```
// Create and post a close event.
ZafEventStruct closeEvent(S_CLOSE);
zafEventManager->Put(closeEvent);
```

```
// Create a copy event and send it to the string field.
ZafEventStruct copyEvent(S_COPY);
string->Event(copyEvent);
```

Members

converted

ZafWindowObject ***converted**;

If this member is null, the event's information has not been converted in the context of a window object. If it is non-null, it points to the object in whose context the event information was converted. For example, a mouse event's position is specified with the object's top left being (0,0), so the event's position information must be converted in the context of the object in question.

data

```
union
{
     ZafKeyStruct key;
     ZafRegionStruct region;
     ZafPositionStruct position;
     ZafScrollStruct scroll;

     ZafDevice *device;
     ZafDisplay *display;
     ZafEventManager *eventManager;
     const ZafIChar *helpContext;
     ZafWindowObject *windowObject;
     ZafWindow *window;
     ZafWindowManager *windowManager;

     OSWindowID screenID;

     void *data;
};
```

The anonymous union stores additional information needed by various events. User events may utilize the union as needed. Union information may be accessed using the following methods.

Device

ZafDevice ***Device**(void) const;
void **SetDevice**(ZafDevice *tDevice);

Device() returns the device flavor of the event's anonymous union, and SetDevice() may be used to set it.

Display

```
ZafDisplay *Display(void) const;
void SetDisplay(ZafDisplay *tDisplay);
```

Display() returns the display flavor of the event's anonymous union, and SetDisplay() may be used to set it.

EventManager

```
ZafEventManager *EventManager(void) const;
void SetEventManager(ZafEventManager *tEventManager);
```

EventManager() returns the eventManager flavor of the event's anonymous union, and SetEventManager() may be used to set it.

HelpContext

```
const ZafIChar *HelpContext(void) const;
void SetHelpContext(const ZafIChar *tHelpContext);
```

HelpContext() returns the helpContext flavor of the event's anonymous union, and SetHelpContext() may be used to set it.

InputType

```
ZafEventType InputType(ZafEventType ccode = 0) const;
```

InputType() returns the type of event this is, whether it be a native event or a ZAF event. The possible return values are as follows:

InputType()	**Description**
E_KEY	Keyboard events
E_MOUSE	Mouse events
S_SYSTEM_EVENT	ZAF system events
L_LOGICAL_EVENT	ZAF logical events
E_DEVICE_EVENT	ZAF device events

Key

```
const ZafKeyStruct *Key(void) const;
void SetKey(ZafKeyStruct *tKey);
```

Key() returns the key flavor of the event's anonymous union, and SetKey() may be used to set it.

modifiers

`ZafRawCode **modifiers**;`

This member stores the modifier keys that are associated with a keyboard or mouse event. The different modifier keys are represented with flags that may be combined into bit patterns. See ZafKeyStruct::shiftState for more information.

osEvent

`OSEventStruct **osEvent**;`

This member stores the native event information for environment-specific events. When the event's type member is E_OSEVENT, this member contains native event information.

Position

```
const ZafPositionStruct *Position(void) const;
void SetPosition(ZafPositionStruct *tPosition);
```

Position() returns the position flavor of the event's anonymous union, and SetPosition() may be used to set it.

rawCode

`ZafRawCode **rawCode**;`

This member stores raw information about an event. If the event is a keyboard event, rawCode stores the raw key value returned from the native environment (see ZafKeyStruct::value for more information). If the event is a mouse event, rawCode stores which buttons are depressed as bit values combined together. The possible values for rawCode in a mouse event are as follows:

Mouse event's rawCode	**Description**
`M_LEFT`	The left mouse button has been depressed
`M_LEFT_CHANGE`	The mouse is moving with the left button depressed, or the left button has been released
`M_MIDDLE`	The middle mouse button has been depressed
`M_MIDDLE_CHANGE`	The mouse is moving with the middle button depressed, or the middle button has been released
`M_RIGHT`	The right mouse button has been depressed
`M_RIGHT_CHANGE`	The mouse is moving with the right button depressed, or the right button has been released

Region

```
const ZafRegionStruct *Region(void) const;
void SetRegion(ZafRegionStruct *tRegion);
```

Region() returns the region flavor of the event's anonymous union, and SetRegion() may be used to set it.

route

```
ZafWindowObject *route;
```

If this member is non-null, the window manager sends the event directly to the object specified.

ScreenID

```
OSWindowID ScreenID(void) const;
void SetScreenID(OSWindowID tScreenID);
```

ScreenID() returns the screenID flavor of the event's anonymous union, and SetScreenID() may be used to set it.

Scroll

```
const ZafScrollStruct *Scroll(void) const;
void SetScroll(ZafScrollStruct *tScroll);
```

Scroll() returns the scroll flavor of the event's anonymous union, and SetScroll() may be used to set it.

text

```
ZafIChar *text;
```

This member allows textual information to be associated with an event. If the event was generated by ZAF or the native environment, the object handling an event where text is non-null must delete it. See the appendix on Event Definitions under the application events for more information.

type

```
ZafEventType type;
```

This member specifies the event's type. See the appendix on Event Definitions for more information on the event types supported by ZAF.

VoidData

```
void *VoidData(void) const;
void SetVoidData(void *tData);
```

VoidData() returns the data flavor of the event's anonymous union, and SetVoidData() may be used to set it. This particular flavor of the event's anonymous union is provided for programmer use to allow associating data of any type with an event.

Window

```
ZafWindow *Window(void) const;
void SetWindow(ZafWindow *tWindow);
```

Window() returns the window flavor of the event's anonymous union, and Set-Window() may be used to set it.

WindowManager

```
ZafWindowManager *WindowManager(void) const;
void SetWindowManager(ZafWindowManager *tWindowManager);
```

WindowManager() returns the windowManager flavor of the event's anonymous union, and SetWindowManager() may be used to set it.

WindowObject

```
ZafWindowObject *WindowObject(void) const;
void SetWindowObject(ZafWindowObject *tWindowObject);
```

WindowObject() returns the windowObject flavor of the event's anonymous union, and SetWindowObject() may be used to set it.

ZafFile

BinaryMode	Read	Temporary
Create	ReadData	TextMode
DerivedAccess	ReadOnly	Write
Error	ReadWrite	WriteData
Length	Seek	operator >>
OpenCreate	Tell	operator <<

Inheritance `ZafFile : ZafElement`

Declaration `#include <z_file.hpp>`

Description ZafFile is the base class for all file classes such as ZafDiskFile and ZafStorageFile. ZafFile is an abstract class since it defines pure virtual functions.

Constructor The ZafFile class constructor initializes the members associated with a ZafFile object and its base classes. The default values set by ZafFile are listed below.

Member Initializations

ZafFile	
`Error()`	`ZAF_ERROR_NONE`

`ZafFile``(ZafFileMode mode);`

This constructor is called by subclass constructors, initializes the members associated with a ZafFile object, and chains to the ZafElement constructor. *mode* specifies the mode in which the file is opened, and may be a combination of the following bitwise values:

ZafFileMode	Description
`ZAF_FILE_BINARY`	Causes the file to open in binary mode, meaning that '\n' and '\r' characters are not translated when reading or writing
`ZAF_FILE_CREATE`	Causes the file to be created, even if it already exists

ZafFileMode	Description
`ZAF_FILE_DERIVED_ACCESS`	Causes the file to open in derived access mode, meaning that it is not actually opened or closed by ZAF, but by a derived class
`ZAF_FILE_OPENCREATE`	Causes the file to be opened if it exists, or to be created if it doesn't exist
`ZAF_FILE_READ`	Causes the file to be opened in read-only mode, meaning that the file cannot be written
`ZAF_FILE_READWRITE`	Causes the file to be opened in read-write mode, meaning the file can be read and written
`ZAF_FILE_TEMPORARY`	Causes a temporary file to be opened, meaning that the file is deleted automatically after it is closed
`ZAF_FILE_TEXT`	Causes the file to open in text mode, meaning that '\n' and '\r' characters are translated appropriately for the environment when reading or writing

Destructor

```
virtual ~ZafFile(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafFile object and chains to the ZafElement destructor.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

BinaryMode

```
bool BinaryMode(void) const;
```

If BinaryMode() is true, the file is opened in binary mode, meaning that '\n' and '\r' characters are not translated when reading or writing.

Create

```
bool Create(void) const;
```

If Create() is true, the file is created, even if it already exists.

DerivedAccess

```
bool DerivedAccess(void) const;
```

If DerivedAccess() is true, the file is opened in derived access mode, meaning that it is not actually opened or closed by ZAF, but by a derived class.

Error

```
ZafError Error(void) const;
ZafError SetError(ZafError error);
```

Error() stores the last error that occurred with the file. The default value of Error() is ZAF_ERROR_NONE, but it may be set by the file or file system whenever an error occurs, and SetError() may be called to change it. Note that the programmer is responsible for setting this attribute back to ZAF_ERROR_NONE when appropriate. The types of errors that can be set are defined in the header file z_env.hpp. Generally, however, only the following error values will be used by a file:

Error()	**Description**
ZAF_ERROR_FILE_OPEN	The file specified could not be opened
ZAF_ERROR_FILE_POSITION	The file pointer could not be positioned
ZAF_ERROR_FILE_READ	An error occurred trying to read the file
ZAF_ERROR_FILE_WRITE	An error occurred trying to write the file
ZAF_ERROR_INVALID_ID	A file or directory could not be found with the numeric or string ID specified
ZAF_ERROR_INVALID_NAME	A file or directory could not be found with the name specified
ZAF_ERROR_INVALID_TARGET	The file could not be saved, since it is read-only
ZAF_ERROR_NONE	No error has occurred
ZAF_ERROR_STORAGE_VERSION	The storage file specified is the wrong version, and must be converted

In addition to the error types described above, error values greater than or equal to 10,000 are reserved for use on user-defined files.

Length

```
virtual ZafOffset Length(void) const = 0;
```

Length() abstractly defines returning the length of a derived file object. Length() returns -1 if an error occurs.

OpenCreate

```
bool OpenCreate(void) const;
```

If OpenCreate() is true, the file is opened if it exists, or it is created if it doesn't exist.

Read

```
virtual int Read(ZafInt8 &value);
virtual int Read(ZafUInt8 &value);
virtual int Read(ZafInt16 &value);
virtual int Read(ZafUInt16 &value);
virtual int Read(ZafInt32 &value);
virtual int Read(ZafUInt32 &value);
int Read(int &value);
virtual int Read(double &value);
```

operator >>

```
ZafFile &operator>>(ZafInt8 &value);
ZafFile &operator>>(ZafUInt8 &value);
ZafFile &operator>>(ZafInt16 &value);
ZafFile &operator>>(ZafUInt16 &value);
ZafFile &operator>>(ZafInt32 &value);
ZafFile &operator>>(ZafUInt32 &value);
ZafFile &operator>>(int &value);
ZafFile &operator>>(double &value);
```

These overloaded members and operators simply call ReadData() and pass in *value* and the appropriate size of *value*. The Read() members return what ReadData() returns to them.

```
virtual int Read(ZafIChar *string, int length);
ZafFile &operator>>(ZafIChar *string);
```

This overloaded function and operator read a string out of the file into the *string* buffer. If *length* is -1, the whole string is read into *string*; otherwise, if the string to be read is longer than *length*, it is not read. The number of bytes read is returned. On success, this is the number of bytes in the string plus two for the size of the string. Error() is also set to an appropriate value.

```
virtual int Read(ZafIChar **string);
ZafFile &operator>>(ZafIChar **string);
```

This overloaded function and operator create a buffer large enough for the string to be read plus a null terminator, read the string out of the file into the new buffer, and return a pointer to the buffer in *string*. The number of bytes read is returned. On success, this is the number of bytes in the string plus two for the size of the string. Error() is also set to an appropriate value.

```
virtual int Read(void *buffer, int size, int num);
```

This overloaded function simply calls ReadData(), passing it *buffer* and *size* * *num*. Read() returns whatever ReadData() returns.

ReadData

```
virtual int ReadData(void *buffer, int size) = 0;
```

ReadData() abstractly defines reading data from a derived file object. The data is read into *buffer*, which must have already been allocated by the programmer, and *size* specifies the number of bytes to read. On success, ReadData() returns the number of bytes read into *buffer*; otherwise zero is returned. Error() is also set to an appropriate value.

ReadOnly

```
bool ReadOnly(void) const;
```

If ReadOnly() is true, the file cannot be written.

ReadWrite

```
bool ReadWrite(void) const;
```

If ReadWrite() is true, the file may be read and written.

Seek

```
virtual int Seek(ZafOffset offset, ZafSeek location) = 0;
```

Seek() abstractly defines moving the file pointer of a derived file object. *location* specifies the position in the file from where *offset* specifies. Possible values of *location* and what they mean follow:

ZafSeek	**ZafOffset**
ZAF_SEEK_START	The offset is measured from the beginning of the file toward the end of the file
ZAF_SEEK_CURRENT	A positive offset is measured from the current file pointer, and a negative offset is measured toward the beginning of the file.

ZafSeek	ZafOffset
ZAF_SEEK_END	The offset is measured from the end of the file toward the beginning of the file

Seek() returns 0 if successful, and -1 if an error occurs (in which case Error() is also set appropriately).

Tell

```
virtual ZafOffset Tell(void) const = 0;
```

Tell() abstractly defines returning the current offset of the file pointer in a derived file object. -1 is returned if an error occurs.

Temporary

```
bool Temporary(void) const;
```

If Temporary() is true, the file is temporary, and is deleted automatically after it is closed.

TextMode

```
bool TextMode(void) const;
```

If TextMode() is true, the file is opened in text mode, meaning that '\n' and '\r' characters are translated appropriately for the environment when reading or writing.

Write

```
virtual int Write(ZafInt8 value);
virtual int Write(ZafUInt8 value);
virtual int Write(ZafInt16 value);
virtual int Write(ZafUInt16 value);
virtual int Write(ZafInt32 value);
virtual int Write(ZafUInt32 value);
int Write(int value);
virtual int Write(double value);
```

operator <<

```
ZafFile &operator<<(ZafInt8 value);
ZafFile &operator<<(ZafUInt8 value);
ZafFile &operator<<(ZafInt16 value);
ZafFile &operator<<(ZafUInt16 value);
ZafFile &operator<<(ZafInt32 value);
ZafFile &operator<<(ZafUInt32 value);
ZafFile &operator<<(int value);
ZafFile &operator<<(double value);
```

These overloaded members and operators simply call WriteData() and pass in *value* and the appropriate size of *value*. The Write() members return what WriteData() returns to them.

```
virtual int Write(const ZafIChar *string);
ZafFile &operator<<(const ZafIChar *string);
```

This overloaded function and operator write *string* to the file. The number of bytes written is returned. On success, this is the number of bytes in the string plus two for the size of the string. Error() is also set to an appropriate value.

```
virtual int Write(const void *buffer, int size, int num);
```

This overloaded function simply calls WriteData(), passing it *buffer* and *size* * *num*. Write() returns whatever WriteData() returns.

WriteData

```
virtual int WriteData(const void *buffer, int size) = 0;
```

WriteData() abstractly defines writing data to a derived file object. *buffer* is a pointer to the data to be written, and *size* specifies the number of bytes to write. On success, WriteData() returns the number of bytes written; otherwise zero is returned. Error() is also set to an appropriate value.

ZafFileDialog

Directory	Filter	GetFile
File	FullPath	

Inheritance

```
ZafFileDialog : ZafDialogWindow : ZafWindow :
   ((ZafWindowObject : ZafElement), ZafList)
```

Declaration

```
#include <z_fildlg.hpp>
```

Description

ZafFileDialog provides support for easily presenting a dialog that asks the end user to either choose an existing file or type the name of a new file to be created. ZafFileDialog utilizes the native file services on each environment, if available, so the dialog is familiar to the end user.

Constructors

All ZafFileDialog constructors initialize the member variables associated with an instantiated ZafFileDialog object. The default values set by the ZafFileDialog and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafFileDialog. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafFileDialog	
`Directory()`	`""` (empty string)
`File()`	`""` (empty string)
`Filter()`	`""` (empty string)
ZafWindow	
`Modal()`	`true`†
ZafElement	
`ClassID()`	`ID_ZAF_FILE_DIALOG`
`ClassName()`	`"ZafFileDialog"`

ZafFileDialog`(int left, int top, int width, int height);`

This constructor is useful in straight-code situations, creating a file dialog object without putting it on the screen (see GetFile()). *left*, *top*, *width*, and *height* specify the size and position of the file dialog for environments that support custom size and location for file dialogs; otherwise the file dialog is sized and positioned appropriately by the environment.

Since Destroyable() is false by default, the programmer may create one Zaf-FileDialog and use it many times by calling GetFile() repeatedly for each new filename.

`ZafFileDialog(const ZafFileDialog &copy);`

The copy constructor creates a new ZafFileDialog object and initializes its data from *copy*.

An example of how to create a file dialog follows:

```
// Create a file dialog.
ZafFileDialog fileDialog(5, 5, 60, 14);

// Bring up the file dialog to open an existing file.
ZafEventType result = fileDialog.GetFile(ZAF_FILE_DIALOG_OPEN);

// Get the file name without any path information.
const ZafIChar *filename = fileDialog.File();

// Get the full path name for the file.
ZafIChar fullPath[ZAF_MAXPATHLEN];
fileDialog.FullPath(fullPath, ZAF_MAXPATHLEN);
```

Destructor

`virtual ~ZafFileDialog(void);`

The destructor is used to free the memory associated with a ZafFileDialog object. It chains to the ZafDialogWindow, ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Directory

`const ZafIChar *Directory(void) const;`
`virtual void SetDirectory(const ZafIChar *directory);`

Directory() specifies the full pathname of the parent directory of File() without a terminating path separator. SetDirectory() may be used to change it, but calls to GetFile() will change this attribute according to the file chosen by the end user.

File

```
const ZafIChar *File(void) const;
virtual void SetFile(const ZafIChar *file);
```

File() specifies the filename chosen by the end user. SetFile() may be used to change it, but calls to GetFile() will change this attribute according to the file chosen by the end user.

Filter

```
const ZafIChar *Filter(void) const;
virtual void SetFilter(const ZafIChar *filter);
```

Filter() specifies the non-portable file filter used by some environments when listing files the end user may choose from. For example, the Zinc Designer for Microsoft Windows sets the filter to "*.znc", allowing the user to choose Zinc data files. The end user may also type any preferred file name, but the environment's file dialog only displays the files the filter specifies in the file list. SetFilter() may be used to change this attribute.

FullPath

```
void FullPath(ZafIChar *pathBuffer, int bufferSize);
```

FullPath() specifies the full pathname of the file chosen by the end user. *pathBuffer* must be allocated by the programmer before calling FullPath(), and *bufferSize* is the maximum number of characters that will be written to *pathBuffer*, guarding against writing past the end of the buffer.

GetFile

```
ZafDialogEvent GetFile(ZafFileDialogRequest request);
```

GetFile() causes the file dialog to be presented on the screen, and GetFile() returns after the user has either cancelled the file dialog, or successfully chosen a file. *request* specifies the type of file dialog to present, and may be one of the following:

ZafFileDialogRequest	Description
`ZAF_FILE_DIALOG_NEW`	Allows the end user to browse to the desired directory and type a new or used filename
`ZAF_FILE_DIALOG_OPEN`	Allows the end user to browse to the desired directory and choose an existing file

ZafFileDialogRequest	Description
`ZAF_FILE_DIALOG_SAVEAS`	Allows the end user to browse to the desired directory and type a new or used filename

GetFile() returns one of the following values, indicating the result of the file dialog:

Return value	Description
`S_DLG_CANCEL`	A file was not successfully chosen, so Directory(), File(), and FullPath() are invalid
`S_DLG_OK`	A file was successfully chosen, so Directory(), File(), and FullPath() are valid

ZafFileInfoStruct

attributes	length	ReadOnly
Directory	name	stringID
internalHandle	numberID	

Inheritance `Root struct`

Declaration `#include <z_file.hpp>`

Description

ZafFileInfoStruct is used internally by ZafFileSystem's subclasses' Find*() methods during file searches. The programmer must provide a ZafFileInfo-Struct object to these methods, but FindFirst() initializes the object. See Zaf-FileSystem for more information.

Members

attributes

`ZafFileAttribute **attributes**;`

attributes specifies what type of object was found. The possible values of attribute are as follows:

ZafFileAttribute	Description
ZAF_FATTRIB_NONE	The object is a file, and may be written to
ZAF_FATTRIB_DIRECTORY	The object is a directory
ZAF_FATTRIB_READONLY	The object is read-only, so it may not be written to

Directory

`bool **Directory**(void);`

If Directory() is true, the object found is a directory; otherwise it is a file.

internalHandle

`void ***internalHandle**;`

internalHandle is used internally by subclasses of ZafFileSystem to keep track of the current file search, and should not be accessed by the programmer.

length

`ZafOffset **length**;`

If the object found is a file, length specifies the number of bytes the file contains.

name

`const ZafIChar *`**`name`**`;`

name specifies the name of the file or directory that was found. No path information is included in the name.

numberID

`ZafNumberID `**`numberID`**`;`

numberID specifies the ZafNumberID of the object found, if appropriate. For example, since ZafDiskFileSystem finds objects on disk, they don't have numberIDs. But ZafStorage finds objects in a Zinc data file, which do have numberIDs.

ReadOnly

`bool `**`ReadOnly`**`(void);`

If ReadOnly() is true, the object found is read-only, meaning that it cannot be written to.

stringID

`ZafStringID `**`stringID`**`;`

stringID specifies the ZafStringID of the object found, if appropriate. For example, since ZafDiskFileSystem finds objects on disk, they don't have stringIDs. But ZafStorage finds objects in a Zinc data file, which do have stringIDs.

ZafFileSystem

ChDir	FindFirst	parentDirectoryName
Close	FindNext	Remove
currentDirectoryName	GetCWD	Rename
Error	MkDir	RmDir
FindClose	Open	rootDirectoryName

Inheritance `ZafFileSystem : ZafElement`

Declaration `#include <z_file.hpp>`

Description ZafFileSystem is the base class for all file system classes such as ZafDiskFile-System and ZafStorage. ZafFileSystem is an abstract class since most of its functions are pure virtual.

Constructor The ZafFileSystem class constructor initializes the members associated with a ZafFileSystem object and its base classes. The default values set by ZafFile-System are listed below.

Member Initializations

ZafFileSystem

`Error()`	`ZAF_ERROR_NONE`

`**ZafFileSystem**(void);`

This constructor is called by subclass constructors, initializes the members associated with a ZafFileSystem object, and chains to the ZafElement con-structor.

Destructor `virtual ~**ZafFileSystem**(void);`

This virtual destructor is used to free the memory associated with an instanti-ated ZafFileSystem object and chains to the ZafElement destructor.

Members Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

ChDir

```
virtual int ChDir(const ZafIChar *newPath, ZafStringID
    stringID = ZAF_NULLP(ZafIChar),ZafNumberID numberID =
    0) = 0;
```

ChDir() abstractly defines changing the current directory for a derived file system. *newPath* specifies the path name of the directory to be changed to. *stringID* specifies the string identification constant associated with the directory, if applicable (such as in ZafStorage). *numberID* specifies the numeric identification constant associated with the directory, if applicable (such as in ZafStorage). ChDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Close

```
virtual void Close(ZafFile *file) = 0;
```

Close() abstractly defines closing *file*, which is a file in the file system previously opened with Open().

currentDirectory-Name

```
static ZafIChar *currentDirectoryName;
```

currentDirectoryName is a public static specifying the name of the current directory in a file system, which is ".".

Error

```
ZafError Error(void) const;
ZafError SetError(ZafError error);
```

Error() stores the last error that occurred with the file system. The default value of Error() is ZAF_ERROR_NONE, but it may be set by the file system whenever an error occurs, and SetError() may be called to change it. Note that the programmer is responsible for setting this attribute back to ZAF_ERROR_NONE when appropriate. The types of errors that can be set are defined in the header file z_env.hpp. Generally, however, only the following error values will be used by a file system:

Error()	**Description**
ZAF_ERROR_FILE_OPEN	The file specified could not be opened
ZAF_ERROR_FILE_POSITION	The file pointer could not be positioned
ZAF_ERROR_FILE_READ	An error occurred trying to read the file
ZAF_ERROR_FILE_WRITE	An error occurred trying to write the file

Error()	Description
`ZAF_ERROR_INVALID_ID`	A file or directory could not be found with the numeric or string ID specified
`ZAF_ERROR_INVALID_NAME`	A file or directory could not be found with the name specified
`ZAF_ERROR_INVALID_TARGET`	The file could not be saved, since it is read-only
`ZAF_ERROR_NONE`	No error has occurred
`ZAF_ERROR_STORAGE_VERSION`	The storage file specified is the wrong version, and must be converted

In addition to the error types described above, error values greater than or equal to 10,000 are reserved for use on user-defined file systems.

FindClose

```
virtual int FindClose(ZafFileInfoStruct &fileInfo) = 0;
```

FindClose() abstractly defines finalizing a find operation begun with Find-First(). *fileInfo* is the same ZafFileInfoStruct object used by FindFirst() and FindNext(), and memory allocated in *fileInfo* is deleted by FindClose(). Find-Close() returns 0 if the operation was successful; otherwise it returns -1.

FindFirst

```
virtual int FindFirst(ZafFileInfoStruct &fileInfo, const
   ZafIChar *searchName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0) = 0;
```

FindFirst() abstractly defines initializing a find operation. FindFirst() searches for a file with the search pattern specified by *searchName*, or with the string identification constant (if applicable, such as in ZafStorage) specified by *stringID*, or with the numeric identification constant (if applicable, such as in ZafStorage) specified by *numberID*. *searchName* may contain wildcards appropriate to the file system. For example, in ZafStorage, "?" means any single character, and "*" means any string of characters. *fileInfo* is a ZafFileInfo-Struct object allocated by the programmer, and *fileInfo* is initialized by FindFirst(). FindFirst() returns 0 if a file was found; otherwise it returns -1.

FindNext

```
virtual int FindNext(ZafFileInfoStruct &fileInfo, const
   ZafIChar *searchName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0) = 0;
```

FindNext() abstractly defines continuing a find operation initiated by Find-First(). FindNext() searches for the next file with the same values for *search-Name*, *stringID*, or *numberID* as were specified in the call to FindFirst().

fileInfo is the same ZafFileInfoStruct object passed to FindFirst(). FindNext() returns 0 if a file was found; otherwise it returns -1.

GetCWD

```
virtual int GetCWD(ZafIChar *pathName, int pathLength) =
    0;
```

GetCWD() abstractly defines copying the path name of the current directory for a derived file system (without a terminating path separating character) into the buffer specified by *pathName*. *pathName* must be allocated by the programmer, and *pathLength* specifies the number of ZafIChar characters in *pathName*. GetCWD() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

MkDir

```
virtual int MkDir(const ZafIChar *pathName, ZafStringID
    stringID = ZAF_NULLP(ZafIChar), ZafNumberID numberID =
    0) = 0;
```

MkDir() abstractly defines creating a new directory for a derived file system. *pathName* specifies the path name of the directory to be created. *stringID* specifies the string identification constant associated with the directory, if applicable (such as in ZafStorage). *numberID* specifies the numeric identification constant associated with the directory, if applicable (such as in ZafStorage). MkDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Open

```
virtual ZafFile *Open(const ZafIChar *fileName, const
    ZafFileMode mode, ZafStringID stringID =
    ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0) = 0;
```

Open() abstractly defines opening the file in the file system specified by fileName. *mode* specifies the mode the file is opened with (see the ZafFile constructor for more information). *stringID* specifies the string identification constant associated with the file, if applicable (such as in ZafStorage). *numberID* specifies the numeric identification constant associated with the file, if applicable (such as in ZafStorage). A pointer to the file opened is returned.

parentDirectoryName

```
static ZafIChar *parentDirectoryName;
```

parentDirectoryName is a public static specifying the name of the parent directory in a file system, which is "..".

Remove

```
virtual int Remove(const ZafIChar *name) = 0;
```

Remove() abstractly defines deleting the file in the file system specified by name. Remove() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Rename

```
virtual int Rename(const ZafIChar *oldName, const
    ZafIChar *newName, ZafStringID stringID =
    ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0) = 0;
```

Rename() abstractly defines renaming the file or directory in the file system specified by *oldName* to *newName*. A non-null *stringID* specifies the string identification constant to be copied to the file or directory, if applicable (such as in ZafStorage). A non-zero *numberID* specifies the numeric identification constant to be copied to the file or directory, if applicable (such as in ZafStorage). If *oldName* and *newName* are the same, *stringID* and *numberID* are still copied to the file or directory (if not null and 0, respectively). Rename() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

RmDir

```
virtual int RmDir(const ZafIChar *pathName, bool
    deleteContents = false) = 0;
```

RmDir() abstractly defines deleting a directory for a derived file system. *pathName* specifies the path name of the directory to be deleted. If *deleteContents* is false, RmDir() will only delete the directory if it is empty; otherwise, RmDir() will delete the contents of the directory along with the directory itself. RmDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

rootDirectoryName

```
static ZafIChar *rootDirectoryName;
```

rootDirectoryName is a public static specifying the name of the root directory in a file system, which is "~".

ZafFormatData

FormattedText

Inheritance `ZafFormatData : ZafData : (ZafElement, ZafNotification)`

Declaration `#include <z_fdata.hpp>`

Description ZafFormatData serves as the base class to all formattable ZAF data classes, including ZafBignumData, ZafDateData, ZafIntegerData, ZafStringData, ZafRealData, ZafTimeData, and ZafUTimeData. A common aspect of these derived classes is their use of string manipulation functions, the most apparent being the public FormattedText() member. In addition to this function, however, ZafFormatData also provides protected Sprintf() and Sscanf() members that allow derived objects to format and manipulate string information that can be used for the screen presentation of their data.

ZafFormatData is an abstract class. Its abstract nature is implied by the base ZafData pure virtual functions and by the newly declared pure virtual function called FormattedText(). Thus, derived format classes must resolve the abstractions inherited from the base ZafData and ZafFormatData classes.

Constructors All ZafFormatData constructors initialize the member variables associated with an instantiated ZafFormatData object. The default values set by the ZafFormatData constructor or overridden from those set by base class constructors follow:

Member Initializations

ZafElement	
`ClassID()`	`ID_ZAF_FORMAT_DATA`
`ClassName()`	`"ZafFormatData"`

`ZafFormatData``(void);`

The ZafFormatData class constructor, like the ZafData constructor, is protected. The primary purpose of this constructor is to chain the ZafData portion of the class with its base class constructors. Please refer to the specific data object you are using for complete information about the object's construction.

ZafFormatData(const ZafIChar *name, ZafDataPersistence &persist);

This constructor is used for persistence. The parameters and values of this constructor are deferred to the ZafWindow section of this manual, since most persistence is done at the ZafWindow level.

Destructor

virtual ~**ZafFormatData**(void);

This virtual destructor is used to free the memory associated with an instantiated ZafFormatData object. Since ZafFormatData does not define any new members, its destructor simply chains to the ZafData class destructor.

A ZafFormatData pointer may be deleted even though the class definition is abstract. This is done by allocating a derived data object and then by setting the returned object to a format data pointer. The following code shows the correct use of the ZafFormatData destructor under these conditions:

```
// Create a string data object.
ZafFormatData *string = new ZafStringData("Hello World!");
...
// Free the string.
delete string;
```

The pointer assignment shown above is permitted because ZafFormatData is a base class to ZafStringData. When the string object's destructor is called, the actual contents of the ZafStringData instance are freed because the base class destructor is declared virtual.

For complete information on the type of memory that is freed as a result of a call to the destructor, see the reference chapter on the particular object you created.

Members

FormattedText

virtual int **FormattedText**(ZafIChar *buffer, int maxLength, const ZafIChar *format = 0) const = 0;

This is a pure virtual function that abstractly defines "formatted text retrieval" functionality for a derived object. The following example illustrates what the FormattedText() function returns for several derived data objects:

```
// Show various results of FormattedText().
ZafIChar buffer[256];

ZafDateData date(1, 1, 59);
date->FormattedText(buffer, 256);
printf("date - %s\n", buffer);
```

```
ZafIntegerData integer(100);
integer->FormattedText(buffer, 256, "%d");
printf("integer - %s\n", buffer);

ZafStringData string("hello");
string->FormattedText(buffer, 256);
printf("string - %s\n", buffer);

==========
date - 01/01/1959
integer - 100
string - hello
```

The specific set of formatting capabilities is defined by the derived class. (See the FormattedText() description of each class for additional information.)

Zinc Application Framework uses this function in conjunction with its window objects to get the formatted presentation of a data object that can be presented to the screen. This allows the user interface component to pass and manipulate string information, while allowing the data portion to remain in a compact and precise internal representation.

ZafFormattedString

CompressedData	FormatData	SetFormatText
DeleteData	SetCompressedText	SetExpandedText
ExpandedData	SetDeleteText	

Inheritance `ZafFormattedString : ZafString : ZafWindowObject : ZafElement`

Declaration `#include <z_fmtstr.hpp>`

Description ZafFormattedString is a single-line text object that allows keyboard input using a programmer-defined input format. All strings entered into a ZafFormattedString are validated on a character-by-character basis against a predefined input mask. Additional functionality is inherited from ZafString.

Constructors All ZafFormattedString constructors initialize the member variables associated with an instantiated ZafFormattedString object. The default values set by the ZafFormattedString and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafFormattedString. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafFormattedString	
`CompressedData()`	`null`
`DeleteData()`	`null`
`ExpandedData()`	`null`
`FormatData()`	`null`
ZafString	
`LowerCase()`	`false`†
`OutputFormat()`	`null`†
`Password()`	`false`†
`RangeData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_FORMATTED_STRING`
`ClassName()`	`"ZafFormattedString"`

```
ZafFormattedString(int left, int top, int width, const
   ZafIChar *compressedText, const ZafIChar *format,
   const ZafIChar *deleteText);
```

This constructor is useful in straight-code situations, particularly if the ZafFormattedString object is to create, maintain and destroy its own ZafStringData objects automatically. *left*, *top*, and *width* specify the position and size of the object on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired (see ZafWindowObject::SetCoordinateType). *compressedText* is the unformatted value that initially appears in the new ZafFormattedString object, *format* is the format "mask", and *deleteText* specifies the "null" characters to appear in the ZafFormattedString when no valid character has been entered. See CompressedData(), FormatData(), and DeleteData() for more information on these parameters.

```
ZafFormattedString(int left, int top, int width,
   ZafStringData *compressedText, ZafStringData *format,
   ZafStringData *deleteText);
```

This constructor is useful in straight-code situations where ZafStringData objects have already been created. For more information on using ZafStringData objects, see the chapter on ZafStringData. *left*, *top*, and *width* are the same as the previous constructor.

```
ZafFormattedString(const ZafFormattedString &copy);
```

The copy constructor calls the overloaded Duplicate() to create a new ZafFormattedString object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafFormattedString object simply points to the original data, otherwise copies are made.

```
ZafFormattedString(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafFormattedString creation techniques follow:

```
// Create a sample window with formatted string objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Create a formatted string and pass in the values directly.
```

```
window1->Add(new ZafFormattedString(1, 1, 20, "8017858900",
    "LNNNLLNNNLNNNN", "(...) ...-...."));

// Create string data objects.
ZafStringData *compressData = new ZafStringData("8017858996");
ZafStringData *formatData = new ZafStringData("LNNNLLNNNLNNNN");
ZafStringData *deleteData = new ZafStringData("(...) ...-....");
// Create a formatted string that uses the data
// previously created.
ZafFormattedString *phoneNumber = new ZafFormattedString(1, 2,
    20, compressData, formatData, deleteData));
window1->Add(phoneNumber);

// Get the expanded text of the formatted string object.
// expandedText will be "(801) 785-8900".
ZafIChar *expandedText = phoneNumber->ExpandedData()->Text();
```

Destructor

`virtual ~`**`ZafFormattedString`**`(void);`

The destructor is used to free the memory associated with a ZafFormatted-String object, including all the data object pieces that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafFormattedString object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

CompressedData

`ZafStringData *`**`CompressedData`**`(void) const;`

`virtual ZafError `**`SetCompressedData`**`(ZafStringData *compressedData);`

SetCompressed-Text

`virtual ZafError `**`SetCompressedText`**`(const ZafIChar *compressedText);`

The CompressedData() object stores the actual raw data without the format literals (see FormatData() for more information on format literals). For example, if a formatted phone number were “(801) 785-8900” the CompressedData would probably be “8017858900”.

CompressedData() may be shared among several objects, or it may belong to a single ZafFormattedString object. If shared, all the associated objects will be notified when the CompressedData() changes. SetCompressedData() may be used to associate a CompressedData() object with a ZafFormattedString object. For more information on data sharing in ZAF, see ZafDataManager. SetCompressedData() will delete the previous CompressedData() object if it is Destroyable() and no other object uses it.

SetCompressedText() may be used instead of SetCompressedData(). In this case *compressedText* is placed into the existing CompressedData() member of ZafFormattedString.

The return value for CompressedData() is a pointer to the CompressedData() object associated with the ZafFormattedString object. The return value for SetCompressedData() and SetCompressedText() is normally ZAF_ERROR_NONE.

DeleteData

```
ZafStringData *DeleteData(void) const;
virtual ZafError SetDeleteData(ZafStringData
   *deleteData);
```

SetDeleteText

```
virtual ZafError SetDeleteText(const ZafIChar
   *deleteText);
```

The DeleteData() object stores the data to be placed in character positions for which no CompressedData() character is present. DeleteData() also stores the characters to be used as literal, uneditable characters (specified in the corresponding FormatData() character by 'L'). See the constructor code snippet for an example.

DeleteData() may be shared by multiple objects, or it may belong to a single ZafFormattedString. If shared, all the associated objects will be notified when DeleteData() changes. For more information on data sharing in ZAF, see ZafDataManager. SetDeleteData() will delete the previous DeleteData() object if it is Destroyable() and no other object uses it.

SetDeleteText() may be used instead of SetDeleteData(). In this case, *deleteText* is placed into the existing DeleteData() member of ZafFormattedString.

The return value for DeleteData() is a pointer to the DeleteData() object associated with the ZafFormattedString object. The return value for SetDeleteData() and SetDeleteText() is normally ZAF_ERROR_NONE.

ExpandedData

```
ZafStringData *ExpandedData(void) const;
virtual ZafError SetExpandedData(ZafStringData
   *expandedData);
```

SetExpandedText

```
virtual ZafError SetExpandedText(const ZafIChar
   *expandedText);
```

The ExpandedData() object stores the actual data displayed, including format literals and applicable DeleteData(). (see FormatData() for more information on format literals). The constructor code snippet shows an example.

ExpandedData() piece may be shared by multiple objects, or it may belong to a single ZafFormattedString object. If shared, all the associated objects will be notified when ExpandedData() changes. SetExpandedData() may be used to associate a ExpandedData() object with a ZafFormattedString object. For more information on data sharing in ZAF, see ZafDataManager. SetExpandedData() will delete the previous ExpandedData() object if it is Destroyable() and no other object uses it.

SetExpandedText() may be used instead of SetExpandedData(). In this case, expandedText is placed into the existing ExpandedData() member of ZafFormattedString.

The return value for ExpandedData() is a pointer to the ExpandedData() object associated with the ZafFormattedString object. The return value for SetExpandedData() and SetExpandedText() is normally ZAF_ERROR_NONE.

FormatData

```
ZafStringData *FormatData(void) const;
virtual ZafError SetFormatData(ZafStringData
   *formatData);
```

SetFormatText

```
virtual ZafError SetFormatText(const ZafIChar
   *formatText);
```

FormatData() stores the formatting data including format literals and validation options. This formatData provides the input mask used to format and validate all input.

For example, to allow entry in a US phone number format, FormatData() might be set to

```
"LNNNLLNNNLNNNN aaaa"
```

and DeleteData() set to

```
"(   )    -         ".
```

If the user then typed the characters

```
"123456abc7890x321"
```

The final, formatted text (ExpandedData()) would be

```
"(123) 456-7890 x321".
```

And the final CompressedData() would be

`"1234567890x321".`

Note that the embedded "abc" keystrokes would be seen as invalid due to the FormatData() and therefore discarded.

Valid characters in the FormatData() input mask include the following:

FormatData() option	**Description**
a	Allows a space (' ') or any alphabetic character ('a' through 'z' or 'A' through 'Z')
A	Same as the 'a' option except that a lower-case character is automatically converted to upper-case
c	Allows a space (' '), any numeric digit ('0' through '9'), or any alphabetic character ('a' through 'z' or 'A' through 'Z')
C	Same as the 'c' option except that a lower-case character is automatically converted to upper-case
L	Uses the literal character specified in DeleteData(), and skips this position while the end user types
N	Allows any numeric digit
x	Allows any printable character
X	Same as the 'x' option except that a lower-case character is automatically converted to upper-case

FormatData() may be shared by multiple objects, or it may belong to a single ZafFormattedString. If shared, all the associated objects will be notified when the FormatData() changes. SetFormatData() may be used to associate a FormatData() object with a ZafFormattedString object. For more information on data sharing in ZAF, see ZafDataManager. SetFormatData() will delete the previous FormatData() object if it is Destroyable() and no other object uses it.

SetFormatText() may be used instead of SetFormatData(). In this case *formatText* is placed into the existing FormatData() member of ZafFormattedString.

The return value for FormatData() is a pointer to the FormatData() object associated with the ZafFormattedString object. The return value for SetFormatData() and SetFormatText() is normally ZAF_ERROR_NONE.

ZafGeometryManager

Event

Inheritance `ZafGeometryManager : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_gmgr.hpp>`

Description ZafGeometryManager provides support for non-absolute positioning of child objects. For example, an object may be positioned relative to an edge of another object; or an object may size itself relative to the size of a window, perhaps constrained to a minimum and maximum size.

The programmer may specify combinations of constraints and attachments for any child object by adding ZafAttachment, ZafDimensionConstraint, and ZafRelativeConstraint objects to the ZafGeometryManager for the window. See ZafConstraint, ZafAttachment, ZafDimensionConstraint, and ZafRelative-Constraint for more information.

Constructors All ZafGeometryManager constructors initialize the member variables associated with an instantiated ZafGeometryManager object. The default values set by the ZafGeometryManager and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafGeometryManager. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindowObject

`AcceptDrop()`	`false`†
`AutomaticUpdate()`	`true`†
`BackgroundColor()`	`ZAF_CLR_NULL`†
`Bordered()`	`false`†
`CoordinateType()`	`ZAF_PIXEL`†
`CopyDraggable()`	`false`†
`Disabled()`	`true`†
`Focus()`	`false`†
`Font()`	`ZAF_FNT_NULL`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†

Member Initializations

`Noncurrent()`	`true`†
`OSDraw()`	`false`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`QuickTip()`	`null`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`Selected()`	`false`†
`SupportObject()`	`true`†
`TextColor()`	`ZAF_CLR_NULL`†
`UserFunction()`	`null`†
`UserPalette()`	`null`†
`Visible()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_GEOMETRY_MANAGER`
`ClassName()`	`"ZafGeometryManager"`
`NumberID()`	`ZAF_NUMID_GEOMETRY`
`StringID()`	`"ZAF_NUMID_GEOMETRY"`

`ZafGeometryManager``(void);`

This constructor is useful in straight-code situations, and creates a ZafGeometryManager object to be added to a window.

`ZafGeometryManager``(const ZafGeometryManager &copy);`

The copy constructor creates a new ZafGeometryManager object and initializes its data from *copy*.

```
ZafGeometryManager(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a geometry manager follows:

```
// Create a status bar with geometry-managed children.
ZafStatusBar *stat = new ZafStatusBar(0, 0, 0, 1);
```

```
ZafString *string = new ZafString(0, 0, 15, new
    ZafStringData("String"));
stat->Add(string);
ZafTime *time = new ZafTime(15, 0, 15, new ZafTimeData);
stat->Add(time);

// Time field will remain at the right side of the status bar.
ZafAttachment *attach = new ZafAttachment(time, ZAF_ATCF_RIGHT);
attach->SetOffset(0);

// Create the geometry manager and add the first constraint.
ZafGeometryManager *geo = new ZafGeometryManager;
geo->Add(attach);

// String field will occupy the remaining space.
attach = new ZafAttachment(string, ZAF_ATCF_RIGHT);
attach->SetStretch(true);
attach->SetReference(time);
attach->SetOppositeSide(true);
attach->SetOffset(1);

// Add the second constraint to the geometry manager.
geo->Add(attach);

// Add the geometry manager to the status bar.
stat->Add(geo);
```

Destructor

`virtual ~`**`ZafGeometryManager`**`(void);`

The destructor is used to free the memory associated with a ZafGeometryManager object. It chains to the ZafWindowObject, ZafElement, and ZafList destructors.

Generally, the programmer will not directly destroy a ZafGeometryManager object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Event

`virtual ZafEventType `**`Event`**`(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafGeometryManager object. The following events are handled:

ZafEventType	Description
S_ADD_OBJECT	causes event.windowObject to be added to the geometry manager's constraint list

ZafEventType	Description
`S_COMPUTE_SIZE`	causes the geometry manager to recompute its size and to notify all its constraints that the parent window has changed size by passing the S_COMPUTE_SIZE message to them
`S_INITIALIZE`	causes the geometry manager to initialize itself and to pass the S_INITIALIZE message to all its constraints
`S_SUBTRACT_OBJECT`	causes event.windowObject to be removed from the geometry manager's constraint list

ZafGroup

AutoSelect	HotKeyIndex
HotKeyChar	StringData

Inheritance `ZafGroup : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_group.hpp>`

Description ZafGroup is a container object used to logically group other objects. A ZafGroup may have a title and or a border. ZafGroups are typically used to contain controls such as radio buttons that must act as a set and are therefore more sophisticated than simple line boxes. Once “inside” a ZafGroup, common keystrokes may act somewhat differently than in other contexts. For example, arrow keys may move between controls in a ZafGroup, and the tab key moves away from the group.

Constructors All ZafGroup constructors initialize the member variables associated with an instantiated ZafGroup object. The default values set by the ZafGroup and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafGroup. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafGroup

AutoSelect()	false
HotKeyChar()	'\0'
HotKeyIndex()	-1
StringData()	null

ZafWindow

Destroyable()	false†
Locked()	false†
Maximized()	false†
Minimized()	false†
Modal()	false†
Moveable()	false†
Sizeable()	false†
Temporary()	false†

Member Initializations

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`true`

ZafElement

`ClassID()`	`ID_ZAF_GROUP`
`ClassName()`	`"ZafGroup"`

`**ZafGroup**(int left, int top, int width, int height, const ZafIChar *text);`

This constructor is useful in straight-code situations and allows the ZafGroup object to create, maintain and destroy its own ZafStringData object. *left*, *top*, *width*, and *height* specify the position and size on a parent window. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. See ZafWindowObject::SetCoordinateType() for more information. *text* specifies the string to initially appear in the new Zaf-Group object.

`**ZafGroup**(int left, int top, int width, int height, ZafStringData *stringData);`

This constructor is useful in straight-code situations where a ZafStringData object has already been created. This constructor could be used when manually maintaining a ZafStringData object, rather than having the ZafGroup class create and maintain the data object automatically. (See ZafStringData). See the previous constructor for a description of *left*, *top*, *width* and *height*.

`**ZafGroup**(const ZafGroup &copy);`

The copy constructor calls the overloaded Duplicate() to create a new Zaf-Group object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafGroup object simply points to the original data, otherwise copies are made.

`**ZafGroup**(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code shows how to create a ZafGroup object.

```
// Create a sample window with a group of radio buttons.
ZafWindow *window = new ZafWindow(10, 10, 40, 10);
ZafGroup *group = new ZafGroup(1, 1, 30, 5, "Group");

// Add the radio buttons to the group.
group->SetAutoSelect(true);
group->Add(new ZafButton(1, 0, 25, 1, "Choice 1",
    ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
group->Add(new ZafButton(1, 1, 25, 1, "Choice 2",
    ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
group->Add(new ZafButton(1, 2, 25, 1, "Choice 3",
    ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));
group->Add(new ZafButton(1, 3, 25, 1, "Choice 4",
    ZAF_NULLP(ZafBitmapData), ZAF_RADIO_BUTTON));

// Finally, add the group of radio buttons to the window.
window->Add(group);
```

Destructor

`virtual ~`**`ZafGroup`**`(void);`

The destructor is used to free the memory associated with a ZafGroup object, including all the data object pieces that are Destroyable(). It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafGroup object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoSelect

`bool `**`AutoSelect`**`(void) const;`
`virtual bool `**`SetAutoSelect`**`(bool autoSelect);`

If AutoSelect() is true, the first group item in a ZAF_SINGLE_SELECTION group becomes selected when the group initially appears on screen. AutoSelect() also causes a group item to be selected when it receives focus. The default value of this attribute is false, but SetAutoSelect() may be called to change it.

HotKeyChar
HotKeyIndex

```
ZafIChar HotKeyChar(void) const;
int HotKeyIndex(void) const;
virtual ZafIChar SetHotKey(ZafIChar hotKeyChar, int index
   = -1);
```

When typed with a modifier key (such as <ALT> or <Command>) the *hotKeyChar* causes a group to receive keyboard focus. The hot key *index* is the zero-based index specifying which character to visually distinguish in the group's title.

The hot key character does not cause any display modification, and the hot key index does not cause any action to be performed when that character is typed with the modifier key. The default value of HotKeyChar() is 0, indicating that there is no hot key character associated with the group, and the default value of HotKeyIndex() is -1, indicating that no character is to be visually distinguished as the hot key character.

The following code shows how to create a group with a hot key:

```
// Create a group with a hot key.
ZafGroup *group = new ZafGroup(1, 1, 12, 4, "Group");
group->SetHotKey('G', 0);
```

StringData

```
ZafStringData *StringData(void) const;
virtual ZafError SetStringData(ZafStringData *string);
```

The StringData() object is where the textual data for the title is stored for the ZafGroup object. The StringData() piece may be shared by multiple “users”, or it may belong to a single object. If shared, all the associated objects will be notified when the StringData() changes. SetStringData() may be used to associate a StringData() object with an object. For more information on data sharing in ZAF, see ZafDataManager. SetStringData() will delete the previous StringData() object if it is Destroyable() and no other object uses it.

The return value for StringData() is a pointer to the StringData() object associated with the ZafGroup object. The return value for SetStringData() is normally ZAF_ERROR_NONE.

The function SetText(), inherited from ZafWindowObject, may be used to set the title on the group without the programmer having to create a ZafStringData object.

ZafHelpStub

DisplayHelp

Inheritance

```
Root class
```

Declaration

```
#include <z_help.hpp>
```

Description

ZafHelpStub serves solely as a base class for ZafHelpSystem, so that ZafHelp-System and its base classes are not linked into a program that does not make use of them. ZafHelpStub declares a pure virtual function DisplayHelp() that is defined in ZafHelpSystem. The programmer should normally not derive from this class.

Constructor

```
ZafHelpStub(void);
```

This constructor creates a ZafHelpStub object. Since ZafHelpStub is a virtual class, the programmer will normally not call this constructor.

Destructor

```
virtual ~ZafHelpStub(void);
```

The destructor is used to free the memory associated with a ZafHelpStub object. Since ZafHelpStub is a virtual class, the programmer will not normally call this destructor.

Members

DisplayHelp

```
virtual void DisplayHelp(const ZafIChar *name) = 0;
```

DisplayHelp() is a pure virtual function. ZafHelpSystem overloads this function to provide basic help display functionality

ZafHelpSystem

DisplayHelp	Event	ResetStorage

Inheritance

```
ZafHelpSystem : ZafHelpStub, ZafWindow :
   (ZafWindowObject : ZafElement), ZafList
```

Declaration

```
#include <z_help.hpp>
```

Description

ZafHelpSystem is ZAF's built-in support for context-sensitive help. If a ZafHelpSystem has been instantiated (see the code snippet under the constructors), and the end user types the help key (such as <F1> or <Command-?>), the ZafHelpSystem is presented. If the window object that has keyboard focus has been assigned a help context via ZafWindowObject::HelpContext(), that help context is presented; otherwise, a list of help contexts available is presented.

ZafHelpSystem presents a help context from the user-specified data file in a top-level window with a scrollable text field, and provides a button that when clicked causes an index of all available help contexts to be displayed. When the index of help contexts is presented, the end user may choose any of the help contexts with the keyboard or the mouse and select it to be displayed.

Advanced programmers may derive from ZafHelpSystem to tie into native or third-party engines.

Constructors

All ZafHelpSystem constructors initialize the member variables associated with an instantiated ZafHelpSystem object. The default values set by the ZafHelpSystem and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafWindow	
`Destroyable()`	`false`
ZafElement	
`ClassID()`	`ID_ZAF_HELP_SYSTEM`
`ClassName()`	`"ZafHelpSystem"`

ZafHelpSystem`(ZafFileSystem *helpStorage);`

This constructor creates a ZafHelpSystem object, initializes information used by ZafHelpSystem, and sets the global zafHelpSystem. There should only be one ZafHelpSystem instantiated during the life of an application. *helpStorage* specifies an instantiated data file that contains the help contexts to be used by ZafHelpSystem.

ZafHelpSystem`(const ZafHelpSystem &copy);`

The copy constructor creates a new ZafHelpSystem object and initializes its data from copy.

The following code shows how to create a ZafHelpSystem object.

```
int ZafApplication::Main(void)
{

  . . .

  // Open the data file.
  ZafStorage *storage = new ZafStorage("main.znc",
    ZAF_FILE_READWRITE);
  // Create the help system.
  if (!storage->Error())
    zafHelpSystem = new ZafHelpSystem(storage,
    ZAF_NULLP(ZafIChar));

  . . .

  // Get user input.
  Control();

  // Clean up.
  if (zafHelpSystem)
    delete zafHelpSystem;
  if (storage)
    delete storage;

  // Return success.
  return (0);
}
```

Destructor

```
virtual ~ZafHelpSystem(void);
```

The destructor is used to free the memory associated with a ZafHelpSystem object. It chains to the ZafHelpStub, ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Since the ZafHelpSystem constructor sets Destroyable() to false, the programmer must destroy a ZafHelpSystem object when appropriate to the application. Generally, the ZafHelpSystem should be deleted as the application is shutting down, as seen in the code snippet above.

Members

DisplayHelp

```
virtual void DisplayHelp(const ZafIChar *name);
```

DisplayHelp() causes the help system window to appear. If it is minimized, then it is first restored. If it is already open, it is brought to the front of all the other windows on the window manager. name is the name of the help context that will be displayed in the help system window.

Generally, ZAF calls DisplayHelp() automatically with the appropriate help context name when the end user requests help, but the programmer may call it at any time. The end user may resize, minimize, or close the help system window, and it may be left open in the background if the user selects another window.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events sent to ZafHelpSystem, either by processing the events itself, or by passing them to ZafWindow::Event() for base class processing. Events (actually "requests") handled directly by ZafHelpSystem follow:

Event	Description
S_HLP_CLOSE	causes the help system window to close
S_HLP_SHOW_INDEX	causes the help system window to display the index of all available help contexts
S_HLP_SHOW_TOPIC	causes the help system window to display event.windowObject's help context
S_HLP_SELECT_TOPIC	causes the help system window to display the help context corresponding to the name displayed in the help system window's string field
S_HLP_UPDATE_NAME	causes the help system window to set its string field corresponding to its selected list item

See ZafWindow for more information.

ResetStorage

`virtual void **ResetStorage**(ZafFileSystem *helpStorage);`

ResetStorage() causes the help system to find help contexts in a different storage file. helpStorage specifies the instantiated data file that contains the help contexts to be used by ZafHelpSystem.

ResetStorage() is particularly useful when changing languages for help contexts. The following code snippet shows how to use this function:

```
// Use the spanish help contexts instead of english.
ZafStorage *oldHelpStorage = myHelpStorage;
myHelpStorage = new ZafStorage("help_es.znc",
    ZAF_FILE_READWRITE);

if (!myHelpStorage->Error())
{
  // Reset the help system storage.
  myHelpSystem->ResetStorage(myHelpStorage);
  delete oldHelpStorage;
}
```

ZafHelpTips

Event	InitialDelay	SetUserPalette
HelpObject	NewHelpTipDelay	
HelpTipsType	Poll	

Inheritance `ZafHelpTips : ZafDevice : ZafElement`

Declaration `#include <z_htips.hpp>`

ZafHelpTips is a device class that can display limited help information when a user moves the mouse over a viewable object. The information displayed may consist of a "quick tip," a "help tip," or both.

"Quick tips" are small, temporary windows that contain a short message. ZAF's implementation is similar to Microsoft Windows style "tool tips" except that quick tips may be invoked by almost any user interface object—not just toolbars. Quick tips may include single or multiple lines of text.

To invoke a quick tip the user must move the mouse over an object, then pause briefly. The quick tip is removed if the user moves the mouse outside the region of the object, clicks the mouse, or presses any key. SetQuickTip() must be called by each ZafWindowObject to set the text to be displayed. (See ZafWindowObject for more information.)

"Help tips" are help messages that are displayed in a traditional user interface object instead of a temporary window. For example, a status bar may display a string that changes as the mouse moves over different objects.

To invoke a help tip the user must move the mouse over an object. The help tip is removed when the user moves the mouse outside the object. SetHelpObject-Tip() must be called by each ZafWindowObject to set the text to be displayed. (See ZafWindowObject for more information.) SetHelpObject() must also be called once to initialize ZafHelpTips to point at the object that will display the help tip. SetHelpObject() must be called by the programmer since this pointer is often global to an application.

Note: Quick tips and help tips require that the ZafHelpTips device first be added to the ZafEventManager.

Constructor The ZafHelpTips constructor initializes the member variables associated with a new ZafHelpTips object. The default values set by ZafHelpTips follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafHelpTips	
`HelpObject()`	`null`
`HelpTipsType()`	`ZAF_HELPTIPS_QUICKTIP`
`InitialDelay()`	`50 (milliseconds)`
`NewHelpTipDelay()`	`50 (milliseconds)`
ZafDevice	
`DeviceType()`	`E_HELPTIPS`
ZafElement	
`ClassID()`	`ID_ZAF_HELPTIPS`
`ClassName()`	`"ZafHelpTips"`
`NumberID()`	`ID_ZAF_HELPTIPS`
`StringID()`	`"ZafHelpTips"`

`ZafHelpTips``(ZafDeviceState state = D_OFF, ZafHelpTipsType helpTipsType = ZAF_HELPTIPS_QUICKTIP);`

This constructor is used to instantiate a ZafHelpTips object to be added to a ZafEventManager object. *helpTipsType* specifies the type of help tips to be handled by the ZafHelpTips object. For a discussion on device *state*, see the ZafDevice section of this manual.

To enable help tips in an application the following code could be used:

```
int ZafApplication::Main(void)
{
  ...

  // Enable help tips in my application.
  ZafHelpTips *helpTips = new ZafHelpTips(D_ON,
    ZAF_HELPTIPS_BOTH);
  zafEventManager->Add(helpTips);

...
}
```

Destructor

`virtual ~`**`ZafHelpTips`**`(void);`

The virtual destructor is used to free the memory associated with an instantiated ZafHelpTips object. Normally ZafHelpTips will be destroyed when the ZafEventManager is destroyed during normal application termination.

Members

Event

`virtual ZafEventType` **`Event`**`(const ZafEventStruct &event);`

ZafHelpTips processes several events in addition to those handled by all ZafDevice objects.

Event (Device Request)	Action
`DH_HELP_TIPS_TIMER`	Immediately expires the ZafHelpTips timer causing the device to display event.windowObject-> QuickTip().
`DH_SET_HELP_OBJECT`	Causes ZafHelpTips to reassign its help tips object to event.windowObject. See SetHelpObject().
`DH_UPDATE_HELP_OBJECT`	Causes ZafHelpTips to display event.windowObject->HelpObjectTip() in the current help object.
`N_MOUSE_LEAVE`	Causes ZafHelpTips to remove its quick tip and to update help object with its previous text contents.
`N_MOUSE_ENTER`	Causes ZafHelpTips to activate the timer that must elapse before a quick tip is displayed. The help object is immediately updated with event.windowObject-> HelpObjectTip().

HelpObject

`ZafWindowObject *`**`HelpObject`**`(void) const;`
`virtual void` **`SetHelpObject`**`(ZafWindowObject *helpObject);`

SetHelpObject() sets the pointer to the help object of a ZafHelpTips instance. *helpObject* should point at the text-capable ZafWindowObject that will display future help tips. HelpObject() returns a pointer to the current help object.

Users may find it helpful to have different help objects in different windows. For example, as a user moves from one window to another, the help object may also move to the new window. The following code shows this technique.

```
// Handle the N_CURRENT message inside a derived window's
// Event() function.  Change the help object to point at
// helpBarObject (a string object displayed on the status bar
// of the current window).

case N_CURRENT:
  {
    ZafEventStruct htipEvent(DH_SET_HELP_OBJECT);
    htipEvent.windowObject = helpBarObject;
    eventManager->Event(htipEvent, E_HELPTIPS);
  }
  break;
```

HelpTipsType

```
ZafHelpTipsType HelpTipsType(void) const;
virtual ZafHelpTipsType SetHelpTipsType(ZafHelpTipsType
    helpTipsType);
```

HelpTipsType() returns the type of help tips which are controlled by a ZafHelpTips object. The default value of this attribute is ZAF_HELPTIPS_QUICKTIP but the user may call SetHelpTipsType() to change it. Here are the possible types of help tips:

ZafHelpTipsType	**Description**
ZAF_HELPTIPS_QUICKTIP	Causes ZafHelpTips display only quick tips.
ZAF_HELPTIPS_HELPOBJECT	Causes ZafHelpTips to display only help tips.
ZAF_HELPTIPS_BOTH	Causes ZafHelpTips to manage both quick tips and help tips.

InitialDelay

```
int InitialDelay(void);
static int SetInitialDelay(int initialDelay);
```

SetInitialDelay() sets the initial delay of a ZafHelpTips device. *initialDelay* is specified in milliseconds and indicates the timer interval that must elapse before the quick tip of a user interface object is displayed on the desktop.

NewHelpTipDelay

```
int NewHelpTipDelay(void);
static int SetNewHelpTipDelay(int newHelpTipDelay);
```

SetNewHelpTipDelay() indicates the newHelpTipDelay of a ZafHelpTips device in milliseconds. This interval timer begins after exiting an object for which a quick tip has been displayed, and continues until another object is entered for which a quick tip exists, or until the timer expires. If this timer interval does not expire before the sibling is reached the sibling’s quick tip is immediately displayed instead of waiting the normal InitialDelay() period.

Poll

`virtual void **Poll**(void);`

This virtual function is called by ZafEventManager::Get(). Get() checks the timer of the active ZafHelpTips device. Get() may cause a quick tip to be displayed, removed, or the timer to be reseeded. Users will not typically call this function.

SetUserPalette

`void **SetUserPalette**(ZafPaletteStruct *userPalette);`

SetUserPalette() allows quick tips to be displayed using custom colors or fonts. *userPalette* is a pointer to a valid ZafPaletteStruct that should already contain complete color and font information. If a userPalette is not assigned to the ZafHelpTips device, the quick tip will be displayed in its default colors. (Default colors are platform-specific and are assigned when the ZafHelpTips device is initially constructed.)

ZafHzList

AutoSortData	SelectionType	SetTextColor
CellHeight	SetBackgroundColor	
CellWidth	SetFont	

Inheritance

`ZafHzList : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_hlist.hpp>`

Description

ZafHzList object is a custom list object that arranges items horizontally in as many rows as will fit in the client region. A ZafHzList object may have a horizontal scroll bar associated with it. Like ZafVtList it supports single, multiple and extended selection methods, and list children may not be Noncurrent().

Constructors

All ZafHzList constructors initialize the member variables associated with an instantiated ZafHzList object. The default values set by the ZafHzList and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafHzList. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafHzList

AutoSortData()	false
CellHeight()	user-supplied parameter
CellWidth()	user-supplied parameter

ZafWindow

Destroyable()	false†
Locked()	false†
Maximized()	false†
Minimized()	false†
Modal()	false†
Moveable()	false†
NormalHotKeys()	false†
Sizeable()	false†

ZafWindowObject

Bordered()	true
ZafElement	

Member Initializations

`ClassID()`	`ID_ZAF_HZ_LIST`
`ClassName()`	`"ZafHzList"`

`ZafHzList``(int left, int top, int width, int height, int cellWidth, int cellHeight);`

This constructor is useful in straight-code situations. *left*, *top*, *width* and *height* specify the list's position and size on its parent. *cellWidth* and *cellHeight* specify the fixed width and height of each list item for positioning purposes. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired (see ZafWindowObject::SetCoordinate-Type).

`ZafHzList``(const ZafHzList &copy);`

The copy constructor calls the overloaded Duplicate() to create a new ZafH-zList object and initialize its data from *copy*.

`ZafHzList``(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafHzList creation techniques follow:

```
// Create a sample window with a horizontal list of strings.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);

// Create the horizontal list object.
ZafHzList *hList1 = new ZafHzList(1, 1, 20, 5, 10, 1);

// Add a scroll bar and the strings to the horizontal list.
hList1->Add(new ZafScrollBar(0, 0, 0, 0,
   ZAF_NULLP(ZafScrollData), ZAF_HORIZONTAL_SCROLL));
hList1->Add(new ZafString(0, 0, 20, "String 1", -1));
hList1->Add(new ZafString(0, 0, 20, "String 2", -1));
hList1->Add(new ZafString(0, 0, 20, "String 3", -1));
hList1->Add(new ZafString(0, 0, 20, "String 4", -1));
hList1->Add(new ZafString(0, 0, 20, "String 5", -1));
hList1->Add(new ZafString(0, 0, 20, "String 6", -1));
```

```
// Add the list to the window.
window1->Add(hList1);
...
// Create a sample window with a horizontal list of buttons.
ZafWindow *window2 = new ZafWindow(10, 10, 50, 10);

// Create the horizontal list object and its children.
ZafHzList *hList2 = new ZafHzList(1, 1, 20, 5, 10, 1);

// Allow the list children to draw bitmap information.
hList2->SetOSDraw(false);
extern ZafBitmapData *bitmap1, *bitmap2, *bitmap3, *bitmap4;
hList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap1));
hList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap2));
hList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap3));
hList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap4));

// Add the list to the window.
window2->Add(hList2);
```

Destructor

`virtual ~`**`ZafHzList`**`(void);`

The destructor is used to free the memory associated with a ZafHzList object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafHzList object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. If the Set*() function does not successfully change the state as requested, however, it will instead return the current state.

AutoSortData

`bool `**`AutoSortData`**`(void) const;`
`virtual bool `**`SetAutoSortData`**`(bool autoSortData);`

If AutoSortData() is true, the list will automatically sort its children as they are added to the list. The function returned by CompareFunction() is used to sort the children. By default, sorting is done in alphabetical order, but SetCompareFunction() may be called to provide a custom sorting function. See ZafList::CompareFunction() for more information about sorting list children. The default value of this attribute is false, but the user may call SetAutoSortData() to change it.

SetBackground-Color

```
virtual ZafLogicalColor
   SetBackgroundColor(ZafLogicalColor color,
   ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of list children, the ZafHzList object sets the ParentPalette() attribute on each of its children—therefore all children use the background color of the ZafHzList (see ZafWindowObject::ParentPalette()). This overloaded function allows this color to be changed.

CellHeight

CellWidth

```
int CellHeight(void) const;
int CellWidth(void) const;
virtual int SetCellHeight(int cellHeight);
virtual int SetCellWidth(int cellWidth);
```

CellHeight() and CellWidth() specify the height and width of each item in the list. Each list item is allocated this size for spacing purposes. CellHeight() and CellWidth() are specified by CoordinateType() (see ZafWindowObject). The constructor assumes cell coordinates unless SetCoordinateType is used.

SelectionType

```
ZafSelectionType SelectionType(void) const;
virtual ZafSelectionType
   SetSelectionType(ZafSelectionType selectionType);
```

ZafHzLists may allow different types of selection behavior. SetSelectionType() allows this behavior to be changed from the single-selection default. Valid values are listed.

SelectionType()	Description
`ZAF_SINGLE_SELECTION`	Allows only one item to be selected. If another item is selected any previously selected item is deselected.
`ZAF_MULTIPLE_SELECTION`	Allows multiple items to be selected. "Selection actions," including mouse clicks, cause the selection state of an item to be toggled. The state of other list items is unchanged.

SelectionType()	**Description**
`ZAF_EXTENDED_SELECTION`	Allows multiple items to be selected, and does this using native multiple- and extended-selection techniques. For example, a single click might act as single-select, shift-click might select a range of items, and ctrl-click might act as multiple-select.

SetFont

```
virtual ZafLogicalFont SetFont(ZafLogicalFont font);
```

To provide consistency in the appearance of list children, the ZafHzList object sets the ParentPalette() attribute on each of its children—therefore all children use the font of the ZafHzList (see ZafWindowObject::ParentPalette()). This overloaded function allows the font to be changed.

SetTextColor

```
virtual ZafLogicalColor SetTextColor(ZafLogicalColor
    color, ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of list children, the ZafHzList object sets the ParentPalette() attribute on each of its children—therefore all children use the text color of the ZafHzList (see ZafWindowObject::ParentPalette()). This overloaded function allows the text color to be changed.

ZafI18nData

AddStaticModule	I18nName	SubtractStaticModule
CountryCodeToZafLocale	OSI18nName	ZafLanguageToZafLocale
I18nAllocate	OSLanguageToZafLanguage	ZafLocaleToZafLanguage
I18nFree	ResetI18n	

Inheritance `ZafI18nData : ZafData : ZafNotification, ZafElement`

Declaration `#include <z_idata.hpp>`

Description ZafI18nData is the base class for the three internationalization classes: ZafCodeSetData, ZafLanguageData, and ZafLocaleData. It is not intended to be instantiated directly and has no public constructor. ZafI18nData provides a standard interface used to manipulate the individual internationalization components.

Programmers will typically use only the ResetI18n() member of this class, but a thorough understanding of ZafI18nData is essential to developers intending to manipulate the internationalization capabilities of Zinc Application Framework.

ZafI18nData performs many functions, but three are key:

- Determine the proper language, locale, and codeset (mapping) during application initialization.
- Initialize global ZafCodeSetData, ZafLocaleData, and ZafLanguageData members.
- Maintain global internationalization information used by other objects.

By the time ZafApplication::Main() has started, the internationalization components have already been initialized once. The algorithm used to initialize the internationalization components is as follows:

Get the internationalization identification using the following heirarchy: the value passed into ResetI18n(), the ZAF_LANG environment variable, information obtained from the operating system, and finally the values compiled into the application. A complete internationalization specification takes the form “en_US.437” and indicates the language (en=English), country (US=United States), and codeset (437=map local codepage 437 to/from ISO or Unicode).

Next, each of the individual internationalization components is initialized. ZafDataManager is queried to determine if the component is already available, or the component is loaded from persistence. If these fail the default values compiled into the application are used.

Constructors

ZafI18nData constructors are all protected. See the constructors for ZafCodeSetData, ZafLanguageData, and ZafLocaleData.

ZafI18nData is initially constructed inside ZAF prior to ZafApplication::Main. Programmers can reset this initialization using ResetI18n() as shown below.

```
int ZafApplication::Main()
{
  LinkMain();

  ZafStorage *storage = new ZafStorage("i18n.dat",
    ZAF_FILE_READ);
  if (!storage->Error())
  {
    zafDataPersistence = new ZafDataPersistence(storage);
    // Reinitialize for current language, locale, and codeset.
    ZafI18nData::ResetI18n();
  }

  zafWindowManager->Add(new HellowWindow());

  Control();

  delete storage;
  delete zafDataPersistence;
}
```

Destructor

virtual ~**ZafI18nData**(void);

The destructor is used to free the memory associated with the ZafI18nData object. This destructor chains to the ZafData, ZafNotification, and ZafElement destructors.

Members

AddStaticModule

static bool **AddStaticModule**(ZafFreeModule freeModule,
    ZafAllocateModule allocateModule =
    ZAF_NULLF(ZafAllocateModule), ZafClassID category =
    ID_DEFAULT);

SubtractStatic-Module

static bool **SubtractStaticModule**(ZafFreeModule
    freeModule, ZafAllocateModule allocateModule =
    ZAF_NULLF(ZafAllocateModule));

AddStaticModule() is a mechanism for freeing and allocating static data at program runtime. It is used internally by ZAF, and is not intended to be used by the programmer. *freeModule* is a pointer to a function that is to be called during program termination or when internationalization is reset. *allocateModule* is a pointer to a function that is to be called to allocate static data. *category* specifies the class identifier associated with the static data.

SubtractStaticModule() removes support for *freeModule* and *allocateModule* after they have been passed to AddStaticModule(). The definition of ZafAllocateModule and ZafFreeModule are shown below:

```
typedef void (*ZafAllocateModule)(void);
typedef void (*ZafFreeModule)(bool);
```

CountryCodeToZafLocale

```
static const ZafIChar *CountryCodeToZafLocale(int
   countryCode);
```

This function maps *countryCode* to a string description of the locale. The country code passed in depends on the operating system that the software is running on. This function is used by OSI18nName().

OSLanguageToZafLanguage

```
static const ZafIChar *OSLanguageToZafLanguage(const
   ZafIChar *osLanguage);
```

On systems that need it, this function maps *osLanguage* to a string describing the language being used. *osLanguage* is a system dependent string. This function is used by OSI18nName().

ZafLocaleToZafLanguage

```
static const ZafIChar *ZafLocaleToZafLanguage(const
   ZafIChar *zafLocale);
```

This function maps *zafLocale* to the appropriate language string. *zafLocale* is a string describing the location the program is running in (e.g. Spain or Germany). Two character ISO country codes are valid input for *zafLocale*.

ZafLanguageToZafLocale

```
static const ZafIChar *ZafLanguageToZafLocale(const
   ZafIChar *zafLanguage);
```

This function maps *zafLanguage* to the appropriate locale string. *zafLanguage* is a string describing the language of the operating system (e.g. Spanish or German). Two character ISO language codes are valid input for *zafLanguage*.

OSI18nName

```
static const ZafIChar *OSI18nName(void);
```

This function determines the internationalization name for the current system. The name will take the form language[_locale[.codeset]]. For instance the string "es_ES.850" means that the language is Spanish, the locale is Spain, and the codeset is 850.

I18nName

```
static const ZafIChar *I18nName(void);
static ZafError SetI18nName(const ZafIChar *i18nName);
```

I18nName() allows the user to query the program about which internationalization settings it is running with. SetI18nName allows the user to set the internationalization components of the program using *i18nName*. *i18nName* should be of the form language[_locale[.codeset]]. These functions use the ISO string form to denote the internationalization settings. For more information on the form of the string used see OSI18nName().

```
static ZafError SetI18nName(const ZafIChar *languageName,
   const ZafIChar *localeName, const ZafIChar
   *codeSetName);
```

SetI18nName() initializes the internationalization components. *codeSetName* should be a string describing the codeset that is required. The string pointers are passed to the corresponding initialization routine for each component. If the pointer is NULL the component will initialize with the compiled-in defaults.

I18nAllocate

```
static void I18nAllocate(const ZafIChar *i18nName =
   ZAF_NULLP(ZafIChar));
```

This function allocates the internationalization components. If *i18nName* is NULL then the function queries the system to determine the internationalization name. If a string is passed in, it must be of the form language[_locale[.codeset]]. See the OSI18nName() section for more information.

I18nFree

```
static void I18nFree(bool globalRequest = false);
```

This function frees the global internationalization components, if globalRequest is true.

ResetI18n

```
static const ZafIChar *ResetI18n(const ZafIChar *newName
   = ZAF_NULLP(ZafIChar));
```

This function checks if the *newName* is different than the current internationalization settings. If the settings are different it frees and reallocate the internationalization components using *newName*. If *newName* is NULL then the function queries the system to determine the internationalization name to use. If a string is passed in it should be of the form language[_locale[.codeset]]. See the OSI18nName() section of this chapter for more information. An example of a typical use for ResetI18n() is shown below.

```
int ZafApplication::Main()
{
  LinkMain();

  ZafStorage *storage = new ZafStorage("i18n.dat",
    ZAF_FILE_READ);
  if (!storage->Error())
  {
    zafDataPersistence = new ZafDataPersistence(storage);

    // Reinitialize for current language, locale, and codeset.
    ZafI18nData::ResetI18n();
  }

  zafWindowManager->Add(new HellowWindow());

  Control();

  delete storage;
  delete zafDataPersistence;
}
```

ZafIcon

IconData IconType SetIconImage

Inheritance ZafIcon : ZafButton : ZafWindowObject : ZafElement

Declaration `#include <z_icon1.hpp>`

Description ZafIcon displays a native icon (miniature bitmap). ZafIcon is used to display icons representing minimized windows, if supported by the environment. Where the environment provides a system default icon image, ZafIcon will use it. Most ZafIcon functionality is inherited from its base class, ZafButton.

Constructors All ZafIcon constructors initialize the member variables associated with an instantiated ZafIcon object. The default values set by the ZafIcon and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafIcon. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafIcon

IconData()	null
IconType()	ZAF_NATIVE_ICON

ZafButton

AllowDefault()	false†
AllowToggling()	false†
AutoRepeatSelection()	false†
BitmapData()	null†
ButtonType()	ZAF_FLAT_BUTTON†
Depth()	0 (2 in Motif)†
HotKeyChar()	0†
HotKeyIndex()	-1†
SelectOnDoubleClick()	true

ZafWindowObject

Bordered()	true (only in Motif)
RegionType()	ZAF_INSIDE_REGION†
SupportObject()	true (only if ZAF_MINIMIZE_ICON)

ZafElement

ClassID()	ID_ZAF_ICON

Member Initializations

`ClassName()`	`"ZafIcon"`
`NumberID()`	`ZAF_NUMID_MIN_ICON (if ZAF_MINIMIZE_ICON)`
`StringID()`	`"ZAF_NUMID_MIN_ICON" (if ZAF_MINIMIZE_ICON)`

```
ZafIcon(int left, int top, const ZafIChar *text,
   ZafIconData *iconData = ZAF_NULLP(ZafIconData),
   ZafIconType iconType = ZAF_NATIVE_ICON);
```

This constructor is useful in straight-code situations, particularly if you wish the ZafIcon object to create, maintain and destroy its own ZafStringData object automatically. *left* and *top* specify the position where the left and top of the icon will be placed on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *text* specifies the string to be displayed under the icon image.

iconData specifies the icon to be displayed on the ZafIcon object. *iconType* specifies the type of icon to be created. (See IconType() for more information.)

```
ZafIcon(int left, int top, ZafStringData *title,
   ZafIconData *iconData = ZAF_NULLP(ZafIconData),
   ZafIconType iconType = ZAF_NATIVE_ICON);
```

This constructor is also useful in straight-code situations, particularly if you have already created a ZafStringData object to be associated with the icon. (See ZafStringData for more information.) *title* specifies the string data object to be associated with the icon. Either *title* or *iconData* may be null, to provide an image-only or a string-only icon. Otherwise, this constructor is the same as the first.

ZafIconData may be shared by many ZafIcons to conserve system resources or ensure consistency. See ZafDataManager for information on sharing data objects.

```
ZafIcon(const ZafIcon &copy);
```

The copy constructor calls the overloaded Duplicate() to create a new ZafIcon object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafIcon object simply points to the original data, otherwise copies are made.

```
ZafIcon(const ZafIChar *name, ZafObjectPersistence
    &persist);
```

The final constructor is used for persistence. The parameters and values of this constructor are deferred to the ZafWindow section of this manual, since most persistence is done at the ZafWindow level.

Here are some code snippets that show various ZafIcon object creation techniques.

```
// Create a sample window with some icon objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);

// Add the icons to the window.
extern ZafIconData *iconData;
window1->Add(new ZafIcon(1, 4, ZAF_NULLP(ZafStringData),
    iconData));
// Add a hand icon.
ZafIcon *handIcon = new ZafIcon(20, 4, "Stop",
    ZAF_NULLP(ZafIconData)));
handIcon->SetIconImage(ZAF_HAND_ICON);
window1->Add(handIcon);
...
// Create a sample window with a minimize icon.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
extern ZafIconData *windowIconData;
window2->Add(new ZafIcon(1, 4, ZAF_NULLP(ZafStringData),
    windowIconData, ZAF_MINIMIZE_ICON));
```

Destructor

```
virtual ~ZafIcon(void);
```

The destructor is used to free the memory associated with a ZafIcon object, including all the data object pieces that are Destroyable(). It chains to the ZafButton, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafIcon object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

IconData

```
ZafIconData *IconData(void) const;
virtual ZafError SetIconData(ZafIconData *iconData);
```

The IconData() object is where the actual image data is stored. The IconData() may be shared among several ZafIcon objects (perhaps to save memory by allowing many icon objects to use the same image data), or it may belong to a single ZafIcon object. If shared among several ZafIcon objects, all the associated ZafIcon objects will be updated when the IconData() changes. SetIconData() may be used to associate an IconData() object with a ZafIcon object. For more information on data sharing in ZAF, see ZafDataManager. SetIconData() will delete the previous IconData() object if it is Destroyable() and no other object uses it.

The return value for IconData() is a pointer to the IconData() object associated with the ZafIcon object. The return value for SetIconData() is normally ZAF_ERROR_NONE.

IconType

```
ZafIconType IconType(void) const;
virtual ZafIconType SetIconType(ZafIconType iconType);
```

IconType() specifies a ZafIcon object type. The type is used to control platform-specific and context-specific display behavior. The default value of this attribute is ZAF_NATIVE_ICON, but the user may call SetIconType() to change it. Possible icon types include:

IconType()	**Description**
ZAF_NATIVE_ICON	Creates a native icon object (may look different from environment to environment)
ZAF_MINIMIZE_ICON	Creates a minimize icon object for a window

SetIconImage

```
virtual ZafIconData *SetIconImage(ZafIconImage
    iconImage);
```

ZAF provides several icon images for use with applications, and where available, ZafIcon may use a system default icon image. The programmer may call SetIconImage() to utilize a default image provided by ZAF or the system. Supplied icon images include:

ZafIconImage	**Description**
ZAF_APPLICATION_ICON	Default application icon
ZAF_ASTERISK_ICON	Asterisk icon, commonly used for note messages

ZafIconImage	Description
`ZAF_EXCLAMATION_ICON`	Exclamation icon, commonly used for warning messages
`ZAF_HAND_ICON`	Hand or stop icon, commonly used for error messages
`ZAF_QUESTION_ICON`	Question icon, commonly used for help messages

ZafIconData

Array	Height	operator =
Clear	Width	

Inheritance

```
ZafIconData : (ZafImageData : ZafData :
   (ZafNotification, ZafElement)), ZafIconStruct
```

Declaration

```
#include <z_icon.hpp>
```

Description ZafIconData objects can be used to store and manipulate icon information. ZafIconData is generally used in conjunction with the ZafIcon class.

Constructors All ZafIconData constructors initialize the member variables associated with an instantiated ZafIconData object. The default values set by the ZafIconData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafIconData	
`Array()`	`null`
ZafElement	
`ClassID()`	`ID_ZAF_ICON_DATA`
`ClassName()`	`"ZafIconData"`

```
ZafIconData(const ZafImageStruct &data);
ZafIconData(const ZafIconStruct &data);
```

These constructors allocate a ZafIconData instance and initialize its data to the values in *data*.

```
ZafIconData(const ZafIconData &copy);
```

The copy constructor creates a new ZafIconData object and initializes its data from *copy*.

```
ZafIconData(const ZafIChar *name, ZafDataPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code snippet shows how to create a ZafIconData object:

```
// Create an icon array.
#define blk ZAF_CLR_BLACK
#define wte ZAF_CLR_WHITE
static ZafLogicalColor ZAF_FARDATA plusIconArray[81] =
{
   blk,blk,blk,blk,blk,blk,blk,blk,blk,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,blk,blk,blk,blk,blk,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,
   blk,blk,blk,blk,blk,blk,blk,blk,blk
};
static ZafIconStruct plusIcon(9, 9, plusIconArray, true);

// Create ZafIconData objects based on the icon array.
ZafIconData icon1(plusIcon);
ZafIconData icon2(icon1);
```

Destructor

`virtual ~`**`ZafIconData`**`(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafIconData object.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Array

`ZafLogicalColor *`**`Array`**`(void) const;`

Array() returns the portable logical color array that the icon data is based on. This array is converted to a native environment icon handle. Each element of the array is a ZAF logical color. See ZafDisplay for more information.

Clear

```
virtual void Clear(void);
```

Clear() destroys the portable Array() if StaticArray() is false, and it destroys the environment handle if StaticHandle() is false. Regardless of StaticArray() and StaticHandle(), the portable Array() and the environment handle are both set to null, effectively clearing the icon data.

Height

```
int Height(void) const;
```

Height() returns the height of the icon data.

SetIcon

```
virtual ZafError SetIcon(int width, int height,
   ZafLogicalColor *array);
virtual ZafError SetIcon(const ZafIconStruct &icon);
```

These functions copy the data passed in to the ZafIconData object. *width* and *height* are the width and height of *array*, respectively. If StaticArray() is true, *array* becomes Array(); otherwise, a new array is created for Array(). In the second function, the data is copied from *icon*. These functions always return ZAF_ERROR_NONE.

Width

```
int Width(void) const;
```

Width() returns the width of the icon data.

operator =

```
ZafIconData &operator=(const ZafIconData &icon);
```

This operator copies the data from *icon* into this ZafIconData object.

ZafIconStruct

StaticHandle

Inheritance `ZafIconStruct : ZafImageStruct`

Declaration `#include <z_dsp.hpp>`

Description ZafIconStruct is used to store icon information. The base ZafImageStruct stores the portable image array using elements of ZafLogicalColors, and ZafIconStruct defines additional members that store environment-specific structures for the icon filled by the ZafDisplay conversion function ZafDisplay::ConvertToOSIcon().

Constructors All ZafIconStruct constructors initialize the member variables associated with an instantiated ZafIconStruct object. The default values set by the ZafIconStruct constructors follow.

Member Initializations

ZafIconStruct

`StaticHandle()`	`false`

ZafImageStruct

`array`	`null`
`height`	`0`
`StaticArray()`	`false`
`width`	`0`

`ZafIconStruct``(void);`

This constructor allocates a ZafIconStruct instance and initializes its data to indicate that no icon information has been set.

`ZafIconStruct``(const ZafImageStruct &data);`

This constructor allocates a ZafIconStruct instance and initializes its data to the values in *data*. The environment-specific icon information is initialized to indicate that the icon has not yet been converted.

ZafIconStruct(int width, int height, ZafLogicalColor
    *array, bool staticArray);

This constructor allocates a ZafIconStruct instance and initializes its data to the values passed in. *width* and *height* indicate the size of the image, *array* specifies a pointer to the portable array of ZafLogicalColors, and *staticArray* indicates if array is declared static.

The following code snippet shows how to create a ZafIconStruct object:

```
// Create an icon structure.
#define blk ZAF_CLR_BLACK
#define wte ZAF_CLR_WHITE
static ZafLogicalColor ZAF_FARDATA plusIconArray[81] =
{
   blk,blk,blk,blk,blk,blk,blk,blk,blk,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,blk,blk,blk,blk,blk,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,wte,wte,blk,wte,wte,wte,blk,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,
   blk,blk,blk,blk,blk,blk,blk,blk,blk
};
static ZafIconStruct plusIcon(9, 9, plusIconArray, true);
```

Members

StaticHandle

bool **StaticHandle**(void) const;
bool **SetStaticHandle**(bool staticHandle);

If StaticHandle() is true, the environment-specific information (generally known as a handle) of the ZafIconStruct is recognized as static, so that it will not be deleted by ZAF, and may be used by several ZafIconStruct objects. This attribute is initialized to false, but it may be changed with SetStaticHandle(). Both functions return the current value of the StaticHandle() attribute.

ZafImage

AutoSize	PathName	Tiled
PathID	Scaled	Wallpaper

Inheritance `ZafImage : ZafWindowObject : ZafElement`

Declaration `#include <z_image.hpp>`

Description The ZafImage object supports the display of native image types such as bitmaps and pictures. In Microsoft Windows and OS/2, bitmaps are supported. In Motif, both xbm and xpm bitmaps are supported. In DOS, PCX images are supported. On the Macintosh, PICT resources are supported.

In Motif, a third-party image library is utilized that must be built to support xbm and xpm bitmaps in ZafImage. Information about this process is found in the file readme.mtf in the readme subdirectory.

Constructors All ZafImage constructors initialize the member variables associated with an instantiated ZafImage object. The default values set by the ZafImage and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafImage. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafImage

`AutoSize()`	`false`
`PathID()`	`user-supplied parameter`
`PathName()`	`user-supplied parameter`
`Scaled()`	`false`
`Tiled()`	`false`
`Wallpaper()`	`false`

ZafWindowObject

`AcceptDrop()`	`false`†
`CopyDraggable()`	`false`†
`Focus()`	`false`†
`Font()`	`ZAF_FNT_NULL`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†

Member Initializations

`Noncurrent()`	`true`†
`OSDraw()`	`false`
`TextColor()`	`ZAF_CLR_NULL`†
ZafElement	
`ClassID()`	`ID_ZAF_IMAGE`
`ClassName()`	`“ZafImage”`

```
ZafImage(int left, int top, int width, int height, const
   ZafIChar *pathName, int pathID = -1);
```

This constructor is useful in straight-code situations. The *left* and *top* parameters specify the position where the left and top of the object will be placed on its parent. The *width* and *height* parameters specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. The *pathName* parameter may be either (1) the path and filename specifying the file on disk that contains the image, or (2) the resource name of the image in the application file or an open system file. The *pathID* parameter is the resource ID number of the image in the application file or an open system file. Usually, either *pathName* or *pathID* will be used, but not both. If *pathName* is null, it is ignored. If pathID is -1, it is ignored.

```
ZafImage(const ZafImage &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafImage object and copies the object’s information.

```
ZafImage(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, as most persistence is done at the ZafWindow level.

Sample ZafImage creation techniques follow:

```
// Create a sample window with an image.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Load the image found in the file MYIMAGE.
window1->Add(new ZafImage(0, 1, 10, 6, "MYIMAGE"));
```

```
...
// Create a sample window with an image.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
// Load the image found in the application file with resource ID
    3000.
const int myImageID = 3000;
window1->Add(new ZafImage(0, 1, 10, 6, ZAF_NULLP(ZafIChar),
    myImageID));
```

Destructor

`virtual ~`**`ZafImage`**`(void);`

This destructor is used to free the memory associated with a ZafImage object. It chains to the ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafImage object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. If the Set*() function does not successfully change the state as requested, however, it will instead return the current state.

AutoSize

`bool `**`AutoSize`**`(void) const;`
`virtual bool `**`SetAutoSize`**`(bool autoSize);`

If AutoSize() is true, the image will automatically adjust the size of its background area to match the size of its displayed image. This is particularly useful if the image has a border, and the border is to exactly surround the image. Note that the original region (passed into the constructor or read from the persistent object file) is preserved internally by ZAF and used if region computations are required by later programmer interaction with the image.

If AutoSize() is false, the image will display with its original region. The default value of this attribute is false, but the user may call SetAutoSize() to change it.

PathID

`int `**`PathID`**`(void);`
`virtual ZafError `**`SetPathID`**`(int pathID);`

The PathID() is the resource ID number of the native image in the application file or an open system file. Finding a resource by ID number is generally faster than finding a resource by name, if the resource is in the application file or an open system file. If PathID() is -1, it is ignored. The default value of this attribute is -1, but the user may call SetPathID() to change it.

PathName

```
const ZafIChar *PathName(void);
virtual ZafError SetPathName(const ZafIChar *pathName);
```

The PathName() may be either the resource name of the native image in the application file or an open system file, or a path and filename of the file containing the resource. Finding a resource by ID number is generally faster than finding a resource by name, if the resource is in the application file or an open system file. If PathName() is null it is ignored. The user may pass this attribute's initial value into the constructor, and the user may call SetPathID() to change it.

Scaled

```
bool Scaled(void) const;
virtual bool SetScaled(bool scaled);
```

If Scaled() is true, the image will automatically adjust its size (either stretching or shrinking) to exactly match the size of its containing region. Scaled() and Tiled() should never be true at the same time, as the resulting behavior is undefined.

If Scaled() is false, the image will display with its original size. The default value of this attribute is false, but the user may call SetScaled() to change it.

Tiled

```
bool Tiled(void) const;
virtual bool SetTiled(bool tiled);
```

If Tiled() is true, the image will display enough copies of itself within its containing region so as to completely fill the region. Some copies of itself on the right and bottom of the containing region may be clipped to the region. Scaled() and Tiled() should never be true at the same time, as the resulting behavior is undefined.

If Tiled() is false, the image will display just one copy of itself. The default value of this attribute is false, but the user may call SetTiled() to change it.

Wallpaper

```
bool Wallpaper(void) const;
virtual bool SetWallpaper(bool wallpaper);
```

If Wallpaper() is true, the image will automatically become a SupportObject(), adjust its background to occupy its parent's entire client region, and display behind all other objects in its parent's client region. If a Wallpaper() image is neither Scaled() nor Tiled(), the image will be centered within its parent's client region.

If Wallpaper() is false, the image will display as a normal child object. The default value of this attribute is false, but the user may call SetWallpaper() to change it.

ZafImageData

Inheritance `ZafImageData : ZafData : ZafNotification, ZafElement`

Declaration `#include <z_idata1.hpp>`

Description ZafImageData serves as the base class to all image types including: ZafBitmapData, ZafIconData, and ZafMouseData. The common aspect of these derived classes is their derivation and use of the structure ZafImageStruct, defined in z_dsp.hpp. ZafImageData provides protected members that allow derived objects to clear and manipulate the image information associated with their class.

ZafImageData is actually an abstract class! It's abstract nature is not readily apparent, but rather is implied by inheritance, since it does not provide an overload for the pure virtual base ZafData::Clear() function. Thus, derived image classes must resolve the Clear() abstraction inherited from the base ZafData class.

Constructor All ZafImageData constructors initialize the member variables associated with an instantiated ZafImageData object. Default values initialized by ZafImageData or overridden from base class constructors follow:

Member Initializations

ZafElement	
`ClassID()`	`ID_ZAF_IMAGE_DATA`
`ClassName()`	`"ZafImageData"`

```
ZafImageData(void);
```

The ZafImageData class constructor, like the ZafData constructor, is protected. The primary purpose of this constructor is to chain the ZafImageData portion of the class with its base class constructors. Please refer to the specific data object you are using, for complete information about the object's construction.

```
ZafImageData(const ZafIChar *name, ZafDataPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Destructor

virtual ~**ZafImageData**(void);

This virtual destructor is used to free the memory associated with an instantiated ZafImageData object. Since ZafImageData does not define any new members, its destructor simply chains to the ZafData class destructor.

You can destroy a ZafImageData pointer even though the class definition is abstract. This is done by allocating a derived image object and then by setting the returned object to an image data pointer. The following code shows the correct use of the ZafImageData destructor under these conditions:

```
// Get a persistent bitmap button.
ZafImageData *image = new ZafBitmapData("help_button",
    zafDefaultStorage);
...
// Free the image.
delete image;
```

The pointer assignment, shown above, is permitted because ZafImageData is a base class to ZafBitmapData. When the bitmap object’s destructor is called, the actual contents of the ZafBitmapData instance are freed because the base class destructor is declared virtual.

ZafImageStruct

array	width
StaticArray	height

Inheritance `Root struct`

Declaration `#include <z_dsp.hpp>`

Description

ZafImageStruct is used to store portable images as an array of ZafLogicalColors. ZafImageStruct is used a base struct for other image structs in ZAF that have equivalent environment structures, such as ZafIconStruct and ZafMouseStruct.

Members

array

```
ZafLogicalColor *array;
```

array is a pointer to the array of ZafLogicalColors associated with the ZafImageStruct object. Since there is no constructor for this struct, this attribute is not initialized at this level, so the programmer must initialize it if explicitly creating a ZafImageStruct object.

StaticArray

```
bool StaticArray(void) const;
bool SetStaticArray(bool staticArray);
```

If StaticArray() is true, array is recognized as static, so that it will not be deleted by ZAF, and may be used by several ZafImageStruct objects. Since there is no constructor for this struct, this attribute is not initialized at this level, so the programmer must initialize it if explicitly creating a ZafImageStruct object. The attribute may be initialized or changed with SetStaticArray(). Both functions return the current value of the StaticArray() attribute.

width
height

```
int width, height;
```

width and height specify the size of array.

ZafInteger

Event	IntegerData

Inheritance ZafInteger : ZafString : ZafWindowObject : ZafElement

Declaration `#include <z_int1.hpp>`

Description The ZafInteger object is a single-line integer object that allows user input through the keyboard. ZafInteger inherits base class functionality from ZafString, allowing support for operations such as copy/cut/paste.

Formats ZafString and derived classes parse input and display output based on default or programmer-defined input and output formats. Programmers may use the SetInputFormat() and SetOutputFormat() families of functions to change the default format. These functions are documented in the ZafString reference.

Each class derived from ZafFormatData handles a different set of formatting arguments, in addition to those supported by its base classes. ZafIntegerData (and therefore ZafInteger) handles the following arguments:

Format Argument	Substitution
%d, %D	Decimal integer
%o, %O	Octal integer
%x	Hexadecimal integer using lower-case
%X	Hexadecimal integer using upper-case
%i	Decimal, hexadecimal, or octal integer
%u	Unsigned decimal integer

Constructors All ZafInteger constructors initialize the member variables associated with an instantiated ZafInteger object. The default values set by the ZafInteger and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafInteger. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafInteger	
`IntegerData()`	`null`
`ZafString`	
`LowerCase()`	`false`†
`Password()`	`false`†

Member Initializations

`StringData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†

ZafElement

`ClassID()`	`ID_ZAF_INTEGER`
`ClassName()`	`“ZafInteger”`

`ZafInteger``(int left, int top, int width, long value);`

This constructor is useful in straight-code situations, particularly if the ZafInteger object is to create, maintain and destroy its own ZafIntegerData object automatically. *left* and *top* specify the position where the left and top of the object will be placed on its parent, while *width* specifies the width of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *value* is the value that initially appears in the new ZafInteger object.

```
ZafInteger(int left, int top, int width, ZafIntegerData
   *integerData = ZAF_NULLP(ZafIntegerData));
```

This constructor is useful in straight-code situations where a ZafIntegerData object has already been created. This constructor could be used to maintain data pieces manually, rather than having the ZafInteger class create and maintain the data pieces automatically. For example, to maintain a database of ZafIntegerData objects and tie them into ZafInteger objects, maintain some ZafIntegerData objects and create ZafInteger objects using the ZafIntegerData objects by passing them into *integerData*. For more information on using ZafIntegerData objects, see the chapter on ZafIntegerData. *left*, *top*, and *width* are the same as the previous constructor.

`ZafInteger``(const ZafInteger &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafInteger object and copies the object’s information. If the data objects are StaticData(), then the new ZafInteger object simply points to the original data objects. If the data objects are not StaticData(), then a copy is made for the new ZafInteger object. This behavior allows a programmer to use static data for more than one ZafInteger object.

ZafInteger(const ZafIChar *name, ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafInteger creation techniques follow:

```
// Create a sample window with integer objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Create integers and pass in the values directly.
window1->Add(new ZafInteger(0, 1, 25, 100));
window1->Add(new ZafInteger(0, 2, 25, 200));
...
// Create a sample window with integer objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
// Create integer data objects.
ZafIntegerData *integerData1 = new ZafIntegerData(100);
ZafIntegerData *integerData2 = new ZafIntegerData(200);
// Create integers that use the data previously created.
window2->Add(new ZafInteger(0, 1, 25, integerData1));
window2->Add(new ZafInteger(0, 2, 25, integerData2));
```

Destructor

virtual ~**ZafInteger**(void);

The destructor is used to free the memory associated with a ZafInteger object, including all the data object pieces that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafInteger object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Event

virtual ZafEventType **Event**(const ZafEventStruct &event);

This overloaded function handles all events that get sent to the ZafInteger object, whether by processing the events itself, or by passing them to ZafString::Event() for base class processing. See ZafWindowObject for more information.

ZafInteger handles the following events differently than its base classes:

Event()	Description
`N_RESET_I18N`	causes the object to redisplay its data according to the new internationalization values
`S_COPY_DATA`	causes the object to copy event.windowObject's IntegerData() if event.windowObject is a ZafInteger object
`S_SET_DATA`	causes the object to create a new IntegerData() object, then copy into it event.windowObject's IntegerData() if event.windowObject is non-null and is a ZafInteger object

IntegerData

```
ZafIntegerData *IntegerData(void) const;
virtual ZafError SetIntegerData(ZafIntegerData
    *integerData);
```

The IntegerData() object is where the actual data is stored. The IntegerData() piece may be shared among several ZafInteger objects, or it may belong to a single ZafInteger object. If shared among several ZafInteger objects, all the associated ZafInteger objects will be updated when the IntegerData() piece changes. SetIntegerData() may be used to associate an IntegerData() object with a ZafInteger object. For more information on data sharing in ZAF, see ZafDataManager. SetIntegerData() will delete the previous IntegerData() object if it is Destroyable() and no other object uses it.

The return value for IntegerData() is a pointer to the IntegerData() object associated with the ZafInteger object. The return value for SetIntegerData() is normally ZAF_ERROR_NONE. The following code shows the proper use of these functions:

```
// Get the data.
const ZafIntegerData *data = integer1->IntegerData();
...
// Add the integer data.
ZafIntegerData *newData = new ZafIntegerData(100);
    integer1->SetIntegerData(newData);
```

ZafIntegerData

Clear	operator --	operator *=
FormattedText	operator ++	operator /=
long	operator =	operator %=
SetInteger	operator +=	
Value	operator -=	

Inheritance

`ZafIntegerData : ZafFormatData : ZafData :`
`ZafNotification, ZafElement`

Declaration

`#include <z_int.hpp>`

Description

ZafIntegerData objects can be used to store and manipulate 32-bit integers.

ZafIntegerData combines number encapsulation with data and object notification from ZafData. It is most often used in conjunction with the ZafInteger user interface object but may be used as a stand-alone object if desired.

ZafIntegerData supports the use of printf-style formatting and parsing arguments during string operations. Refer to standard library documentation for detailed information on printf functions and conversion characters.

Constructors

ZafIntegerData constructors allocate space for the integer data and initialize the member variables associated with a ZafIntegerData object.

The default values set by ZafIntegerData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafIntegerData

`Value()`	`(varies by constructor)`

ZafElement

`ClassID()`	`ID_ZAF_INTEGER_DATA`
`ClassName()`	`“ZafIntegerData”`

`**ZafIntegerData**(void);`

The basic constructor allocates a ZafIntegerData instance and initializes its value to 0.

ZafIntegerData(long value);

This constructor allocates a ZafIntegerData instance and initializes its contents to *value*.

ZafIntegerData(const ZafIChar *string, const ZafIChar
   *format = ZAF_NULLP(ZafIChar));

This constructor allocates a ZafIntegerData instance and initializes its value to the numeric equivalent of *string*. The conversion uses the printf-style specifier *format* to interpret the string. If *format* is null ZafIntegerData uses its locale-specific default format.

ZafIntegerData(const ZafIntegerData &copy);

This constructor is the copy constructor. It allocates a new ZafIntegerData instance and copies all member data from *copy*.

ZafIntegerData(const ZafIChar *name, ZafDataPersistence
   &persist);

This constructor is the persistent constructor. It allocates a new ZafInteger-Data instance and reads most member data from directory *name* in the persistent data file referred to by *persist*. The StringID() of the new data is *name*.

```
// Sample ZafIntegerData creation techniques
long value = 100;
ZafIntegerData integer1(value);
ZafIntegerData copyInteger = integer1;
ZafIntegerData zeroInteger;
```

Destructor

virtual ~**ZafIntegerData**(void);

This virtual destructor is used to free the memory associated with an instantiated ZafIntegerData object. Unless StaticData() is true, a ZafIntegerData object will be destroyed automatically when all ZafInteger objects that refer to it are destroyed.

Members

Clear

virtual void **Clear**(void);

Clear() is a virtual function that sets the value of a ZafIntegerData object to zero.

FormattedText

```
virtual int FormattedText(ZafIChar *buffer, int
   maxLength, const ZafIChar *format = 0) const;
```

FormattedText() fills *buffer* with a string representation of the Zaf-IntegerData using the printf-style specifier *format* to build the string. A locale-specific default format is used if *format* is not included. Buffer contents will be truncated if they exceed *maxLength* characters. FormattedText() returns the integer value it receives from its call to sprintf().

```
// Show results of FormattedText().
ZafIChar buffer[256];

ZafIntegerData myint(123);
myint.FormattedText(buffer, 256);
printf("decimal int - %s\n", buffer);
myint.FormattedText(buffer, 256, "%X");
printf("hexadecimal - %s\n", buffer);

==========
decimal int - 123
hexadecimal - 7B
```

SetInteger

```
virtual ZafError SetInteger(long value);
virtual ZafError SetInteger(const ZafIChar *buffer, const
   ZafIChar *format);
virtual ZafError SetInteger(const ZafIntegerData
   &integer);
```

SetInteger() functions set the value of the ZafIntegerData object from various numeric input types, another ZafIntegerData, or an interpreted string. Refer to FormattedText for more information on ZafIntegerData/string conversions. Overloaded operator = offers similar functionality to SetInteger() and is more commonly used.

Value
long

```
long Value(void) const;
operator long();
```

Value() returns the value of a ZafIntegerData as a long. The convenience operator long(), which returns Value(), is more commonly used.

```
// Perform numerical operations on a ZafIntegerData
ZafIntegerData myint(123);
myint = myint.Value() + 15;
printf("integer - %u\n", myint);
```

```
myint = myint - 21;
printf("integer - %u\n", myint);

==========
integer - 138
integer - 117
```

operator --

```
ZafIntegerData operator--(void);
ZafIntegerData operator--(int);
```

These pre- and post-operators decrement the ZafIntegerData object's value by 1.

operator ++

```
ZafIntegerData operator++(void);
ZafIntegerData operator++(int);
```

These pre- and post-operators increment the ZafIntegerData object's value by 1.

operator =

```
ZafIntegerData &operator=(long value);
```

This operator assigns the ZafIntegerData object's value to the input *value*.

operator +=

```
ZafIntegerData &operator+=(long value);
```

This operator increments the ZafIntegerData object's value by the input *value*.

operator -=

```
ZafIntegerData &operator-=(long value);
```

This operator decrements the ZafIntegerData object's value by the input *value*.

*operator *=*

```
ZafIntegerData &operator*=(long value);
```

This operator multiplies the ZafIntegerData object's value by the input *value* and uses the resulting product to set the ZafIntegerData object's value.

operator /=

```
ZafIntegerData &operator/=(long value);
```

This operator divides the ZafIntegerData object's value by the input *value* and uses the resulting quotient to set the ZafIntegerData object's value.

operator %=

```
ZafIntegerData &operator%=(long value);
```

This operator divides the ZafIntegerData object’s value by the input *value* and uses the resulting remainder to set the ZafIntegerData object’s value.

ZafKeyboard

AltPressed	Event	ShiftPressed
CtrlPressed	Poll	

Inheritance `ZafKeyboard : ZafDevice : ZafElement`

Declaration `#include <z_keybrd.hpp>`

Description ZafKeyboard is the class that defines keyboard device support. A keyboard device accepts events from a keyboard, so keys typed by the end user enter the ZAF system through ZafKeyboard.

Constructors All ZafKeyboard constructors initialize the member variables associated with an instantiated ZafKeyboard object. Default values set by the ZafKeyboard follow, as well as base class values when overridden by ZafKeyboard.

Member Initializations

ZafDevice

`DeviceType()`	`E_KEYBOARD`

ZafElement

`ClassID()`	`ID_ZAF_KEYBOARD`
`ClassName()`	`"ZafKeyboard"`
`NumberID()`	`ID_ZAF_KEYBOARD`
`StringID()`	`"ZafKeyboard"`

`ZafKeyboard``(ZafDeviceState state = D_ON);`

This constructor is used to instantiate a ZafKeyboard object to be added to a ZafEventManager object. *state* specifies the initial state of the device.

`ZafKeyboard``(const ZafKeyboard &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafKeyboard object and copies the object's information. An example of how to create a ZafKeyboard object follows:

```
// Instantiate the input devices.
ZafEventManager *eventManager = new ZafEventManager;
```

```
eventManager->Add(new ZafKeyboard);
eventManager->Add(new ZafMouse);
eventManager->Add(new ZafCursor);
```

Destructor

`virtual ~ZafKeyboard(void);`

The destructor is used to free the memory associated with a ZafKeyboard object. It chains to the ZafDevice and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafKeyboard object, since it is automatically destroyed when the event manager is destroyed. For more information on device object deletion, see ZafEventManager::~ZafEventManager().

Members

AltPressed

`bool AltPressed(unsigned int shiftState) const;`

AltPressed() returns true if *shiftState* indicates that the <Alt> (or <Command>) key was pressed; otherwise it returns false. When a keyboard event comes through the system, event.key.shiftState may be directly passed into AltPressed().

CtrlPressed

`bool CtrlPressed(unsigned int shiftState) const;`

CtrlPressed() returns true if *shiftState* indicates that the <Control> key was pressed; otherwise it returns false. When a keyboard event comes through the system, event.key.shiftState may be directly passed into CtrlPressed().

Event

`virtual ZafEventType Event(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafKeyboard object. ZafKeyboard handles the D_STATE message, which causes a device to return its state.

Poll

`virtual void Poll(void);`

In some environments, the Poll() function checks the keyboard device for any input events and posts them on the event manager's queue, if the ZafKeyboard's state is not D_OFF. In other environments where keyboard events are handled automatically by the native environment's event queue, Poll() simply blocks keyboard events from coming through ZAF's event manager queue if the ZafKeyboard's state is D_OFF.

ShiftPressed

```
bool ShiftPressed(unsigned int shiftState) const;
```

ShiftPressed() returns true if *shiftState* indicates that the <Shift> key was pressed; otherwise it returns false. When a keyboard event comes through the system, event.key.shiftState may be directly passed into ShiftPressed().

ZafKeyStruct

shiftState	value

Inheritance

`Root struct`

Declaration

`#include <z_key.hpp>`

Description

ZafKeyStruct is used to store information about a keystroke. The most common use of ZafKeyStruct is by ZafEventStruct's key member. When a keyboard event comes through the system, event.key contains the information about the keystroke.

Members

shiftState

`ZafRawCode` **`shiftState`**`;`

shiftState specifies the state of the modifier keys when the keystroke occurred. This member may contain any combination of the following bitwise values:

S_ALT	Indicates that the <alt> key was depressed
S_CAPS_LOCK	Indicates that the <caps lock> key was depressed
S_CMD	Indicates that the <command> key was depressed
S_CTRL	Indicates that the <control> key was depressed
S_INSERT	Indicates that the <insert> key was depressed
S_KEYDOWN	Indicates that the key was pressed
S_KEYUP	Indicates that the key was released
S_LEFT_SHIFT	Indicates that the left <shift> key was depressed
S_NUM_LOCK	Indicates that the <num lock> key was depressed
S_OPT	Indicates that the <option> key was depressed
S_RIGHT_SHIFT	Indicates that the right <shift> key was depressed
S_SCROLL_LOCK	Indicates that the <scroll lock> key was depressed
S_SHIFT	Indicates that either <shift> key was depressed

value

`ZafIChar` **`value`**`;`

value specifies the character value of the key that was pressed, if it is mappable. In ISO 8859-1 mode the value is an ISO 8859-1 code, in Unicode mode the value is a Unicode code, and in native mode the value is an ASCII code.

ZafLanguageData

blankString	LanguageAllocate	SetMessage
Clear	LanguageFree	StaticData
errorString	LanguageName	ZafLanguageStruct
GetMessage	SetLanguage	

Inheritance `ZafLanguageData : ZafI18nData : ZafData : ZafNotification, ZafElement`

Declaration `#include <z_lang.hpp>`

Description ZafLanguageData maintains message tables so that different languages may easily be supported by a single executable and a data file containing the application messages (see ZafLanguageStruct for more information on the format of the message table entries). See ZafI18nData::ResetI18n() for more information about internationalization of an application.

Many ZAF classes automatically load ZafLanguageData objects of their own, but the programmer may create ZafLanguageData objects to keep track of tables of strings as needed.

Constructors All ZafLanguageData constructors initialize the member variables associated with an instantiated ZafLanguageData object. The default values set by the ZafLanguageData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafLanguageData	
`StaticData()`	`false`
ZafElement	
`ClassID()`	`ID_ZAF_LANGUAGE_DATA`
`ClassName()`	`"ZafLanguageData"`

`ZafLanguageData``(bool staticData = false);`

This constructor creates a new empty language table that may be loaded using SetLanguage(). *staticData* indicates the initial value of StaticData().

```
ZafLanguageData(ZafLanguageStruct *data, bool staticData
    = false);
```

This constructor creates a new language table based on the table specified by *data*. *staticData* specifies the value of StaticData(). All the information in *data* is copied to the new language table.

```
ZafLanguageData(const ZafLanguageData &copy);
```

The copy constructor creates a new ZafLanguageData object and initializes its data from *copy*.

```
ZafLanguageData(const ZafIChar *name, ZafDataPersistence
    &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Destructor

```
virtual ~ZafLanguageData(void);
```

The destructor is used to free the memory associated with a ZafLanguageData object. It chains to the ZafI18nData, ZafData, ZafNotification, ZafElement destructors.

Members

blankString

```
static ZafIChar ZAF_FARDATA blankString[];
```

blankString specifies a default string with simply a null terminator in it for use in clearing out any string in an application, since it is public and static.

Clear

```
virtual void Clear(void);
```

Clear() clears the language table associated with this ZafLanguageData object and deletes its language table if StaticData() is false.

errorString

```
static ZafIChar ZAF_FARDATA errorString[];
```

errorString specifies a default string with the word "Error" in it for the current language being used in the application for use anywhere in an application, since it is public and static.

GetMessage

```
ZafIChar *GetMessage(ZafNumberID numberID, bool
    useDefault = false, ZafIChar *hotKeyChar =
    ZAF_NULLP(ZafIChar), int *hotKeyIndex =
    ZAF_NULLP(int)) const;
```

GetMessage() finds the message in the language table according to *numberID*. If the message was not found and *useDefault* is true, the first message in the table will be returned; if the message was not found and *useDefault* is false, null is returned. The hot key character associated with the message is returned in *hotKeyChar* if it is not null, and the hot key index is returned in *hotKeyIndex* if it is not null. A pointer to the message is returned if it was found.

LanguageAllocate

```
static void LanguageAllocate(const ZafIChar *name =
   ZAF_NULLP(ZafIChar));
```

LanguageAllocate() is called by ZafI18nData to allocate the language data object for an application using the language specified by *name*. *name* must be non-null, and is the two-character ANSI code for a language, such as "en" for English. The programmer should normally not call LanguageAllocate(). Instead, ZafI18nData::ResetI18n() should be used to change the active language. Refer to the file Readme.i18 for the most current list of languages defined in ZAF. Other languages may be created by the programmer using Zinc Designer.

LanguageFree

```
static void LanguageFree(bool globalRequest = false);
```

LanguageFree() is called by ZafI18nData to delete the language data object for an application with *globalRequest* being true. The programmer should normally not call LanguageFree().

SetLanguage

```
virtual ZafError SetLanguage(ZafLanguageStruct *value);
virtual ZafError SetLanguage(const ZafLanguageData
   &data);
```

SetLanguage() resets the language table associated with the ZafLanguageData object by copying the information from *value* or *data* and causing the data manager to update all its data objects that rely on language information.

LanguageName

```
static const ZafIChar *LanguageName(void);
static ZafError SetLanguageName(const ZafIChar
   *languageName);
```

LanguageName() is the two-character ANSI code for a language, such as "en" for English. SetLanguageName() uses the two-character ANSI code *languageName* to reset the language information for an application, and is called from ZafI18nData::SetI18nName(). The programmer should normally not call SetLanguageName(). Instead, ZafI18nData::ResetI18n() should be used to change the active language. Refer to the file Readme.i18 for the most current list of languages defined in ZAF.

SetMessage

```
virtual ZafError SetMessage(ZafNumberID numberID,
   ZafIChar *text, ZafIChar hotKeyChar = 0, int
   hotKeyIndex = -1);
```

SetMessage() finds the message in the table with *numberID*, and sets its information according to the information passed into the other parameters. *text* specifies the message text, *hotKeyChar* specifies the hot key character, and *hotKeyIndex* specifies the hot key index. If the message was set successfully, ZAF_ERROR_NONE is returned; otherwise, ZAF_ERROR_INVALID_ID is returned if the message was not found or ZAF_ERROR_INVALID_SOURCE is returned if the table was empty.

StaticData

```
bool StaticData(void) const;
virtual bool SetStaticData(bool staticData);
```

If StaticData() is true, the message table associated with the ZafLanguageData object is recognized as static, so that it will not be deleted by ZAF, and may be used by several ZafLanguageData objects. The attribute may be changed with SetStaticArray(). Both functions return the current value of the StaticData() attribute.

ZafLanguageStruct

```
operator ZafLanguageStruct *();
```

This operator returns a pointer to the language table associated with this ZafLanguageData object.

ZafLanguageStruct

hotKeyChar	numberID	text
hotKeyIndex	stringID	

Inheritance

```
Root struct
```

Declaration

```
#include <z_lang.hpp>
```

Description

ZafLanguageStruct objects are used by ZafLanguageData in message tables to allow different languages to be supported by a single application and a data file containing the message tables. The last entry in a table of ZafLanguageStruct entries should specify null in the text member to terminate a table search. See ZafLanguageData::GetMessage() for more information.

Members

text

`ZafIChar *`**`text`**`;`

text specifies the message itself associated with the table entry. This member should be null for the last entry in a table.

numberID

`ZafNumberID `**`numberID`**`;`

numberID is a unique numeric identification constant that identifies each message in the message table, and may be used to search for a message.

stringID

`ZafIChar *`**`stringID`**`;`

stringID is a unique string identification constant that identifies each message in the message table, and is used when searching for a message.

hotKeyChar

`ZafIChar `**`hotKeyChar`**`;`

hotKeyChar specifies the character associated with the message to be used as a hot key. See ZafButton::HotKeyChar() for more information on hot key characters.

hotKeyIndex

`int `**`hotKeyIndex`**`;`

hotKeyIndex specifies the zero-based index into the message of the character to be used as a hot key. See ZafButton::HotKeyIndex() for more information on hot key indices.

ZafList

Add	Find	Sort
CompareFunction	First	Subtract
Count	Get	operator ()
Current	Index	operator +
Destroy	Last	operator -

Inheritance `Root class`

Declaration `#include <z_list.hpp>`

Description ZafList provides support for linked lists of ZafElement objects. Through multiple inheritance, ZafWindow and other classes derive from ZafList to maintain lists of children.

ZafList is also useful as a container class. Any object derived from ZafElement may be kept in a ZafList.

Constructor ZafList initializes its members to the following default values:

Member Initializations

ZafList	
`CompareFunction()`	`user-supplied parameter`
`Current()`	`null`
`First()`	`null`
`Last()`	`null`

```
ZafList(ZafCompareFunction compareFunction =
   ZAF_NULLF(ZafCompareFunction));
```

The ZafList class constructor creates an empty ZafList object. *compareFunction* specifies the function used when elements are compared against each other to determine their order in the list. Below is the definition of ZafCompareFunction. The compare function returns zero if the two parameters are considered equal. If the first should be sorted before the second, then some integer less than zero is returned; otherwise some integer greater than zero is returned.

```
typedef int (*ZafCompareFunction)(ZafElement *, ZafElement *);
```

The following code snippet shows how to create a ZafList object and use it to store a list of objects:

```
// Create an empty list object.
ZafList *list = new ZafList;

// Create several string data objects and store them
// in the list.
for (int i = 0; i < 10; i++)
{
  ZafIChar tempString[16];
  sprintf(tempString, "String %d", i);
  list->Add(new ZafStringData(tempString));
}
```

Destructor

`virtual ~`**`ZafList`**`(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafList object. All the elements attached to the list are deleted.

Members

Add

operator +

```
ZafElement *Add(ZafElement *element);
ZafElement *Add(ZafElement *element, ZafElement
   *position);
ZafList &operator+(ZafElement *element);
```

These functions and operator add *element* to the ZafList object. The Add() functions return a pointer to the object that was added, and the operator returns the ZafList object (useful in multiple uses of the operator in a single statement). *position*, if specified, refers to the element already in the list that *element* is inserted before.

If *position* is not specified, as with the first Add() function and with the operator, the function returned by CompareFunction() is called to determine the position of the new element in the list.

CompareFunction

```
virtual ZafCompareFunction CompareFunction(void) const;
virtual ZafCompareFunction
   SetCompareFunction(ZafCompareFunction
   compareFunction);
```

The function specified by CompareFunction() is used to determine element ordering in the ZafList. If CompareFunction() is null and no position is specified in the Add() function, each new element is added to the end of the list. SetCompareFunction() may be called to set the function used to compare elements. A pointer to the compare function is returned by both of these functions. See the typedef of ZafCompareFunction under the Constructor section.

If SetCompareFunction() is called after the list has been created and populated with elements, Sort() must be called to reorder the list using the new CompareFunction().

Count

```
int Count(void) const;
```

Count() returns the number of elements in the ZafList.

Current

```
ZafElement *Current(void) const;
void SetCurrent(ZafElement *element);
```

Current() specifies the element in the list considered to be current. Current() is not modified by the ZafList class, but must be maintained by the class utilizing the ZafList. Current() will remain null, as it is initialized, unless SetCurrent() is called with *element* specifying the element in the list to be considered current.

If the Current() element in the list is subtracted from the list, Current() will be set to null. The ZAF classes that inherit from ZafList call SetCurrent() internally (usually within NotifyFocus()), and the programmer should normally not call SetCurrent().

Destroy

```
virtual void Destroy(void);
```

Destroy() subtracts all the elements from the list and deletes them, in effectively making the list empty.

Find

```
ZafElement *Find(ZafNumberID numberID);
ZafElement *Find(const ZafIChar *stringID);
```

These functions return a pointer to the element in the list with either the identifier *numberID* or the identifier *stringID*. If an element cannot be found with the identifier provided, null is returned. See ZafElement for more information on these identifiers.

First

```
ZafElement *First(void) const;
```

First() returns a pointer to the first element in the list. If the list is empty, null is returned.

Get

```
ZafElement *Get(int (*findFunction)(void *element1, void
   *matchData), void *matchData);
ZafElement *Get(int index);
```

operator ()

```
ZafElement *operator()(int index);
```

The first Get() function returns a pointer to the element in the list if *findFunction* returns zero based on *matchData*. In other words, Get() calls *findFunction* on each element in the list until one is found that is considered to match *matchData*. If the element is found, a pointer to it is returned; otherwise null is returned.

The second function and the operator return a pointer to the element in the list with the zero- based *index*. If the element does not exist, null is returned.

Index

```
int Index(ZafElement const *element) const;
```

Index() returns the zero-based index of the *element* in the list. If the element is not in the list, -1 is returned.

Last

```
ZafElement *Last(void) const;
```

Last() returns a pointer to the last *element* in the list. If the list is empty, null is returned.

Sort

```
virtual void Sort(void);
```

Sort() causes the elements in the list to be reordered according to CompareFunction(). Add() places each element in the list appropriately, but Sort() must be called when the elements are out of place as a result of either a call to SetCompareFunction() or a call to Add() with the position specified.

Subtract

operator -

```
ZafElement *Subtract(ZafElement *element);
ZafList &operator-(ZafElement *element);
```

This function and operator subtract *element* from the ZafList object. Subtract() returns a pointer to the next object in the list (or null if *element* is the last element), and the operator returns the ZafList object (useful in multiple uses of the operator in a single statement). If *element* is Current(), then Current() is set to null.

ZafListBlock

Full

Inheritance

```
ZafListBlock : ZafList
```

Declaration

```
#include <z_list.hpp>
```

Description

ZafListBlock is a container object used as a base class by ZafQueueBlock to maintain a list block of ZafElement objects. Only ZafElement objects may be added to a ZafListBlock.

Constructors

All ZafListBlock constructors initialize the member variables associated with an instantiated ZafListBlock object.

```
ZafListBlock(int noOfElements, ZafCompareFunction
   compareFunction = ZAF_NULLF(ZafCompareFunction));
```

This constructor creates a ZafListBlock of *noOfElements* ZafElements. *compareFunction* specifies the function used to compare elements when sorting them in the list, and is passed into the ZafList constructor. See ZafList for more information about compare functions.

Destructor

```
virtual ~ZafListBlock(void);
```

The destructor is used to free the memory associated with a ZafListBlock object, including all the ZafElement objects associated with it. It chains to the ZafList destructor.

Members

Full

```
bool Full(void) const;
```

Full() returns true if the list block is full, meaning no other elements may be added to it. Otherwise, it returns false.

ZafLocaleData

canonicalLocale	LocaleFree	TimeStamp
Clear	LocaleName	
LocaleAllocate	SetLocale	

Inheritance

```
ZafLocaleData : ZafI18nData : (ZafData :
   ZafNotification, ZafElement), ZafLocaleStruct)
```

Declaration

```
#include <z_loc.hpp>
```

Description

ZafLocaleData maintains the locale information necessary to internationalize an application, such as month/day/year order, currency symbols, and decimal separators (see ZafLocaleStruct for more information). Locale information is loaded from the operating system at application start-up (ZafApplication calls LocaleAllocate()), and the programmer may change locale information at run-time. See ZafI18nData::ResetI18n() for more information about internationalization of an application.

The programmer will generally not create a ZafLocaleData object, as the global zafLocale is instantiated by the static method LocaleAllocate() at start-up.

Constructors

All ZafLocaleData constructors initialize the member variables associated with an instantiated ZafLocaleData object. The default values set by the ZafLocaleData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafElement

`ClassID()`	`ID_ZAF_LOCALE_DATA`
`ClassName()`	`"ZafLocaleData"`

`ZafLocaleData``(void);`

This constructor creates a new locale copied from the canonical locale (see canonicalLocale below).

`ZafLocaleData``(const ZafLocaleStruct &data);`

This constructor creates a new locale based on the locale specified in the ZafLocaleStruct *data*. All the information in *data* is copied to the new locale.

```
ZafLocaleData(const ZafLocaleData &copy);
```

The copy constructor creates a new ZafLocaleData object and initializes its data from *copy*.

```
ZafLocaleData(const ZafIChar *name, ZafDataPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Destructor

```
virtual ~ZafLocaleData(void);
```

The destructor is used to free the memory associated with a ZafLocaleData object. It chains to the ZafI18nData, ZafData, ZafNotification, ZafElement destructors. The programmer should normally not call this destructor, since the locale is destroyed by ZafApplication at program termination. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

canonicalLocale

```
static ZafLocaleData *canonicalLocale;
```

The currently active locale in a program may be changed at any time, which presents the need for a canonical , or common form for storing locale information. canonicalLocale stores the canonical locale information used for storing data that contains locale information. For example, when a data object containing locale-dependent information is stored, it is converted to the canonical, or common locale, so that when the information gets used again, it can be converted from a known form.

Clear

```
virtual void Clear(void);
```

Clear() copies the locale data from canonicalLocale, in effect clearing the locale information.

SetLocale

```
ZafError SetLocale(const ZafLocaleStruct &value);
```

SetLocale() changes the currently active locale by copying the locale information from value and causing the data manager to update all its data objects that rely on local information.

LocaleAllocate

```
static void LocaleAllocate(const ZafIChar *name =
   ZAF_NULLP(ZafIChar));
```

LocaleAllocate() is called by ZafI18nData to allocate the locale data object for an application using the locale specified by *name*. *name* is the two-character ANSI code for a locale, such as "US" for the United States. If *name* is null, the default locale compiled into the application is used. The programmer should normally not call LocaleAllocate(). Instead, ZafI18nData::ResetI18n() should be used to change the active locale. Refer to the file Readme.i18 for the most current list of locales defined in ZAF. Other locales may be created by the programmer using Zinc Designer.

LocaleFree

```
static void LocaleFree(bool globalRequest = false);
```

LocaleFree() is called by ZafI18nData to delete the locale data object for an application with *globalRequest* being true. The programmer should normally not call LocaleFree().

LocaleName

```
static const ZafIChar *LocaleName(void);
static ZafError SetLocaleName(const ZafIChar
   *localeName);
```

LocaleName() is the two-character ANSI code for a locale, such as "US" for the United States. SetLocaleName() uses the two-character ANSI code *localeName* to reset the locale information for an application, and is called from ZafI18nData::SetI18nName(). The programmer should normally not call SetLocaleName(). Instead, ZafI18nData::ResetI18n() should be used to change the active locale. Refer to the file Readme.i18 for the most current list of locales defined in ZAF.

TimeStamp

```
static ZafUInt32 TimeStamp(void);
```

TimeStamp() returns the current date and time in a platform-independent form. The number of seconds since January 1, 1970 is returned.

ZafLocaleStruct

altDigits	eraTableLength	posCurrencyPrecedes
beginGregorian	fractionDigits	positiveSign
creditLeftParen	grouping	posSignPrecedes
creditRightParen	intCurrencySymbol	postSpaceSeparation
currencySymbol	integerStringInputFormat	realStringInputFormat
dateSeparator	integerStringOutputFormat	realStringOutputFormat
dateStringInputFormat	intFractionDigits	skipGregorian
dateStringOutputFormat	monDecimalSeparator	thousandsSeparator
dateTimeStringInputFormat	monGrouping	time12StringOutputFormat
dateTimeStringOutputFormat	monThousandsSeparator	timeSeparator
decimalSeparator	negativeSign	timeStringInputFormat
defDigits	negCurrencyPrecedes	timeStringOutputFormat
eraTable	negSpaceSeparation	

Inheritance

`Root struct`

Declaration

`#include <z_loc.hpp>`

Description

ZafLocaleStruct is used as a base class by ZafLocaleData, and stores information that may be different for different locales. This information defines a unique locale, and is used by many parts of the ZAF libraries to provide internationalization to an application. See ZafLocaleData for more information.

Members

altDigits

`ZafIChar *`**`altDigits`**`;`

altDigits is the array of alternate digit characters to be used with "%ad" in format strings such as a ZafInteger object's OutputFormatData().

beginGregorian

`ZafUInt32 `**`beginGregorian`**`;`

beginGregorian is the Julian day that the Gregorian calendar was adopted. For example, the United Kingdom (and thus the United States) adopted the Gregorian calendar on October 4, 1582 (2299160 Julian).

creditLeftParen

`ZafIChar *`**`creditLeftParen`**`;`

creditLeftParen is the character used on the left of a negative number when the "@" format character is encountered in format strings such as a ZafBignum object's OutputFormatData().

creditRightParen

`ZafIChar *`**`creditRightParen`**`;`

creditRightParen is the character used on the right of a negative number when the "@" format character is encountered in format strings such as a ZafBignum object's OutputFormatData().

currencySymbol

`ZafIChar `**`currencySymbol`**`[8];`

currencySymbol is the symbol used locally to denote currency.

dateSeparator

`ZafIChar `**`dateSeparator`**`[4];`

dateSeparator is used to separate the day, month, and year pieces of a date string.

dateStringInput-Format

`ZafIChar *`**`dateStringInputFormat`**`;`

dateStringInputFormat is the format string used when inputting dates. See Zaf-String::InputFormatData() for more information.

dateStringOutput-Format

`ZafIChar *`**`dateStringOutputFormat`**`;`

dateStringOutputFormat is the format string used when outputting dates. See ZafString::OutputFormatData() for more information.

dateTimeStringIn-putFormat

`ZafIChar *`**`dateTimeStringInputFormat`**`;`

dateTimeStringInputFormat is the format string used when inputting date/time combination strings, such as with ZafUTime objects. See ZafString::InputFor-matData() for more information.

dateTimeString-OutputFormat

`ZafIChar *`**`dateTimeStringOutputFormat`**`;`

dateTimeStringOutputFormat is the format string used when outputting date/ time combination strings, such as with ZafUTime objects. See ZafString::Out-putFormatData() for more information.

decimalSeparator

`ZafIChar `**`decimalSeparator`**`[4];`

decimalSeparator is the symbol used to separate the whole number portion from the fraction in a non-monetary decimal number, as in ZafReal objects.

defDigits

`ZafIChar *`**`defDigits`**`;`

defDigits is the array of default digit characters to be used with "%d" in format strings such as a ZafInteger object's OutputFormatData().

eraTable

`ZafEraStruct *`**`eraTable`**`;`

eraTable is a table of all the different eras for the locale, and is a table of ZafEraStruct objects. See ZafEraStruct for more information.

eraTableLength

`int `**`eraTableLength`**`;`

eraTableLength is the number of elements in eraTable.

fractionDigits

`int `**`fractionDigits`**`;`

fractionDigits is the number of digits to display after the decimal separator on currency values, as in ZafBignum objects.

grouping

`char `**`grouping`**`[10];`

grouping indicates the numbers of digits to be grouped together from right to left in each section of the whole number portion of a non-monetary number. For example, the first element in the array specifies the number of digits in the first group to the left of the decimal separator. An element value of 0 indicates the end of the array, and the previous element's value is used for the remaining digits in the number.

intCurrencySymbol

`ZafIChar `**`intCurrencySymbol`**`[5];`

intCurrencySymbol is the international currency symbol followed by a space separator.

integerStringInput-Format

`ZafIChar *`**`integerStringInputFormat`**`;`

integerStringInputFormat is the format string used when inputting integers. See ZafString::InputFormatData() for more information.

integerStringOutput-Format

`ZafIChar *`**`integerStringOutputFormat`**`;`

integerStringOutputFormat is the format string used when outputting integers. See ZafString::OutputFormatData() for more information.

intFractionDigits

```
int intFractionDigits;
```

intFractionDigits is the number of digits to display after the decimal separator on international currency values, as in ZafBignum objects. This member is used together with intCurrencySymbol.

monDecimal-Separator

```
ZafIChar monDecimalSeparator[4];
```

monDecimalSeparator is the symbol used to separate the whole number portion from the fraction in a monitary decimal number, as in ZafReal objects.

monGrouping

```
char monGrouping[10];
```

monGrouping indicates the numbers of digits to be grouped together from right to left in each section of the whole number portion of a monetary number. For example, the first element in the array specifies the number of digits in the first group to the left of the decimal separator. An element value of 0 indicates the end of the array, and the previous element's value is used for the remaining digits in the number.

monThousands-Separator

```
ZafIChar monThousandsSeparator[4];
```

monThousandsSeparator is the symbol used to separate thousands (every 3 digits on the left of the decimal separator) in a monetary decimal number, as in ZafInteger objects.

negativeSign

```
ZafIChar negativeSign[4];
```

negativeSign is the symbol used to indicate a negative number.

negCurrency-Precedes

```
int negCurrencyPrecedes;
```

negCurrencyPrecedes is non-zero if the currency symbol precedes negative currency values; otherwise the currency symbol follows negative currency values.

negSignPrecedes

```
int negSignPrecedes;
```

negSignPrecedes is non-zero if the negative symbol precedes negative values; otherwise the negative symbol follows negative values.

negSpace-Separation

`int negSpaceSeparation;`

negSpaceSeparation is non-zero if a space separator is placed between the negative symbol and the value; otherwise no space separator is used.

posCurrency-Precedes

`int posCurrencyPrecedes;`

posCurrencyPrecedes is non-zero if the currency symbol precedes positive currency values; otherwise the currency symbol follows positive currency values.

positiveSign

`ZafIChar positiveSign[4];`

positiveSign is the symbol used to explicitly indicate a positive number.

posSignPrecedes

`int posSignPrecedes;`

posSignPrecedes is non-zero if the explicit positive symbol precedes positive values; otherwise the explicit positive symbol follows positive values.

postSpace-Separation

`int posSpaceSeparation;`

posSpaceSeparation is non-zero if a space separator is placed between the explicit positive symbol and the value; otherwise no space separator is used.

realStringInput-Format

`ZafIChar *realStringInputFormat;`

realStringInputFormat is the format string used when inputting real numbers. See ZafString::InputFormatData() for more information.

realStringOutput-Format

`ZafIChar *realStringOutputFormat;`

realStringOutputFormat is the format string used when outputting real numbers. See ZafString::OutputFormatData() for more information.

skipGregorian

`ZafUInt16 skipGregorian;`

skipGregorian is the number of days skipped when the Gregorian calendar was adopted. For example, the United Kingdom (and thus the United States) skipped 11 days to October 15, 1582.

thousands-Separator

`ZafIChar` **`thousandsSeparator`**`[4];`

thousandsSeparator is the symbol used to separate thousands (every 3 digits on the left of the decimal separator) in a non-monetary decimal number, as in ZafInteger objects.

time12StringOutput Format

`ZafIChar *`**`time12StringOutputFormat`**`;`

time12StringOutputFormat is the format string used when outputting explicitly 12-hour clock times. See ZafString::OutputFormatData() for more information.

timeSeparator

`ZafIChar` **`timeSeparator`**`[4];`

timeSeparator is used to separate the hour, minute, and second pieces of a time string.

timeStringInput-Format

`ZafIChar *`**`timeStringInputFormat`**`;`

timeStringInputFormat is the format string used when inputting times. See ZafString::InputFormatData() for more information.

timeStringOutput-Format

`ZafIChar *`**`timeStringOutputFormat`**`;`

timeStringOutputFormat is the format string used when outputting times. See ZafString::OutputFormatData() for more information.

ZafMaximizeButton

Inheritance `ZafMaximizeButton : ZafButton : ZafWindowObject : ZafElement`

Declaration `#include <z_max.hpp>`

Description The ZafMaximizeButton object may only be added to a ZafWindow. The ZafMaximizeButton is the maximize/restore button decoration on a ZafWindow, and is generally drawn by the environment. The ZafMaximizeButton object is used to maximize and restore the parent window with a ZafMouse device.

Constructors All ZafMaximizeButton constructors initialize the member variables associated with an instantiated ZafMaximizeButton object. The default values set by the ZafMaximizeButton and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafMaximizeButton. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafButton

`AllowDefault()`	`false`†
`AllowToggling()`	`false`†
`AutoRepeatSelection()`	`false`†
`AutoSize()`	`true`†
`ButtonType()`	`ZAF_3D_BUTTON`†
`Depth()`	`1`†
`HotKeyChar()`	`0`†
`HotKeyIndex()`	`-1`†
`HzJustify()`	`ZAF_HZ_CENTER`†
`SelectOnDoubleClick()`	`false`†
`SelectOnDownClick()`	`false`†
`SendMessageText()`	`null`†
`SendMessageWhenSelected()`	`true`†
`Value()`	`Used internally by ZAF`†
`VtJustify()`	`ZAF_VT_CENTER`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`CopyDraggable()`	`false`†

Member Initializations

`Disabled()`	`false`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`QuickTip()`	`null`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`Selected()`	`false`†
`SupportObject()`	`true`†
`SystemObject()`	`false`
`UserFunction()`	`null`†
ZafElement	
`ClassID()`	`ID_ZAF_MAXIMIZE_BUTTON`
`ClassName()`	`"ZafMaximizeButton"`
`NumberID()`	`ZAF_NUMID_MAXIMIZE`
`StringID()`	`"ZAF_NUMID_MAXIMIZE"`

`ZafMaximizeButton``(void);`

This constructor is useful in straight-code situations to create a ZafMaximize-Button object.

`ZafMaximizeButton``(const ZafMaximizeButton &copy);`

The copy constructor creates a new ZafMaximizeButton object and initializes its data from *copy*.

```
ZafMaximizeButton(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a maximize button follows:

```
// Create a sample window.
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
ZafMaximizeButton *max = new ZafMaximizeButton;
window->Add(max);
```

Destructor

virtual ~**ZafMaximizeButton**(void);

The destructor is used to free the memory associated with a ZafMaximizeButton object. It chains to the ZafButton, ZafWindowObject, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafMaximizeButton object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

ZafMessageWindow

ClearMessageFlags	IconImage	MessageFlags
DefaultMessageFlag	Message	

Inheritance

`ZafMessageWindow : ZafDialogWindow : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_msgwin.hpp>`

Description

ZafMessageWindow provides support for easily presenting a message dialog and returning a standard reply from the end user. ZafMessageWindows can automatically include icons and buttons based on “option flags” specified by the programmer. For example, a message window could be used to present an error message and allow the user to select “OK” or “Cancel”. ZafMessageWindow is derived from ZafDialogWindow, and is therefore a true dialog window class.

A message window is not moveable or sizeable by nature, since its border indicates a dialog window rather than movability and sizability and since a message window’s contents should promote understandability. A message window is also by its nature not a temporary window, since the end user is expected to dismiss it after acknowledging the message.

Constructors

All ZafMessageWindow constructors initialize the member variables associated with an instantiated ZafMessageWindow object. The default values set by the ZafMessageWindow and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafMessageWindow. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafMessageWindow

`DefaultMessageFlag()`	`user-supplied parameter`
`IconImage()`	`user-supplied parameter`
`Message()`	`user-supplied parameter`
`MessageFlags()`	`user-supplied parameter`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†

Member Initializations

`Moveable()`	`true`†
`SelectionType()`	`ZAF_SINGLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafWindowObject	
`AcceptDrop()`	`false`†
`AutomaticUpdate()`	`true`†
`Bordered()`	`false`†
`Disabled()`	`false`†
`HelpObjectTip()`	`null`†
`RegionType()`	`ZAF_INSIDE_REGION`†
ZafElement	
`ClassID()`	`ID_ZAF_MESSAGE_WINDOW`
`ClassName()`	`"ZafMessageWindow"`

```
ZafMessageWindow(const ZafIChar *title, ZafIconImage
    iconImage, ZafDialogFlags msgFlags, ZafDialogFlags
    defaultFlag, const ZafIChar *format, ...);
```

This constructor is useful in straight-code situations, particularly if the ZafTitle object is to create, maintain and destroy its own ZafStringData object automatically. The message window is sized appropriately, so that all the information fits in the window, and the message window is centered on the main screen when added to the window manager via the Control() method provided by the base ZafDialogWindow class.

title specifies the text to appear in the title bar.

iconImage specifies the icon that is placed in the message window (see IconImage() for more information).

msgFlags specifies the buttons that are placed in the message window (see MessageFlags() for more information).

defaultFlag specifies the default button (see DefaultMessageFlag() for more information).

format, along with the variable arguments that follow, specify the formatted textual message to be added to the message window using format options similar to those used by the printf functions. Refer to standard library documentation for detailed information on printf functions and conversion characters.

```
ZafMessageWindow(ZafStringData *title, ZafIconImage
    iconImage, ZafDialogFlags msgFlags, ZafDialogFlags
    defaultFlag, const ZafIChar *format, ...);
```

This constructor is useful in straight-code situations, particularly if a ZafStringData object has already been created for use by the ZafTitle object. *title* specifies the ZafStringData containing the text to appear in the title bar. See the previous constructor for a description of the other parameters.

```
ZafMessageWindow(const ZafMessageWindow &copy);
```

The copy constructor creates a new ZafMessageWindow object and initializes its data from *copy*.

```
ZafMessageWindow(const ZafIChar *name,
    ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a message window follows:

```
// Create a message window.
ZafMessageWindow *window = new ZafMessageWindow("Error",
    ZAF_EXCLAMATION_ICON, ZAF_DIALOG_OK, ZAF_DIALOG_OK, "You are
    about to commit a grievous error!");

// Add the message window to the window manager.
// Use Control() only if Modal() is true.
// ZafMessageWindows should always be Modal().
// Control() returns only when the user has made a selection.
window->Control();
```

Destructor

```
virtual ~ZafMessageWindow(void);
```

The destructor is used to free the memory associated with a ZafMessageWindow object. It chains to the ZafDialogWindow, ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

```
ZafDialogFlags ClearMessageFlags(ZafDialogFlags
    msgFlags);
```

ClearMessageFlags

ClearMessageFlags() clears only the flags specified by *msgFlags* out of the MessageFlags() attribute. Flags other than those specified in *msgFlags* are left untouched. See MessageFlags() for more information about these flags. ClearMessageFlags() may be called to clear flags any time before the message window appears on the window manager, but has no effect on a visible MessageWindow.

DefaultMessage-Flag

```
ZafDialogFlags DefaultMessageFlag(void) const;
ZafDialogFlags SetDefaultMessageFlag(ZafDialogFlags
   msgFlags);
```

DefaultMessageFlag() specifies the default button on the message window. *msgFlags* specifies the button the same way the MessageFlags() specifies a button. SetDefaultMessageFlag() may be called to change the DefaultMessageFlag() any time before the message window appears on the window manager.

IconImage

```
ZafIconImage IconImage(void) const;
ZafIconImage SetIconImage(ZafIconImage iconImage);
```

IconImage() specifies the icon that appears on the message window. SetIconImage() may be called to change IconImage() any time before the message window appears on the window manager. The following images are defined by ZAF:

IconImage()	**Description**
ZAF_APPLICATION_ICON	Provides a default application icon
ZAF_ASTERISK_ICON	Provides an asterisk icon
ZAF_EXCLAMATION_ICON	Provides an exclamation icon
ZAF_HAND_ICON	Provides a hand icon
ZAF_QUESTION_ICON	Provides a question icon

Message

```
const ZafIChar *Message(void) const;
void SetMessage(const ZafIChar *message);
```

Message() is the textual message that appears on the message window. SetMessage() may be called to change the message any time before the message window appears on the window manager.

MessageFlags

```
ZafDialogFlags MessageFlags(void) const;
ZafDialogFlags SetMessageFlags(ZafDialogFlags msgFlags);
```

MessageFlags() specifies the buttons that are placed on the message window, according to the bit flags described below OR'd together. SetMessageFlags() sets the flags specified in *msgFlags*, and does not modify other flags previously set (see ClearMessageFlags() for information on how to clear flags). SetMessageFlags() may be called to add flags any time before the message window appears on the window manager. The following MessageFlags() are defined by ZAF:

MessageFlags()	**Description**
ZAF_DIALOG_OK	Provides an "OK" button
ZAF_DIALOG_CANCEL	Provides a "Cancel" button
ZAF_DIALOG_YES	Provides a "Yes" button
ZAF_DIALOG_NO	Provides a "No" button
ZAF_DIALOG_ABORT	Provides an "Abort" button
ZAF_DIALOG_RETRY	Provides a "Retry" button
ZAF_DIALOG_IGNORE	Provides an "Ignore" button
ZAF_DIALOG_HELP	Provides a "Help" button (Motif only)

Following is a code snippet showing how to make an OK/Cancel message window:

```
// Create a message window with OK and Cancel buttons.
// The OK button is the default button.
ZafMessageWindow *window = new ZafMessageWindow("Error",
    ZAF_EXCLAMATION_ICON, ZAF_DIALOG_OK | ZAF_DIALOG_CANCEL,
    ZAF_DIALOG_OK, "You have committed a grievous error! By
    selecting the OK button, you admit your guilt...");

// Add the message window to the window manager.
// Use Control() only if Modal() is true.
// ZafMessageWindows should always be Modal().
// Control() returns only when the user has made a selection.
if (window->Control() == S_DLG_CANCEL)
  break;
```

ZafMDIWindow

MDIType

Inheritance `ZafMDIWindow : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_mdiwin.hpp>`

Description A Multiple Document Interface (MDI) is designed for working with multiple "documents" inside of a single application. The MDI specification supported by ZAF is based on the MDI specification developed by Microsoft for Microsoft Windows.

As MDI is a Microsoft Windows concept, it has very different implementations on other environments. Thus, ZafMDIWindow should be used with careful forethought since user interface nuances will be different from platform to platform. For example, due to the global nature of the menu bar on the Macintosh, the entire screen is appropriately used as the MDI parent window for that environment, so MDI children appear out on the screen.

ZafMDIWindow is a mechanism for allowing a decorated window (having a border, title, etc.) to exist as child window while retaining most of its defined behavior. The behavior of decorated windows is defined for root windows (windows attached directly to the window manager) and for MDI windows only.

There are two types of ZafMDIWindow objects: ZAF_MDI_PARENT and ZAF_MDI_CHILD. An MDI parent window must also be a root window, and its behavior is identical to that of ZafWindow. With the exception of support objects, however, the only children allowed inside of an MDI parent window are MDI child windows. An MDI child window must be a child of an MDI parent window. Its behavior is much the same as a root window's behavior except that it is confined to the "client" region of its MDI parent.

Constructors All ZafMDIWindow constructors initialize the member variables associated with an instantiated ZafMDIWindow object. The default values set by the ZafMDIWindow and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafMDIWindow. "†" Indicates a blocking function that prevents changes to the attribute in this class. "††" Indicates a blocking function that prevents changes to the attribute in this class for parent MDI windows, but child MDI windows behave as ZafWindow objects do.

Member Initializations

ZafMDIWindow	
`MDIType()`	`user-supplied parameter`
ZafWindow	
`SelectionType()`	`ZAF_SINGLE_SELECTION`††
`Temporary()`	`false`†
ZafWindowObject	
`AcceptDrop()`	`false`††
`Bordered()`	`false`†
`Disabled()`	`false`†
`Noncurrent()`	`false`†
`ParentPalette()`	`false`†
`RegionType()`	`ZAF_INSIDE_REGION`†
ZafElement	
`ClassID()`	`ID_ZAF_MDI_WINDOW`
`ClassName()`	`"ZafMDIWindow"`

```
ZafMDIWindow(int left, int top, int width, int height,
    ZafMDIType type);
```

This constructor is useful in straight-code situations. *left* and *top* specify the position where the left and top of the object will be placed on its parent or on the window manager. *width* and *height* specify the width and height of the client region of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *type* specifies the type of MDI window and may be either ZAF_MDI_PARENT or ZAF_MDI_CHILD.

```
ZafMDIWindow(const ZafMDIWindow &copy);
```

The copy constructor creates a new ZafMDIWindow object and initializes its data from *copy*.

```
ZafMDIWindow(const ZafIChar *name, ZafObjectPersistence
    &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create an MDI window follows:

```
// Create a parent MDI window with a menu bar.
ZafMDIWindow *parentWindow = new ZafMDIWindow(1, 1, 60, 16,
    ZAF_MDI_PARENT);
parentWindow->AddGenericObjects(new ZafStringData("MDI
    Parent"));
ZafPullDownMenu *menuBar = new ZafPullDownMenu;
ZafPullDownItem *fileMenu = new ZafPullDownItem("File");
fileMenu->Add(new ZafPopUpItem("", ZAF_EXIT_OPTION));
menuBar->Add(fileMenu);
parentWindow->Add(fileMenu);

// Create 2 child MDI windows.
ZafMDIWindow *child1 = new ZafMDIWindow(1, 1, 40, 10,
    ZAF_MDI_CHILD);
child1->AddGenericObjects(new ZafStringData("MDI Child 1"));
ZafMDIWindow *child2 = new ZafMDIWindow(2, 2, 40, 10,
    ZAF_MDI_CHILD);
child2->AddGenericObjects(new ZafStringData("MDI Child 2"));

// Add the children to the parent.
parentWindow->Add(child1);
parentWindow->Add(child2);

// Add the parent to the window manager.
zafWindowManager->Add(parentWindow);
```

Destructor

```
virtual ~ZafMDIWindow(void);
```

The destructor is used to free the memory associated with a ZafMDIWindow object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

MDIType

```
ZafMDIType **MDIType**(void) const;
```

MDIType() specifies whether an MDI window is an MDI parent window or an MDI child window. It returns ZAF_MDI_PARENT for MDI parent windows and ZAF_MDI_CHILD for MDI child windows. This attribute may not be modified after the object is created. MDIType() is specified only as a parameter to the constructor.

ZafMinimizeButton

Inheritance

ZafMinimizeButton : ZafButton : ZafWindowObject : ZafElement

Declaration

`#include <z_min.hpp>`

Description

The ZafMinimizeButton object may only be added to a ZafWindow. The ZafMinimizeButton is the minimize button decoration on a ZafWindow, and is generally drawn by the environment. The ZafMinimizeButton object is used to minimize the parent window with a ZafMouse device.

Constructors

All ZafMinimizeButton constructors initialize the member variables associated with an instantiated ZafMinimizeButton object. The default values set by the ZafMinimizeButton and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafMinimizeButton. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafButton

AllowDefault()	false†
AllowToggling()	false†
AutoRepeatSelection()	false†
AutoSize()	true†
ButtonType()	ZAF_3D_BUTTON†
Depth()	1†
HotKeyChar()	0†
HotKeyIndex()	-1†
HzJustify()	ZAF_HZ_CENTER†
SelectOnDoubleClick()	false†
SelectOnDownClick()	false†
SendMessageText()	null†
SendMessageWhenSelected()	true†
Value()	Used internally by ZAF†
VtJustify()	ZAF_VT_CENTER†

ZafWindowObject

AcceptDrop()	false†
Bordered()	false†
CopyDraggable()	false†

Member Initializations

`Disabled()`	`false`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`QuickTip()`	`null`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`Selected()`	`false`†
`SupportObject()`	`true`†
`SystemObject()`	`false`
`UserFunction()`	`null`†
ZafElement	
`ClassID()`	`ID_ZAF_MINIMIZE_BUTTON`
`ClassName()`	`"ZafMinimizeButton"`
`NumberID()`	`ZAF_NUMID_MINIMIZE`
`StringID()`	`"ZAF_NUMID_MINIMIZE"`

```
ZafMinimizeButton(void);
```

This constructor is useful in straight-code situations to create a ZafMinimizeButton object.

```
ZafMinimizeButton(const ZafMinimizeButton &copy);
```

The copy constructor creates a new ZafMinimizeButton object and initializes its data from *copy*.

```
ZafMinimizeButton(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a minimize button follows:

```
// Create a sample window.
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
ZafMinimizeButton *min = new ZafMinimizeButton;
window->Add(min);
```

Destructor

`virtual ~`**`ZafMinimizeButton`**`(void);`

The destructor is used to free the memory associated with a ZafMinimizeButton object. It chains to the ZafButton, ZafWindowObject, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafMinimizeButton object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

ZafMouse

Event	ImageType	Poll

Inheritance `ZafMouse : ZafDevice : ZafElement`

Declaration `#include <z_mouse2.hpp>`

Description ZafMouse is the class that defines mouse input device support. Some similar input devices that behave like mice are automatically supported by ZafMouse (such as trackballs and trackpads). Other similar input devices (such as touch screens) may derive from ZafMouse to get the same basic functionality, and add specific functionality in the superclass.

Constructors All ZafMouse constructors initialize the member variables associated with an instantiated ZafMouse object. Default values set by the ZafMouse follow, as well as base class values when overridden by ZafMouse.

Member Initializations

ZafMouse	
`ImageType()`	`user-supplied parameter`
ZafDevice	
`DeviceType()`	`E_MOUSE`
ZafElement	
`ClassID()`	`ID_ZAF_MOUSE`
`ClassName()`	`"ZafMouse"`
`NumberID()`	`ID_ZAF_MOUSE`
`StringID()`	`"ZafMouse"`

```
ZafMouse(ZafDeviceState state = D_ON, ZafDeviceImage
   imageType = DM_WAIT);
```

This constructor is used to instantiate a ZafMouse object to be added to a ZafEventManager object. *state* specifies the initial state of the device, and *imageType* specifies the initial image type displayed by the device (see ImageType() for more information).

`ZafMouse(const ZafMouse &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafMouse object and copies the object's information. An example of how to create a ZafMouse object follows:

```
// Instantiate the input devices.
ZafEventManager *eventManager = new ZafEventManager;
eventManager->Add(new ZafKeyboard);
eventManager->Add(new ZafMouse);
eventManager->Add(new ZafCursor);
```

Destructor

`virtual ~ZafMouse(void);`

The destructor is used to free the memory associated with a ZafMouse object. It chains to the ZafDevice and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafMouse object, since it is automatically destroyed when the event manager is destroyed. For more information on device object deletion, see ZafEventManager::~ZafEventManager().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Event

`virtual ZafEventType Event(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafMouse object. ZafMouse handles all the DM_* messages discussed in ImageType(), as well as D_STATE, which causes a device to return its state.

ImageType

```
ZafDeviceImage ImageType(void) const;
virtual ZafDeviceImage SetImageType(ZafDeviceImage
    imageType);
```

ImageType() returns a constant that indicates the mouse's current image type. For example, ImageType() returns DM_VIEW for a mouse device that currently displays the default pointer image. SetImageType() may be called to change a mouse's image type. The different image types supported by ZafMouse are as follows:

ImageType()	Description
DM_BOTTOM_LEFT_CORNER	causes the mouse to show the bottom-left corner image
DM_BOTTOM_RIGHT_CORNER	causes the mouse to show the bottom-right corner image
DM_BOTTOM_SIDE	causes the mouse to show the bottom side image
DM_CANCEL	causes the mouse to show the cancel image
DM_CROSS_HAIRS	causes the mouse to show the cross-hairs image
DM_DRAG	causes the mouse to show the generic drag image
DM_DRAG_COPY	causes the mouse to show the copy-drag image
DM_DRAG_COPY_MULTIPLE	causes the mouse to show the copy-drag multiple image
DM_DRAG_LINK	causes the mouse to show the link-drag image
DM_DRAG_LINK_MULTIPLE	causes the mouse to show the link-drag multiple image
DM_DRAG_MOVE	causes the mouse to show the move-drag image
DM_DRAG_MOVE_MULTIPLE	causes the mouse to show the move-drag multiple image
DM_EDIT	causes the mouse to show the I-bar image
DM_LEFT_SIDE	causes the mouse to show the left side image
DM_MOVE	causes the mouse to show the move image
DM_RIGHT_SIDE	causes the mouse to show the right side image
DM_SELECT	causes the mouse to show the selection image
DM_TOP_LEFT_CORNER	causes the mouse to show the top-left corner image
DM_TOP_RIGHT_CORNER	causes the mouse to show the top-right corner image

ImageType()	Description
`DM_TOP_SIDE`	causes the mouse to show the top side image
`DM_VIEW`	causes the mouse to show the default pointer image
`DM_WAIT`	causes the mouse to show the wait image

Poll

```
virtual void Poll(void);
```

In some environments, the Poll() function checks the mouse device for any input events and posts them on the event manager's queue, if the ZafMouse's state is not D_OFF. In other environments where mouse events are handled automatically by the native environment's event queue, Poll() simply blocks mouse events from coming through ZAF's event manager queue if the ZafMouse's state is D_OFF.

ZafMouseData

Array	HotSpotX	Width
Clear	HotSpotY	operator =
Height	SetMouse	

Inheritance

```
ZafMouseData : (ZafImageData : ZafData :
   (ZafNotification, ZafElement)), ZafMouseStruct
```

Declaration

```
#include <z_mouse1.hpp>
```

Description

ZafMouseData objects can be used to store and manipulate mouse information. ZafMouseData is most often used in conjunction with the ZafMouse device object.

Constructors

All ZafMouseData constructors initialize the member variables associated with an instantiated ZafMouseData object. The default values set by the ZafMouseData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafMouseData

`Array()`	`null`
`HotSpotX()`	`0`
`HotSpotY()`	`0`

ZafElement

`ClassID()`	`ID_ZAF_MOUSE_DATA`
`ClassName()`	`"ZafMouseData"`

`ZafMouseData``(const ZafImageStruct &data);`
`ZafMouseData``(const ZafMouseStruct &data);`

These constructors allocate a ZafMouseData instance and initialize its data to the values in *data*.

`ZafMouseData``(const ZafMouseData &copy);`

The copy constructor creates a new ZafMouseData object and initializes its data from *copy*.

```
ZafMouseData(const ZafIChar *name, ZafDataPersistence
    &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code snippet shows how to create a ZafMouseData object:

```
// Create a mouse image array.
#define gnd ZAF_CLR_BACKGROUND
#define blk ZAF_CLR_BLACK
#define wte ZAF_CLR_WHITE
static ZafLogicalColor ZAF_FARDATA mouseArray[160] =
{
   blk,blk,gnd,gnd,gnd,gnd,gnd,gnd,gnd,gnd,
   blk,wte,blk,gnd,gnd,gnd,gnd,gnd,gnd,gnd,
   blk,wte,wte,blk,gnd,gnd,gnd,gnd,gnd,gnd,
   blk,wte,wte,wte,blk,gnd,gnd,gnd,gnd,gnd,
   blk,wte,wte,wte,wte,blk,gnd,gnd,gnd,gnd,
   blk,wte,wte,wte,wte,wte,blk,gnd,gnd,gnd,
   blk,wte,wte,wte,wte,wte,wte,blk,gnd,gnd,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,gnd,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,blk,
   blk,wte,wte,wte,wte,wte,blk,blk,blk,gnd,
   blk,wte,wte,blk,wte,wte,blk,gnd,gnd,gnd,
   blk,blk,blk,blk,blk,wte,wte,blk,gnd,gnd,
   gnd,gnd,gnd,gnd,blk,wte,wte,blk,gnd,gnd,
   gnd,gnd,gnd,gnd,gnd,blk,wte,wte,blk,gnd,
   gnd,gnd,gnd,gnd,gnd,blk,wte,wte,blk,gnd,
   gnd,gnd,gnd,gnd,gnd,gnd,blk,blk,gnd,gnd
};
static ZafMouseStruct mouseStruct(10, 16, mouseArray, 0, 0,
    true);

// Create ZafMouseData objects based on the mouse image array.
ZafMouseData mouse1(mouseStruct);
ZafMouseData mouse2(mouse1);
```

Destructor

```
virtual ~ZafMouseData(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafMouseData object.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*()

function does not successfully change the state as requested, it will instead return the current state.

Array

```
ZafLogicalColor *Array(void) const;
```

Array() returns the portable logical color array that the mouse data is based on. This array is converted to a native environment mouse image. Each element of the array is a ZAF logical color. See ZafDisplay for more information.

Clear

```
virtual void Clear(void);
```

Clear() destroys the portable Array() if StaticArray() is false, and it destroys the environment handle if StaticHandle() is false. Regardless of StaticArray() and StaticHandle(), the portable Array() and the environment handle are both set to null, effectively clearing the mouse data.

Height

```
int Height(void) const;
```

Height() returns the height of the mouse data.

HotSpotX
HotSpotY

```
int HotSpotX(void) const;
int HotSpotY(void) const;
virtual ZafError SetHotSpot(int hotSpotX, int hotSpotY);
```

The hot spot is the pixel in the mouse data where a mouse click occurs, and is relative to the top left corner of the mouse data. HotSpotX() returns the zero-based position of the hot spot along the x-axis, and HotSpotY() returns the zero-based position of the hot spot along the y-axis. The hot spot may be changed by calling SetHotSpot(). SetHotSpot() always returns ZAF_ERROR_NONE.

SetMouse

```
virtual ZafError SetMouse(int width, int height,
   ZafLogicalColor *array);
virtual ZafError SetMouse(const ZafMouseStruct &mouse);
```

These functions copy the data passed in to the ZafMouseData object. *width* and *height* are the width and height of *array*, respectively. If StaticArray() is true, *array* becomes Array(); otherwise, a new array is created for Array(). In the second function, the data is copied from *mouse*. These functions always return ZAF_ERROR_NONE.

Width

```
int Width(void) const;
```

Width() returns the width of the mouse data.

operator =

```
ZafMouseData &operator=(const ZafMouseData &mouse);
```

This operator copies the data from mouse into this ZafMouseData object.

ZafMouseStruct

hotSpotX	hotSpotY	StaticHandle

Inheritance `ZafMouseStruct : ZafImageStruct`

Declaration `#include <z_dsp.hpp>`

Description ZafMouseStruct is used to store mouse image information. The base ZafImageStruct stores the portable image array using elements of ZafLogicalColors, and ZafMouseStruct defines additional members that store environment-specific structures for the mouse image filled by the ZafDisplay conversion function ZafDisplay::ConvertToOSMouse().

Constructors All ZafMouseStruct constructors initialize the member variables associated with an instantiated ZafMouseStruct object. The default values set by the ZafMouseStruct constructors follow.

Member Initializations

ZafMouseStruct	
`hotSpotX`	`0`
`hotSpotY`	`0`
`StaticHandle()`	`false`
ZafImageStruct	
`array`	`null`
`height`	`0`
`StaticArray()`	`false`
`width`	`0`

`ZafMouseStruct``(void);`

This constructor allocates a ZafMouseStruct instance and initializes its data to indicate that no mouse image information has been set.

`ZafMouseStruct``(const ZafImageStruct &data);`

This constructor allocates a ZafMouseStruct instance and initializes its data to the values in data. The environment-specific mouse image information is initialized to indicate that the mouse image has not yet been converted.

```
ZafMouseStruct(int width, int height, ZafLogicalColor
   *array, int hotSpotX, int hotSpotY, bool staticArray);
```

This constructor allocates a ZafMouseStruct instance and initializes its data to the values passed in. *width* and *height* indicate the size of the image, *array* specifies a pointer to the portable array of ZafLogicalColors, *hotSpotX* and *hotSpotY* indicate the position of the hot spot within the image (see the explanation of the members hotSpotX and hotSpotY below), and *staticArray* indicates if array is declared static.

The following code snippet shows how to create a ZafMouseStruct object:

```
// Create a mouse image structure.
#define gnd ZAF_CLR_BACKGROUND
#define blk ZAF_CLR_BLACK
#define wte ZAF_CLR_WHITE
static ZafLogicalColor ZAF_FARDATA mouseArray[160] =
{
   blk,blk,gnd,gnd,gnd,gnd,gnd,gnd,gnd,gnd,
   blk,wte,blk,gnd,gnd,gnd,gnd,gnd,gnd,gnd,
   blk,wte,wte,blk,gnd,gnd,gnd,gnd,gnd,gnd,
   blk,wte,wte,wte,blk,gnd,gnd,gnd,gnd,gnd,
   blk,wte,wte,wte,wte,blk,gnd,gnd,gnd,gnd,
   blk,wte,wte,wte,wte,wte,blk,gnd,gnd,gnd,
   blk,wte,wte,wte,wte,wte,wte,blk,gnd,gnd,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,gnd,
   blk,wte,wte,wte,wte,wte,wte,wte,blk,blk,
   blk,wte,wte,wte,wte,wte,blk,blk,blk,gnd,
   blk,wte,wte,blk,wte,wte,blk,gnd,gnd,gnd,
   blk,blk,blk,blk,blk,wte,wte,blk,gnd,gnd,
   gnd,gnd,gnd,gnd,blk,wte,wte,blk,gnd,gnd,
   gnd,gnd,gnd,gnd,gnd,blk,wte,wte,blk,gnd,
   gnd,gnd,gnd,gnd,gnd,blk,wte,wte,blk,gnd,
   gnd,gnd,gnd,gnd,gnd,gnd,blk,blk,gnd,gnd
};
static ZafMouseStruct mouseStruct(10, 16, mouseArray, 0, 0,
   true);
```

Members

hotSpotX
hotSpotY

`int` **`hotSpotX`**`,` **`hotSpotY`**`;`

The hot spot is the pixel in the mouse image where a mouse click occurs, and is relative to the top left corner of the mouse image. hotSpotX specifies the zero-based position of the hot spot along the x-axis, and hotSpotY specifies the zero-based position of the hot spot along the y-axis.

StaticHandle

```
bool StaticHandle(void) const;
bool SetStaticHandle(bool staticHandle);
```

If StaticHandle() is true, the environment-specific information (generally known as a handle) of the ZafMouseStruct is recognized as static, so that it will not be deleted by ZAF, and may be used by several ZafMouseStruct objects. This attribute is initialized to false, but it may be changed with SetStaticHandle(). Both functions return the current value of the StaticHandle() attribute.

ZafMSWindowsApp

available3D	dragStartPosition	MDIFrameJumpProc
commonControlsAvailable	dragTest	mouseTimerID
convertText	dropDownCombo	native3D
CreateSubclassedWindow	hInstance	ObjectFromHandle
ctl3dModule	HotKeyText	objectLowWord
Ctl3dRegister	InitializeWrappers	objectHighWord
Ctl3dEnabled	JumpProc	windowsPlatform
Ctl3dAutoSubclass	FrameJumpProc	windowsVersion
Ctl3dUnregister	FrameProc	
Ctl3dSubclassCtl	MDIChildJumpProc	

Inheritance

Root class

Declaration

```
#include <w_app.hpp>
```

Description

ZafMSWindowsApp is an advanced, internal class used by the Microsoft Windows versions of ZAF 5 and encapsulates various Microsoft Windows application-specific information. Most of the members of ZafMSWindowsApp are public statics and may be accessed from anywhere in the application, but most of the members are "advanced" and should normally not be accessed by the programmer. ZafMSWindows is provided for advanced Microsoft Windows programmers who may need access to this information for custom, non-portable development. A ZafMSWindowsApp instance is created by ZafApplication and destroyed on exit.

Constructor

```
ZafMSWindowsApp(HINSTANCE hInstance);
```

The ZafMSWindowsApp constructor initializes the information associated with an instantiated ZafMSWindowsApp object. *hInstance* should be the HINSTANCE passed into WinMain().

Destructor

```
virtual ~ZafMSWindowsApp(void);
```

The destructor is used to free the memory associated with a ZafMSWindowsApp object. Generally, the programmer will not directly destroy a ZafMSWindowsApp object, since it is automatically destroyed when the application closes down.

Members

available3D

```
static bool available3D;
```

This member is only available when the macro ZAF_MSWINDOWS_3D is defined, and indicates if 3D control support is available (either built-into the system, or through a DLL).

commonControls-Available

```
static bool commonControlsAvailable;
```

If commonControlsAvailable is true, the system contains support for common controls (such as in Microsoft Windows 95); otherwise common controls are not supported. This member is only available in the 32-bit version of the ZAF libraries for Microsoft Windows.

convertText

```
static bool convertText;
```

If convertText is false, the native system string encoding matches the ZAF library string encoding (either ISO or Unicode), so no conversion is necessary between ZafIChar strings and native strings; otherwise the conversion routines found in ZafCodeSetData are used to convert strings.

CreateSubclassed-Window

```
static HWND CreateSubclassedWindow(ZafWindowObject
   *object, const ZafIChar *lpClassName, DWORD dwStyle,
   const ZafIChar *text = NULL,  HWND hWndParent = 0,
   DWORD dwExStyle = WS_EX_NOPARENTNOTIFY, HINSTANCE
   hInstance = 0, LPVOID lpParam = 0);
```

CreateSubclassedWindow() is the ZAF substitute for the Microsoft Windows API functions CreateWindow() and CreateWindowEx(). CreateSubclassed-Window() creates a Microsoft Windows "window" and then subclasses from it so that Microsoft Windows messages are routed through the object's Event() function. *object* is a pointer to the ZAF window object to be associated with the new "window". *text* is the ZafIChar version of the text to be associated with the new "window", and is converted to the native Microsoft Windows string format before being passed to CreateWindowEx(). *lpClassName*, *dwStyle*, *hWndParent*, *dwExStyle*, *hInstance*, and *lpParam* are the equivalent parameters passed to CreateWindowEx(). The HWND to be associated with the new "window" is returned, and is normally assigned to the ZAF object's screenID.

ctl3dModule
Ctl3dRegister
Ctl3dEnabled

```
static HMODULE ctl3dModule;
static BOOL (WINAPI *Ctl3dRegister)(HINSTANCE);
static BOOL (WINAPI *Ctl3dEnabled)(void);
```

Ctl3dAutoSubclass
Ctl3dUnregister
Ctl3dSubclassCtl

```
static BOOL (WINAPI *Ctl3dAutoSubclass)(HINSTANCE);
static BOOL (WINAPI *Ctl3dUnregister)(HINSTANCE);
static BOOL (WINAPI *Ctl3dSubclassCtl)(HWND);
```

These members are pointers to the CTL3D modules and functions for non-native 3D support, and are resolved by loading ctl3d32.dll (for 32-bit) or ctl3dv2 (for 16-bit). They are for internal use only, and are not intended to be used by the programmer.

dragStartPosition

```
static POINT ZAF_FARDATA dragStartPosition;
static POINTS dragStartPosition;
```

These members are used internally by the ZAF libraries to support drag and drop under Microsoft Windows, and should not be accessed by the programmer.

dragTest

```
static bool dragTest;
```

This member is used internally by the ZAF libraries to support drag-and-drop under Microsoft Windows, and should not be accessed by the programmer.

dropDownCombo

```
static HWND dropDownCombo;
```

This member is used internally by the ZAF libraries to support combo-boxes under Microsoft Windows, and should not be accessed by the programmer. It is used to keep a handle to the combo-box that is currently open.

hInstance

```
static HINSTANCE hInstance;
```

This member stores a handle to the application instance, which is passed-into WinMain() at application start-up.

HotKeyText

```
static ZafIChar *HotKeyText(const ZafIChar *text, int
    hotKeyIndex);
```

HotKeyText() returns a newly-created string that contains special embedded characters required by the Microsoft Windows API to denote a hot key. *text* is the original ZAF string to be converted. *hotKeyIndex* is the zero-based index of the character in *text* to be displayed as a hot key. The programmer must delete the return value when it is no longer needed.

InitializeWrappers

```
void InitializeWrappers(void);
```

When running in Unicode character mode, InitializeWrappers() initializes function callback pointers used by the ZAF library for Microsoft Windows. This is an advanced routine usually called in the constructor, and should normally not be called by the programmer.

JumpProc

```
static LRESULT CALLBACK JumpProc(HWND hwnd, UINT wMsg,
    WPARAM wParam, LPARAM lParam);
```

JumpProc() is the callback function (the Microsoft Windows “window procedure”) called by Windows and used to send native messages to the appropriate ZAF Event() function for message handling. The parameters are normal WindowProc parameters as documented in the Microsoft Windows API documentation. JumpProc() is an advanced routine, and should normally not be used by the programmer.

FrameJumpProc

```
static LRESULT CALLBACK FrameJumpProc(HWND hwnd, UINT
    wMsg, WPARAM wParam, LPARAM lParam);
```

FrameJumpProc() is the callback function (window procedure for frame windows) called by Microsoft Windows and used to pass the appropriate default function to FrameProc() for normal frame message handling. The parameters are normal WindowProc parameters as documented in the Microsoft Windows API documentation. FrameJumpProc() is an advanced routine, and should normally not be used by the programmer.

FrameProc

```
static LRESULT FrameProc(LRESULT (DefaultProc)(HWND,
    UINT, WPARAM, LPARAM), HWND hwnd, UINT wMsg, WPARAM
    wParam, LPARAM lParam);
```

FrameProc() is the common code for all frame procedures and either routes them to the appropriate ZAF objects for processing, or calls the default callback routine for base class processing by the Microsoft Windows API. The first parameter is a pointer to the default callback routine (DefWindowProc, DefFrameProc or DefMDIChildProc). *hwnd*, *wMsg*, *wParam*, and *lParam* are normal WindowProc parameters as documented in the Microsoft Windows API documentation.

MDIChildJumpProc

```
static LRESULT CALLBACK MDIChildJumpProc(HWND hwnd, UINT
    wMsg, WPARAM wParam, LPARAM lParam);
```

MDIChildJumpProc() is the callback function (window procedure for MDI child frames) called by Microsoft Windows and used to pass the appropriate default function to FrameProc() for MDI child frame message handling. The parameters are normal WindowProc parameters as documented in the Microsoft Windows API documentation. MDIChildJumpProc() is an advanced routine, and should normally not be used by the programmer.

MDIFrameJump-Proc

```
static LRESULT CALLBACK MDIFrameJumpProc(HWND hwnd, UINT
    wMsg, WPARAM wParam, LPARAM lParam);
```

MDIFrameJumpProc() is the callback function (window procedure for MDI frame windows) called by Microsoft Windows and used to pass the appropriate default function to FrameProc() for MDI parent frame message handling. The parameters are normal WindowProc parameters as documented in the Microsoft Windows API documentation. MDIFrameJumpProc() is an advanced routine, and should normally not be used by the programmer.

mouseTimerID

```
static UINT mouseTimerID;
```

This member is used internally by the ZAF libraries to support the N_MOUSE_ENTER and N_MOUSE_LEAVE events under Microsoft Windows, and should not be accessed by the programmer.

native3D

```
static bool native3D;
```

This member is only available when the macro ZAF_MSWINDOWS_3D is defined, and indicates whether 3-D is supported natively.

ObjectFromHandle

```
static ZafWindowObject *ObjectFromHandle(HWND hwnd);
```

ObjectFromHandle() returns a pointer to the ZAF window object that corresponds to the Microsoft Windows handle hwnd (hwnd is normally equivalent to the object's screenID).

objectLowWord
objectHighWord

```
static ATOM objectLowWord;
static ATOM objectHighWord;
```

These members are used internally by the ZAF libraries for all compilers except Watcom to get pointers to ZAF objects from a window's properties under 16-bit versions of Microsoft Windows, and should not be accessed by the programmer.

```
static char *objectLowWord;
static char *objectHighWord;
```

These members are used internally by the ZAF libraries for the Watcom compiler to get pointers to ZAF objects from a window's properties under 16-bit versions of Microsoft Windows, and should not be accessed by the programmer. (The Watcom-specific differences should disappear in future versions of the Watcom compiler.)

windowsPlatform

`static ZafWindowsPlatform **windowsPlatform**;`

windowsPlatform specifies which flavor of Microsoft Windows the application is running under. The possible values for this member are as follows:

ZafWindowsPlatform	**Description**
ZAF_WIN16	Microsoft Windows (16-bit under Windows 3.x)
ZAF_WIN32S	Microsoft Windows (32-bit under Windows 3.x)
ZAF_WIN32_WINDOWS	Microsoft Windows (32-bit, such as Windows 95)
ZAF_WIN32_NT	Microsoft Windows NT (32-bit)

windowsVersion

`static int **windowsVersion**;`

windowsVersion specifies which version of Microsoft Windows the application is running under. For example, windowsVersion would be 400 under Microsoft Windows NT version 4.0, or it would be 310 for Microsoft Windows version 3.1.

ZafNotebook

CurrentPage	SetTabHotKey	TabHotKeyIndex
FirstPage	TabHeight	TabText
LastPage	TabHotKeyChar	TabWidth

Inheritance

`ZafNotebook : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_notebk.hpp>`

Description

ZafNotebook is a container object used to logically group other objects into tabbed pages. A ZafWindow object with a ZafTitle is added to a ZafNotebook to create a page. The text on the ZafTitle is copied to the corresponding tab. ZafNotebook tabs are scrollable, so more tabs may be on a ZafNotebook than are visible in the available space.

This class is not available in the Personal version of ZAF, but is included with the Registered and Professional versions.

Constructors

All ZafNotebook constructors initialize the member variables associated with an instantiated ZafNotebook object. The default values set by the ZafNotebook and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafNotebook. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafNotebook

CurrentPage()	-1
TabHeight()	0
TabHotKeyChar()	'\0'
TabHotKeyIndex()	-1
TabWidth()	0

ZafWindow

Destroyable()	false†
Locked()	false†
Maximized()	false†
Minimized()	false†
Modal()	false†
Moveable()	false†

Member Initializations

`RegionType()`	`ZAF_AVAILABLE_REGION`
`SelectionType()`	`ZAF_SINGLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafWindowObject	
`AcceptDrop()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_NOTEBOOK`
`ClassName()`	`"ZafNotebook"`

`**ZafNotebook**(int left, int top, int width, int height);`

This constructor is useful in straight-code situations. *left*, *top*, *width*, and *height* specify the position and size on a parent window. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. See ZafWindowObject::CoordinateType() for more information.

`**ZafNotebook**(const ZafNotebook &copy);`

The copy constructor creates a new ZafNotebook object and initializes its data from *copy*.

`**ZafNotebook**(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code shows how to create a ZafNotebook object.

```
// Create a sample window with a notebook.
ZafWindow *window = new ZafWindow(10, 10, 40, 10);
window->AddGenericObjects(new ZafStringData("Notebook
   Window"));
ZafNotebook *notebook = new ZafNotebook(0, 0, 40, 10);

// Create Page 1 with a string and add the page to the notebook.
ZafWindow *page = new ZafWindow(0, 0, 40, 4);
page->Add(new ZafTitle("Page 1"));
```

```
page->Add(new ZafString(2, 0, 20, "string1", 100));
notebook->Add(page);

// Create Page 2 with a string and add the page to the notebook.
page = new ZafWindow(0, 0, 40, 4);
page->Add(new ZafTitle("Page 2"));
page->Add(new ZafString(4, 1, 20, "string2", 100));
notebook->Add(page);

// Finally, add the notebook to the window.
window->Add(notebook);
```

Destructor

`virtual ~`**`ZafNotebook`**`(void);`

The destructor is used to free the memory associated with a ZafNotebook object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

CurrentPage

`int `**`CurrentPage`**`(void) const;`
`virtual int `**`SetCurrentPage`**`(int currentPage);`
`virtual int `**`SetCurrentPage`**`(ZafWindowObject *currentPage);`

CurrentPage() returns the zero-based index of the current page for the ZafNotebook selected either by the end user, or programmatically. SetCurrentPage() may be called to change the current page programmatically by passing as currentPage either the zero-based index or a pointer to the ZafWindow page object for the page to be made current.

The ZafNotebook object receives an N_CHANGE_PAGE event whenever the page is changed either programmatically, or the end user intervention.

FirstPage

`int `**`FirstPage`**`(void) const;`

FirstPage() returns the zero-based index of the first page on the ZafNotebook. If there are no pages, it returns -1; otherwise, it returns 0.

LastPage

`int `**`LastPage`**`(void) const;`

LastPage() returns the zero-based index of the last page on the ZafNotebook. If there are no pages, it returns -1.

TabHeight

```
int TabHeight(void);
virtual int SetTabHeight(int tabHeight);
```

TabHeight() specifies in pixel coordinates the height of the notebook tabs. By default this attribute is 0, which means that the default height for each environment is used, but SetTabHeight() may be used to change it.

TabHotKeyChar
TabHotKeyIndex
SetTabHotKey

```
ZafIChar TabHotKeyChar(int page) const;
int TabHotKeyIndex(int page) const;
virtual ZafIChar SetTabHotKey(int page, ZafIChar
   hotKeyChar, int index = -1);
```

ZafNotebook's tab objects are implemented with the ZafButton class, and thus may utilize hot keys. These functions provide access to the tab objects' hot key information. *page* is the zero-based index of the tab whose hot key information is being accessed. The other parameters to these functions are similar to those passed into ZafButton::HotKeyChar(), ZafButton::HotKeyIndex(), and ZafButton::SetHotKey(). See ZafButton for more information.

TabText

```
virtual const ZafIChar *TabText(int page);
virtual ZafError SetTabText(const ZafIChar *text, int
   page);
```

TabText() returns the text of the tab corresponding to the notebook page with zero-based offset page by getting the text on the corresponding ZafTitle object. SetTabText() may be called to change the text of the tab on the zero-based *page* to what is passed into *text*. The corresponding ZafTitle object's text is modified to *text*.

TabWidth

```
int TabWidth(void);
virtual int SetTabWidth(int tabWidth);
```

TabWidth() specifies in pixel coordinates the width of the notebook tabs. By default this attribute is 0, which means that the tabs are variable-width, each tab calculating its width based on its text, but SetTabWidth() may be used to specify a fixed width for all the tabs.

ZafNotification

AddNotification	SubtractNotifications	UpdateObjects
ClearNotifications	Update	
NotifyCount	UpdateData	

Inheritance Root class

Declaration `#include <z_notify.hpp>`

Description ZafNotification serves as the base class for all objects that add notification to their modes of operation. ZAF defines a whole series of data objects that may automatically notify their window object counter-part when their data has changed. These objects include dates, times, bitmaps, languages, as well as many other data types. For example:

- ZafDateData may notify ZafDate
- ZafTimeData may notify ZafTime
- ZafBitmapData may notify ZafButton
- ZafIconData may notify ZafIcon
- ZafStringData may notify ZafString or ZafText
- ZafScrollData may notify ZafScrollBar

ZafNotification is considered an advanced ZAF class. Therefore, much of the remaining information presented in this chapter is considered advanced material. Readers who don't need a detailed understanding of the underpinnings of the ZafNotification class may elect to skip through those sections that seem too advanced.

In particular, there are only four functions that most users will need to use. These are Update(), SetUpdate(), UpdateData() and UpdateObjects(). These functions are used to directly manipulate the data associated with a set of window objects. Each of these sections is self-contained, and may be referred to without fully understanding the class's advanced features.

Constructor The ZafNotification class constructor is protected. Thus, it can only be called from a derived class's constructor such as ZafData. ZafNotification sets the following default values:

Member Initializations

ZafNotification

`Update()`	`ZAF_UPDATE_ALL`
`NotifyCount()`	`0`

`**ZafNotification**(void);`

The constructor initializes a dynamic array of notification objects that will be called whenever the UpdateData() or UpdateObjects() functions is called. By default, no objects are inserted into the notification array, signified by a notification count of 0. The notification array is modified by calls to AddNotification(), ClearNotification(), or SubtractNotification().

The default type of notification performed by the notify class, ZAF_UPDATE_ALL, causes both changes to the data and to the associated notification object to be simultaneously updated. See Update() for more information.

Destructor

`virtual ~**ZafNotification**(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafNotification object. The ZafNotification portion of the destructor deletes the internal notification array allocated by calls to AddNotification().

A ZafNotification pointer should never be directly deleted! As stated earlier in this section, the ZafNotification class is generally associated with a derived object through multiple inheritance. Consider the class declaration of ZafData:

```
class ZafExportClass ZafData : public ZafElement, public
   ZafNotification
```

An explicit call to the ZafNotification destructor would not have the desired result of destroying the ZafData object, but would result in only the partial deletion of the object. To determine the type of destructor that you should call, refer to the reference chapter on the particular object you created.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AddNotification

```
ZafNotifyObject *AddNotification(ZafNotifyObject
    *object, ZafUpdateFunction function =
    ZAF_NULLF(ZafUpdateFunction), ZafUpdateType type =
    ZAF_UPDATE_ALL);
```

ClearNotifications

```
void ClearNotifications(void);
```

SubtractNotifica-tions

```
ZafNotifyObject *SubtractNotification(ZafNotifyObject
    *object, ZafUpdateFunction function =
    ZAF_NULLF(ZafUpdateFunction));
```

These functions clear or modify the notification objects associated with the derived ZafNotification class. ClearNotifications() deletes the entire internal notification array. AddNotifiction() takes the following arguments:

- the *object* to be associated with the data instance
- the *function* to be called whenever the data component changes
- the *type* of notifications the object should receive

ZafUpdateType's include:

ZafUpdateType()	Definition
ZAF_UPDATE_NONE	Do not update either the data or window object portions of the notification. Using this value causes all notification to be disabled.
ZAF_UPDATE_DATA	Only update the data component of the notification. If this value is used exclusive of ZAF_UPDATE_OBJECT, then changes to the data component will not be reflected by the associated window objects.
ZAF_UPDATE_OBJECT	Only update the window object portion of the notification. If this value is used exclusive of ZAF_UPDATE_DATA, then changes to window objects will not automatically cause the data component to be updated.
ZAF_UPDATE_ALL	Update both the data and window object portions of the notification. Using this value causes all notification to be enabled. This is the default value.

Note that ZAF_UPDATE_DATA and ZAF_UPDATE_OBJECT can be used simultaneously by using the "or" operator: (ZAF_UPDATE_DATA | ZAF_UPDATE_OBJECT). The ZafUpdateFunction argument must be in the following form:

```
ZafError (*ZafUpdateFunction)(ZafNotifyObject *, ZafUpdateType);
```

- *ZafNotifyObject* *: The window object that will be called whenever the data component changes.
- *ZafUpdateType*: The type of operation being performed on the object, as defined above.

The SubtractNotification() arguments *object* and *function* have the same meaning as with AddNotification().

These functions return a ZafError value. Normally, this value will be ZAF_ERROR_NONE (0), but may be any of the error values defined in the header file z_env.hpp. For a description of these values see ZafData::Error() and ZafWindowObject::Error().

The following examples include data notification.

```
static ZafError Update(ZafString *string, ZafUpdateType type)
{ if (type == ZAF_UPDATE_OBJECT) return string->OSSetText();
  else if (type == ZAF_UPDATE_DATA)
    return string->OSGetText();
  else return (ZAF_ERROR_INVALID); }

static ZafError Update(ZafInteger *integer, ZafUpdateType type)
{ if (type == ZAF_UPDATE_OBJECT)
    return integer->OSSetInteger();
  else if (type == ZAF_UPDATE_DATA)
    return integer->OSGetInteger();
  else return (ZAF_ERROR_INVALID); }
```

Data or object notification is very useful in run-time applications. Typically, application frameworks offer window object technology and the ability to manipulate the screen presentation of an object, but few packages have automatic notification of visual presentations connected with the data objects. Whenever a ZAF window object is created with a ZafData derived object, the object registers itself with the data component. The following example, from ZafInteger, shows how this connection is established.

```
ZafError ZafInteger::SetIntegerData(ZafIntegerData
    *newIntegerData)
{
  // Remove old data notification.
  if (integerData)
    integerData->SubtractNotification(this);

  // Reset the integer data.
  ...
  // Re-add new data notification.
  if (integerData)
    integerData->AddNotification(this);
  return (OSSetInteger());
}
```

Once the data/object connection is made, the window object receives notification anytime the data object's value changes. In the code sample above, ZafInteger::integerData is the data component. Whenever the integer data changes, update calls are automatically sent to the ZafInteger object, allowing the object to refresh the information it presents to the screen.

If the data object is attached as a static data element to several window objects, each object registers itself for data notification using the AddNotification() function. This allows each window object to receive notification whenever the data component of the object changes.

When the window object is destroyed, it calls SubtractNotification() to remove itself from the data object's notification list. An example is the ZafInteger destructor:

```
ZafInteger::~ZafInteger(void)
{
  // Remove the data notification.
  if (integerData)
    integerData->SubtractNotification(this);
  ...
}
```

The return value for AddNotification() is the notification argument if the operation is successful. Otherwise null is returned. The return value for Subtract-Notification() is the next notification object in the data object's notification list. If no notification objects exist after the specified object, null is returned.

NotifyCount

`int` **`NotifyCount`**`(void) const;`

NotifyCount() returns the number of elements that have been added to the internal notification array.

Update

`ZafUpdateType` **`Update`**`(void) const;`
`ZafUpdateType` **`Update`**`(ZafNotifyObject *object) const;`
`ZafUpdateType` **`SetUpdate`**`(ZafUpdateType updateType);`

```
ZafUpdateType SetUpdate(ZafNotifyObject *object,
   ZafUpdateType updateType);
```

These functions are used to set the notification state of an object, or to reset the particular notification constraints associated with a notification object. The possible update types are:

- ZAF_UPDATE_NONE
- ZAF_UPDATE_DATA
- ZAF_UPDATE_OBJECT
- ZAF_UPDATE_ALL

As an example, if the notification is ZAF_UPDATE_ALL, then all modifications to the data object are reflected in the associated notification objects, and all modifications to the window objects are reflected in the associated data object. The following code associates a ZafIntegerData object with two ZafString classes.

```
// Associate one data class with two window objects.
ZafIntegerData *intData = new ZafIntegerData(200);
*window1 + new ZafInteger(0, 0, 20, intData, true);
*window2 + new ZafInteger(0, 0, 20, intData, true);
```

When each ZafInteger object is created, it registers itself with the ZafIntegerData instance as a notification object. Later, if the contents of the intData object are changed, the visual representation of the two window objects will automatically be updated.

```
// Change the contents of the intData object.
*intData += 100;
```

If the notification is set to ZAF_UPDATE_NONE, then the visual representation of the object will not automatically be updated on the screen.

Finally, if you set the notification to ZAF_UPDATE_NONE and then back to ZAF_UPDATE_ALL, you must call UpdateObjects() to refresh the data notification objects.

```
// Remove the notification while we do some calculations.
intData->SetUpdate(ZAF_UPDATE_NONE);

// Do some calculations on intData.
*intData += 10;
if (*intData < 100)
  *intData *= 4;
```

```
else if (moonOverParador)
  *data++;

// Reset the notification and update all associated objects.
intData->SetUpdate(ZAF_UPDATE_ALL);
intData->UpdateObjects();
```

If you do not call UpdateObjects(), the contents of the window object will not be updated until the object needs to be re-displayed by the application.

UpdateData

```
ZafError UpdateData(ZafNotifyObject *objectSource =
   ZAF_NULLP(ZafNotifyObject));
```

UpdateData() forces any specified notification objects to immediately update their data information. A null argument means update all the data components.

When non-null, the *objectSource* parameter causes a ZAF_UPDATE_DATA request to be sent to all objects in the notification array that match *object-Source* and that have set their notification either to ZAF_UPDATE_DATA or ZAF_UPDATE_ALL. Be careful using the UpdateData() function, since it is used to reset the data, not the window object. If a matching object is not specified, the data will update according to all the objects in the notification array—an operation that may have undesirable results.

Usually, ZAF_ERROR_NONE is returned.

UpdateObjects

```
ZafError UpdateObjects(ZafNotifyObject *objectMatch =
   ZAF_NULLP(ZafNotifyObject));
```

UpdateObjects() forces any specified notification objects to immediately update visually. A null argument means update all the window object components.

When non-null, the *objectMatch* parameter causes a ZAF_UPDATE_OBJECT request to be sent to all objects in the notification array that match *objectMatch* and that have their notification set to either ZAF_UPDATE_OBJECT or ZAF_UPDATE_ALL. Remember, the notification array contains a set of objects that are to be notified whenever data has changed. Specifying an argument will only cause the specified object to be notified of the data change.

Generally, you will only want to use this function when notification has been disabled, then later re-enabled, or when you want the contents of any associated window objects to immediately update visually. The following example shows how two string objects can be updated when a ZafStringData object is modified.

```
// Associate one data object with two string objects.
ZafStringData *strData = new ZafStringData("Zinc Software",
    200);
window1->Add(new ZafString(0, 0, 20, strData, true));
window2->Add(new ZafString(0, 0, 20, strData, true));
...
// Remove the notification while we do some data work.
strData->SetUpdate(ZAF_UPDATE_NONE);
// Do some work with strData.
if (userWantsFax)
  *strData += ", Fax: 785-8996";
else if (userWantsPhone)
  *strData += ", Phone: 785-8900";
*strData += ", Pleasant Grove, UT";
// Reset the notification and update all associated objects.
strData->SetUpdate(ZAF_UPDATE_OBJECT);
strData->UpdateObjects();
```

Usually, ZAF_ERROR_NONE is returned.

ZafObjectPersistence

AddCompareFunction	GetClassName	Merge
AddObjectConstructor	GetCompareFunction	SetObjectConstructors
AddUserCallback	GetCompareFunctionName	SetUserCallbacks
AddUserObject	GetObjectConstructor	SetUserObjects
ClearCompareFunctions	GetUserCallback	SubtractCompareFunction
ClearObjectConstructors	GetUserCallbackName	SubtractObjectConstructor
ClearUserCallbacks	GetUserObject	SubtractUserCallback
ClearUserObjects	GetUserObjectName	SubtractUserObject

Inheritance `ZafObjectPersistence : ZafDataPersistence`

Declaration `#include <z_win.hpp>`

Description ZafObjectPersistence allows objects derived from ZafWindowObject to be written to, and/or read from a storage object—usually a persistent data file.

Using ZafObjectPersistence, a ZafWindowObject can be constructed directly from information stored in the data file, or stored there for later use. A table of persistent objects is maintained by this class and is used to reference each object's Read() function during construction. A table of ZafWindowObject classes used in application is generated by Zinc Designer, or may be supplied by the programmer. Derived objects may also be supported using a generated table or a programmer-supplied table. See AddObjectConstructor().

ZafObjectPersistence uses ZafFileSystem and ZafFile to maintain and manipulate one or more persistent object data files. See ZafStorage for more information.

Constructors

```
ZafObjectPersistence(ZafFileSystem *fileSystem,
   DataConstructor *dataConstructor, ObjectConstructor
   *objectConstructor, UserFunction *userFunction =
   ZAF_NULLP(UserFunction), CompareFunction
   *compareFunction = ZAF_NULLP(CompareFunction),
   UserObject *userObject = ZAF_NULLP(UserObject));
```

The ZafObjectPersistence class constructor creates a ZafObjectPersistence object based on the open file *fileSystem*, the persistent data constructor table *dataConstructor*, and the persistent window object constructor table *object-Constructor*.

Optionally, the programmer may create tables of other application information to be passed into the constructor as follows: *userFunction* is a table of user functions, *compareFunction* is a table of compare functions (used when sorting), and *userObject* is a table of user-defined objects. These tables must have a terminating entry in which the name field is null.

Following are the definitions of ZafObjectPersistence::ObjectConstructor, ZafObjectPersistence::UserFunction, ZafObjectPersistence::CompareFunction, and ZafObjectPersistence::UserObject. See ZafDataPersistence for definition of ZafDataPersistence::AddDataConstructor.

```
struct ObjectConstructor
{
  ZafClassID classID;
  ZafClassName className;
  ZafObjectConstructor constructor;
};
```

classID is the numeric class identification constant for the window object class, *className* is the string class identification constant for the window object class, and *constructor* is a pointer to the function used to construct an instance of the window object class. Internally, ZAF uses the *className* for its lookups. These identifiers are used by ZafObjectPersistence to locate the correct persistent constructor for a window object class.

The definition of ZafObjectConstructor is as follows:

```
typedef ZafElement *(*ZafObjectConstructor)(const ZafIChar *,
    ZafObjectPersistence &);

struct UserFunction
{
  ZafDataName name;
  ZafUserFunction function;
};
```

name is the unique string name of the user function and *function* is a pointer to the user function. These identifiers are used by ZafObjectPersistence to locate a user function in the user function table. The definitions of ZafDataName and ZafUserFunction are as follows:

```
typedef const ZafIChar *ZafDataName;
typedef ZafEventType (*ZafUserFunction)(ZafWindowObject *,
    ZafEventStruct &, ZafEventType);
```

The definition of ZafObjectConstructor is as follows:

```
struct CompareFunction
{
  ZafDataName name;
  ZafCompareFunction function;
};
```

name is the unique string name of the compare *function* and function is a pointer to the compare function. These identifiers are used by ZafObjectPersistence to locate a compare function in the compare function table. See ZafList for an explanation of CompareFunction.

The definition of ZafObjectConstructor is as follows:

```
struct UserObject
{
  ZafDataName name;
  void *object;
};
```

name is the unique string name of the user object and *object* is a pointer to the user object. Since object is a void pointer, it may refer to any type. These identifiers are used by ZafObjectPersistence to locate a user object in the user object table.

ZafObjectPersistence(const ZafObjectPersistence &copy);

The copy constructor creates a new ZafObjectPersistence object and initializes its data from *copy*.

The following code snippet shows how to create a ZafObjectPersistence object and use it to load a window object from storage:

```
// Create a storage object, which opens the data file.
ZafStorage *storage = new ZafStorage("test.znc", ZAF_FILE_READ);

// Create a persistence object for loading the window object.
// Use the global data and object constructor tables defined
// either in the ZAF persistence library or in the file
// generated by Zinc Designer.
zafObjectPersistence = new ZafObjectPersistence(storage,
    zafDefaultDataConstructor, zafDefaultObjectConstructor);

// Load the window object from the data file.
ZafWindow *window = new ZafWindow("MyWindow",
    *zafObjectPersistence);
```

The following code snippet shows how to derive a class that stores more information than just what the base class stores:

```
// Define the static members of MyStringObject.
ZafClassID MyStringObject::classID = 3600;
ZafClassNameChar MyStringObject::className[] ="MyStringObject";

// Persistent constructor of MyStringObject.
// Call PushLevel() before reading the base class information.
MyStringObject::MyStringObject(const ZafIChar *name,
    ZafObjectPersistence &persist) : ZafString(name,
    persist.PushLevel(className, classID,
    ZAF_PERSIST_DIRECTORY))
{
  if (persist.Error() == ZAF_ERROR_NONE)
  {
    // Read the MyStringObject class information.
    ZafFile *file = persist.CurrentFile();
    *file >> MyStringObject::member;
  }

  // Call PopLevel() after the class information has been read.
  persist.PopLevel();

  // Save the error into the object if the data couldn't be read.
  if (persist.Error() != ZAF_ERROR_NONE)
    SetError(persist.Error());
}

// Define Read(), since ZafWindowObject must add it to the
// ZafObjectPersistence object constructor table.
ZafElement *MyStringObject::Read(const ZafIChar *name,
    ZafObjectPersistence &persist)
{
  return (new MyStringObject(name, persist));
}

// Write() stores the class information in the data file.
void MyStringObject::Write(ZafObjectPersistence &persist)
{
  // Write the base class information.
  // Call PushLevel() before writing the base class information.
  // AllocateFile() is called internally to prepare the file.
  ZafString::Write(persist.PushLevel(className, classID,
    ZAF_PERSIST_DIRECTORY));

  if (persist.Error() == ZAF_ERROR_NONE)
  {
    // Write the MyStringObject class information.
    ZafFile *file = persist.CurrentFile();
    *file << MyStringObject::member;
  }
```

```
    // Call PopLevel() after writing the class information.
    persist.PopLevel();

    // Save the error into the object if the data couldn't be
      written.
    if (persist.Error() != ZAF_ERROR_NONE)
      SetError(persist.Error());
}
```

Destructor

virtual ~**ZafObjectPersistence**(void);

This virtual destructor is used to free the memory associated with an instantiated ZafObjectPersistence object. Generally, the programmer will not directly destroy a ZafObjectPersistence object, since it is destroyed when the application is closed.

Members

AddCompare-Function

```
virtual CompareFunction *AddCompareFunction(ZafDataName
    name, ZafCompareFunction function);
```

AddCompareFunction() adds a compare function to ZafObjectPersistence's table of compare functions. *name* is the unique string name of the compare function and *function* is a pointer to the compare function (available only at run-time). If an entry identified by *name* is already present in the table, its compare function is updated to *function*. A pointer to the CompareFunction element in the table is returned.

AddObject-Constructor

```
virtual ObjectConstructor
    *AddObjectConstructor(ZafClassName className,
    ZafClassID classID, ZafObjectConstructor constructor);
```

AddObjectConstructor() adds a window object class constructor to ZafObjectPersistence's table of constructors. *className* is the string class identification constant for the window object class, *classID* is the numeric class identification constant for the window object class, and *constructor* is a pointer to the function used to construct an instance of the window object class. If an entry with the same class identification constants is already present in the table, its constructor is updated to *constructor*. A pointer to the ObjectConstructor element in the table is returned.

AddUserCallback

```
virtual UserFunction *AddUserCallback(ZafDataName name,
    ZafUserFunction function);
```

AddUserCallback() adds a user function to ZafObjectPersistence's table of user functions. *name* is the unique string name of the user function and *function* is a pointer to the user function (available only at run-time). If an entry identified by *name* is already present in the table, its user function is updated to *function*. A pointer to the UserFunction element in the table is returned.

AddUserObject

```
virtual UserObject *AddUserObject(ZafDataName name, void
    *object);
```

AddUserObject() adds a user object to ZafObjectPersistence's table of user objects. *name* is the unique string name of the user object and *object* is a pointer to the user object. If an entry identified by *name* is already present in the table, its user object is updated to *object*. Since object is a void pointer, it may refer to any type. A pointer to the UserObject element in the table is returned.

ClearCompare-Functions

```
virtual void ClearCompareFunctions(void);
```

ClearCompareFunctions() clears the table of compare functions and destroys the memory associated with the table, so that no compare function is associated with the ZafObjectPersistence object.

ClearObject-Constructors

```
virtual void ClearObjectConstructors(void);
```

ClearObjectConstructors() clears the table of window object constructors and destroys the memory associated with the table, so that no window object constructor is associated with the ZafObjectPersistence object.

ClearUserCallbacks

```
virtual void ClearUserCallbacks(void);
```

ClearUserCallbacks() clears the table of user functions and destroys the memory associated with the table, so that no user function is associated with the ZafObjectPersistence object.

ClearUserObjects

```
virtual void ClearUserObjects(void);
```

ClearUserObjects() clears the table of user objects and destroys the memory associated with the table, so that no user object is associated with the ZafObjectPersistence object.

GetClassName

```
virtual ZafDataName GetClassName(ZafClassID classID);
```

GetClassName() searches the tables of constructors in ZafObjectPersistence, then in ZafDataPersistence for a class with a numeric class identification constant of *classID*. If a matching entry is found, its class name is returned; otherwise, null is returned.

GetCompare-Function

```
virtual ZafCompareFunction
   GetCompareFunction(ZafDataName name);
```

GetCompareFunction() finds and returns a compare function in ZafObjectPersistence's table of compare functions according to the unique string name of the compare function name. If no matching compare function is found, null is returned.

GetCompare-FunctionName

```
virtual ZafDataName
   GetCompareFunctionName(ZafCompareFunction function);
```

GetCompareFunctionName() finds and returns the unique string name corresponding to the compare function *function*. If no matching compare function is found, null is returned.

GetObject-Constructor

```
virtual ZafObjectConstructor
   GetObjectConstructor(ZafClassID classID, ZafClassName
   className = 0);
```

GetObjectConstructor() finds and returns a window object class constructor in ZafObjectPersistence's table of constructors according to the class identification constants. classID is the numeric class identification constant for the window object class and className is the string class identification constant for the window object class. If no matching class is found, null is returned.

GetUserCallback

```
virtual ZafUserFunction GetUserCallback(ZafDataName
   name);
```

GetUserCallback() finds and returns a user function in ZafObjectPersistence's table of user functions according to the unique string name of the user function name. If no matching user function is found, null is returned.

GetUserCallback-Name

```
virtual ZafDataName GetUserCallbackName(ZafUserFunction
   function);
```

GetUserCallbackName() finds and returns the unique string name corresponding to the user function *function*. If no matching user function is found, null is returned.

GetUserObject

```
virtual void *GetUserObject(ZafDataName name);
```

GetUserObject() finds and returns a user object in ZafObjectPersistence's table of user objects according to the unique string name of the user object name. If no matching user object is found, null is returned.

GetUserObject-Name

```
virtual ZafDataName GetUserObjectName(void *userObject);
```

GetUserObjectName() finds and returns the unique string name corresponding to the user object *userObject*. If no matching user object is found, null is returned.

Merge

```
bool Merge(ZafObjectPersistence &copy);
```

Merge() merges *copy* and all its data (including tables and file systems) into this ZafObjectPersistence object and returns true. The merged object’s tables and file systems are removed from *copy* and added to this ZafObjectPersistence object, so *copy* is in effect empty after calling this function.

SetCompare-Functions

```
virtual bool SetCompareFunctions(CompareFunction
    *compareFunction);
```

SetCompareFunctions() clears ZafObjectPersistence's table of compare functions, then creates a new table of compare functions based on the pre-built *compareFunction* table. SetCompareFunctions() is an advanced routine, and should normally not be called by the programmer.

SetObject-Constructors

```
virtual bool SetObjectConstructors(ObjectConstructor
    *objectConstructor);
```

SetObjectConstructors() clears ZafObjectPersistence's table of constructors, then creates a new table of constructors based on the pre-built *objectConstructor* table. SetObjectConstructors() is an advanced routine, and should normally not be called by the programmer.

SetUserCallbacks

```
virtual bool SetUserCallbacks(UserFunction
    *userFunction);
```

SetUserCallbacks() clears ZafObjectPersistence's table of user functions, then creates a new table of user functions based on the pre-built *userFunction* table. SetUserCallbacks() is an advanced routine, and should normally not be called by the programmer.

SetUserObjects

```
virtual bool SetUserObjects(UserObject *userObject);
```

SetUserObjects() clears ZafObjectPersistence's table of user objects, then creates a new table of user objects based on the pre-built *userObject* table. SetUserObjects() is an advanced routine, and should normally not be called by the programmer.

Subtract-CompareFunction

```
virtual bool SubtractCompareFunction(ZafDataName name);
```

SubtractCompareFunction() removes a compare function from ZafObjectPersistence's table of compare functions. *name* is the unique string name of the compare function. If the entry was successfully removed, true is returned; otherwise, false is returned.

SubtractObject-Constructor

```
virtual bool SubtractObjectConstructor(ZafClassID
   classID, ZafClassName className = 0);
```

SubtractObjectConstructor() removes a window object class constructor from ZafObjectPersistence's table of constructors. *classID* is the numeric class identification constant for the window object class and *className* is the string class identification constant for the window object class. If the entry was successfully removed, true is returned; otherwise, false is returned.

SubtractUser-Callback

```
virtual bool SubtractUserCallback(ZafDataName name);
```

SubtractUserCallback() removes a user function from ZafObjectPersistence's table of user functions. *name* is the unique string name of the user function. If the entry was successfully removed, true is returned; otherwise, false is returned.

SubtractUserObject

```
virtual bool SubtractUserObject(ZafDataName name);
```

SubtractUserObject() removes a user object from ZafObjectPersistence's table of user objects. *name* is the unique string name of the user object. If the entry was successfully removed, true is returned; otherwise, false is returned.

ZafPaletteData

AddPalette	GetPalette	StaticData
Clear	MapTable	operator ()

Inheritance `ZafPaletteData : ZafData : ZafNotification, ZafElement`

Declaration `#include <z_pal1.hpp>`

Description ZafPaletteData is used to maintain and persist ZafPaletteMap tables, commonly used by ZAF objects derived from ZafWindowObject. See ZafWindowObject::UserPaletteData() for more information.

Constructors All ZafPaletteData constructors initialize the member variables associated with an instantiated ZafPaletteData object. The default values set by the ZafPaletteData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafPaletteData	
`MapTable()`	`null`
`StaticData()`	`false`
ZafElement	
`ClassID()`	`ID_ZAF_PALETTE_DATA`
`ClassName()`	`"ZafPaletteData"`

```
ZafPaletteData(bool staticData = false);
ZafPaletteData(ZafPaletteMap *mapTable, bool staticData =
   false);
```

These constructors allocate a ZafPaletteData instance and initialize StaticData() to *staticData*. *mapTable* specifies the ZafPaletteMap table to use for MapTable(). See ZafPaletteMap for more information.

```
ZafPaletteData(const ZafPaletteData &copy);
```

The copy constructor creates a new ZafPaletteData object and initializes its data from *copy*.

`**ZafPaletteData**(const ZafIChar *name, ZafDataPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code snippet shows how to create a ZafPaletteData object:

```
// Create a ZafPaletteData object.
ZafPaletteMap myPaletteMap[] =
{
  { ZAF_PM_BACKGROUND, ZAF_PM_ANY_STATE, { ZAF_LINE_NULL,
    ZAF_PTN_SOLID_FILL, ZAF_CLR_NULL, ZAF_CLR_WHITE,
    ZAF_MONO_NULL, ZAF_MONO_WHITE, ZAF_FNT_NULL, 0 } },
  { ZAF_PM_TEXT, ZAF_PM_ANY_STATE, { ZAF_LINE_NULL,
    ZAF_PTN_SOLID_FILL, ZAF_CLR_DARKGRAY, ZAF_CLR_WHITE,
    ZAF_MONO_BLACK, ZAF_MONO_WHITE, ZAF_FNT_DIALOG, 0 } },
  { ZAF_PM_ANY_TYPE, ZAF_PM_ANY_STATE, { ZAF_LINE_SOLID,
    ZAF_PTN_SOLID_FILL, ZAF_CLR_BLACK, ZAF_CLR_WHITE,
    ZAF_MONO_BLACK, ZAF_MONO_WHITE, ZAF_FNT_DIALOG, 0 } }
};
ZafPaletteData paletteData(myPaletteMap, false);
```

Destructor

`virtual ~**ZafPaletteData**(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafPaletteData object.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AddPalette

`ZafError **AddPalette**(ZafPaletteType type, ZafPaletteState state, ZafPaletteStruct &palette);`

AddPalette() inserts an entry into the MapTable() and initializes the new entry's fields to *type*, *state*, and *palette*. AddPalette() usually returns ZAF_ERROR_NONE. See ZafPaletteMap for more information.

Clear

`virtual void **Clear**(void);`

Clear() destroys the MapTable() if StaticData() is false. Regardless of StaticData(), MapTable() is set to null, effectively clearing the palette map data.

GetPalette

```
ZafPaletteStruct GetPalette(ZafPaletteType type,
   ZafPaletteState state);
```

GetPalette() finds an entry in the MapTable() corresponding to *type* and *state* and returns the ZafPaletteStruct portion of the entry. If no entry was found corresponding to *type* and *state*, an empty ZafPaletteStruct object is returned. See ZafPaletteMap for more information.

MapTable

```
const ZafPaletteMap *MapTable(void);
virtual ZafError SetMapTable(ZafPaletteMap *paletteMap);
```

MapTable() returns the palette map table associated with the ZafPaletteData object. This attribute defaults to null, but may be changed with SetMapTable(). SetMapTable() usually returns ZAF_ERROR_NONE.

StaticData

```
bool StaticData(void) const;
virtual bool SetStaticData(bool staticData);
```

If StaticData() is true, then MapTable() is considered static, and will not be destroyed by the ZafPaletteData class neither in the destructor, nor in SetMapTable(). This attribute defaults to false, but may be changed with SetStaticData().

operator ()

```
operator const ZafPaletteMap *();
```

This operator returns the MapTable() attribute.

ZafPaletteMap

type	state	palette

Inheritance

`Root struct`

Declaration

`#include <z_pal1.hpp>`

Description

The ZafPaletteMap struct is normally used in tables, and is used to map ZafPaletteStruct values to ZAF objects according to their current drawing type and state. See ZafWindowObject::UserPaletteData() for more information.

Members

type

`ZafPaletteType` **`type`**`;`

type specifies the type of drawing being done for the object. Some examples are ZAF_PM_BACKGROUND (when drawing the background portion of the object) and ZAF_PM_TEXT (when drawing the textual information of the object). See ZafWindowObject::UserPaletteData() for more information.

state

`ZafPaletteState` **`state`**`;`

state specifies the object's current state during the draw operation. Some examples are ZAF_PM_CURRENT (when the object is current) and ZAF_PM_DISABLED (when the object is disabled). See ZafWindowObject::UserPaletteData() for more information.

palette

`ZafPaletteStruct` **`palette`**`;`

palette specifies the palette to be used for the draw operation, if type and state are appropriate for the draw operation. See ZafPaletteStruct for more information.

ZafPaletteStruct

colorBackground	font	monoForeground
colorForeground		osPalette
fillPattern	monoBackground	

Inheritance

`Root struct`

Declaration

`#include <z_pal.hpp>`

Description

ZafPaletteStruct is used to store palette information to be used during draw operations. A common use of ZafPaletteStruct is by ZafPaletteMap's palette member. A draw operation looks into a ZafPaletteStruct object to find the color or style to use. See ZafPaletteMap and ZafWindowObject::UserPalette-Data() for more information.

Members

colorBackground
colorForeground

```
ZafLogicalColor colorBackground;
ZafLogicalColor colorForeground;
```

colorBackground specifies the color to use when drawing a background on a color or grayscale screen, and colorForeground specifies the color to use when drawing a foreground on a color or grayscale screen. The possible values of these members are as follows:

ZafLogicalColor	Description
ZAF_CLR_BACKGROUND	Causes the color to be transparent, so that whatever is underneath the object shows through
ZAF_CLR_BLACK	Causes black to be used
ZAF_CLR_BLUE	Causes blue to be used
ZAF_CLR_BROWN	Causes brown to be used
ZAF_CLR_CYAN	Causes cyan to be used
ZAF_CLR_DARKGRAY	Causes dark gray to be used
ZAF_CLR_DEFAULT	Causes the object to use the environment's default color
ZAF_CLR_GREEN	Causes green to be used
ZAF_CLR_LIGHTBLUE	Causes light blue to be used
ZAF_CLR_LIGHTCYAN	Causes light cyan to be used
ZAF_CLR_LIGHTGRAY	Causes light gray to be used
ZAF_CLR_LIGHTGREEN	Causes light green to be used

ZafLogicalColor	Description
`ZAF_CLR_LIGHTMAGENTA`	Causes light magenta to be used
`ZAF_CLR_LIGHTRED`	Causes light red to be used
`ZAF_CLR_MAGENTA`	Causes magenta to be used
`ZAF_CLR_NULL`	Causes the object to use the class default color
`ZAF_CLR_PARENT`	Causes the object to use it's parent's color
`ZAF_CLR_RED`	Causes red to be used
`ZAF_CLR_WHITE`	Causes white to be used
`ZAF_CLR_YELLOW`	Causes yellow to be used

lineStyle

`ZafLogicalLineStyle **lineStyle**;`

lineStyle specifies the style to use when drawing a line. The possible values of this member are as follows:

ZafLogicalLineStyle	Description
`ZAF_LINE_DEFAULT`	Causes the object to use the environment's default line style
`ZAF_LINE_DOTTED`	Causes a dotted line to be drawn, if supported on the environment
`ZAF_LINE_NULL`	Causes the object to use the class default line style
`ZAF_LINE_PARENT`	Causes the object to use it's parent's line style
`ZAF_LINE_SOLID`	Causes a solid line to be drawn

fillPattern

`ZafLogicalFillPattern **fillPattern**;`

fillPattern specifies the pattern to use when filling a shape. The possible values of this member are as follows:

ZafLogicalFillPattern	Description
`ZAF_PTN_DEFAULT`	Causes the object to use the environ-ment's default fill pattern
`ZAF_PTN_INTERLEAVE_FILL`	Causes a 50% interleave fill pattern to be used
`ZAF_PTN_NULL`	Causes the object to use the class default fill pattern

ZafLogicalFillPattern	Description
ZAF_PTN_PARENT	Causes the object to use it's parent's fill pattern
ZAF_PTN_SOLID_FILL	Causes a solid fill pattern to be used

font

`ZafLogicalFont **font**;`

font specifies the font to use when drawing text. The possible values of this member are as follows:

ZafLogicalFont	Description
ZAF_FNT_APPLICATION	Causes the application font to be used (as with multi-line text fields)
ZAF_FNT_DEFAULT	Causes the object to use the environment's default font
ZAF_FNT_DIALOG	Causes the dialog font to be used (as on dialog windows)
ZAF_FNT_FIXED	Causes the fixed-width font to be used (such as Courier)
ZAF_FNT_NULL	Causes the object to use the class default font
ZAF_FNT_PARENT	Causes the object to use it's parent's font
ZAF_FNT_SMALL	Causes the small font to be used (as with icons)
ZAF_FNT_SYSTEM	Causes the system font to be used (as on window title bars)

monoBackground
monoForeground

```
ZafLogicalColor monoBackground;
ZafLogicalColor monoForeground;
```

monoBackground specifies the color to use when drawing a background on a black and white screen, and monoForeground specifies the color to use when drawing a foreground on a black and white screen. The possible values of these members are as follows:

ZafLogicalColor	Description
ZAF_MONO_BACKGROUND	Causes the color to be transparent, so that whatever is underneath the object shows through
ZAF_MONO_BLACK	Causes black to be used
ZAF_MONO_DEFAULT	Causes the object to use the environment's default color

ZafLogicalColor	Description
`ZAF_MONO_DIM`	Causes dim intensity to be used (text mode only)
`ZAF_MONO_HIGH`	Causes high intensity to be used (text mode only)
`ZAF_MONO_NORMAL`	Causes normal intensity to be used (text mode only)
`ZAF_MONO_NULL`	Causes the object to use the class default color
`ZAF_MONO_PARENT`	Causes the object to use it's parent's color
`ZAF_MONO_WHITE`	Causes white to be used

osPalette

`OSPaletteID` **`osPalette`**`;`

osPalette is used internally by ZAF, and specifies environment-specific palette information, if necessary. This is an advanced member, and the programmer should normally not access this member.

ZafPath

Load

Inheritance

`ZafPath : ZafList`

Declaration

`#include <z_file.hpp>`

Description

A search path may be built by adding ZafPathElement objects to a ZafPath object. The global zafSearchPath is used internally by ZAF when trying to open a data file. The path elements are searched in the order that they were added to the ZafPath object. See ZafPathElement for more information.

Constructor

`ZafPath``(const ZafIChar *pwd, bool getCwd);`

This constructor is useful in straight-code situations, and creates a ZafPath object. If *pwd* is not null, it is a path specification to be added as a ZafPathElement to the new ZafPath object. If *getCwd* is true, the current directory is added as a ZafPathElement to the new ZafPath object as the first child of the ZafPath object (before *pwd* if it was added). Lastly, this constructor attempts to load the "ZAF_PATH" environment variable's contents (see Load() for more information).

An example of how to create a search path follows:

```
// Create the global search path, including the current
   directory.
zafSearchPath = new ZafPath(ZAF_NULLP(ZafIChar), true);

// Add a data file subdirectory to the search path.
extern ZafIChar dataFilePath[];
zafSearchPath->Add(new ZafPathElement(dataFilePath));
```

Members

Load

`bool `**`Load`**`(const ZafIChar *envname);`

Load() finds the *envname* environment variable if it exists in the environment, and loads a new ZafPathElement object for each path specifier denoted by the environment variable into the ZafPath object. The ZafPath constructor automatically calls Load() to attempt to load the "ZAF_PATH" environment variable's contents.

ZafPathElement

Path

Inheritance `ZafPathElement : ZafElement`

Declaration `#include <z_file.hpp>`

Description

A search path may be built by adding ZafPathElement objects to a ZafPath object. Either a full path specification or a partial path specification may be associated with a ZafPathElement object, but path specifications are non-portable. For example, MS-DOS uses a colon (":") for a drive separator and a backslash ("\") for a directory separator. Unix does not have the concept of a drive and it uses a forward slash ("/") for a directory separator. The Macintosh uses a colon (":") for both a drive and a directory separator. The diversity of path specification notation requires that different path elements be used on different environments.

See ZafPath for more information on search paths.

Constructor

The ZafPathElement constructor initializes the member variables associated with an instantiated ZafPathElement object. The default values set by the ZafPathElement follows.

Member Initializations

ZafPathElement	
`Path()`	`user-supplied parameter`

```
ZafPathElement(const ZafIChar *path, int length = -1);
```

This constructor is useful in straight-code situations to create a ZafPathElement object. *path* specifies the environment-specific search pathname to be associated with this ZafPathElement object. *length* specifies the maximum number of ZafIChars to be copied from *path*. If *length* is - 1, the entire *path* buffer is copied into the ZafPathElement object.

See ZafPath for an example of how to create a search path.

Members

Path

```
const ZafIChar *Path(void) const;
ZafError SetPath(const ZafIChar *path, int length = -1);
```

Path() returns the environment-specific search pathname associated with this ZafPathElement object. This attribute may be changed by calling SetPath().

path specifies the environment- specific search pathname to be associated with this ZafPathElement object. *length* specifies the maximum number of ZafI-Chars to be copied from *path*. If *length* is -1, the entire *path* buffer is copied into the ZafPathElement object.

ZafPopUpItem

Add	FocusObject	menu
Count	Get	Sort
Current	GetObject	Subtract
Destroy	Index	operator +
Event	ItemType	operator -
First	Last	

Inheritance `ZafPopUpItem : ZafButton : ZafWindowObject : ZafElement`

Declaration `#include <z_popup.hpp>`

Description ZafPopUpItem objects are the items in a menu. A hierarchical sub-menu may be created by simply adding ZafPopUpItem objects to a ZafPopUpItem object. A ZafPopUpItem object with its Selected() attribute set to true displays a checkmark. It is important to note that ZafPopUpItem objects may only be added to a ZafPullDownItem object, a ZafPopUpMenu object, or another ZafPopUpItem object.

Constructors All ZafPopUpItem constructors initialize the member variables associated with an instantiated ZafPopUpItem object. The default values set by the ZafPopUpItem and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafPopUpItem. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafPopUpItem

`ItemType()`	`user-supplied parameter`
`menu`	`ZafPopUpMenu(0, 0)`
`menu.parent`	`this`
`menu.StringID()`	`"menu"`

ZafButton

`AllowDefault()`	`false`†
`AutoRepeatSelection()`	`false`†
`AutoSize()`	`false`†
`BitmapData()`	`ZAF_NULLP(ZafBitmapData)`†
`ButtonType()`	`ZAF_FLAT_BUTTON`†
`Depressed()`	`false`†
`Depth()`	`0`†

Member Initializations

`HzJustify()`	`ZAF_HZ_LEFT`†
`SelectOnDoubleClick()`	`false`†
`SelectOnDownClick()`	`false`†
`VtJustify()`	`ZAF_VT_CENTER`†
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`CopyDraggable()`	`false`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`RegionType()`	`ZAF_INSIDE_REGION`†
`SupportObject()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_POP_UP_ITEM`
`ClassName()`	`"ZafPopUpItem"`

```
ZafPopUpItem(const ZafIChar *text, ZafPopUpItemType
   itemType = ZAF_NORMAL_ITEM);
```

This constructor is useful in straight-code situations, particularly if you wish the ZafPopUpItem object to create, maintain and destroy its own ZafString-Data object automatically. *text* specifies the text to appear in the new ZafPop-UpItem object, and *itemType* specifies the type of menu item to be created. See ItemType() for more information on menu item types.

```
ZafPopUpItem(ZafStringData *stringData, ZafPopUpItemType
   itemType = ZAF_NORMAL_ITEM);
```

This constructor is also useful in straight-code situations, particularly if you have already created a ZafStringData object to be associated with the ZafPop-UpItem object. This constructor could be used to maintain string data pieces yourself, rather than having the ZafPopUpItem class create and maintain the string data pieces automatically. For example, to maintain a database of Zaf-StringData objects and tie them into ZafPopUpItem objects, maintain your own ZafStringData objects and create ZafPopUpItem objects using your Zaf-StringData objects. For more information on using ZafStringData objects, see

ZafStringData. The *stringData* parameter specifies the string data object to be associated with the ZafPopUpItem object. Otherwise, this constructor (and parameters) is the same as the first.

```
ZafPopUpItem(const ZafPopUpItem &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It copies the information from another ZafPopUpItem object, *copy*. If the data objects are StaticData(), the new ZafPopUpItem object simply points to the original data objects, otherwise a copy is made for the new Zaf-PopUpItem object. This allows a programmer to use static data for more than one ZafPopUpItem object.

```
ZafPopUpItem(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. The parameters and values of this constructor are deferred to the ZafWindow section of this manual, since most persistence is done at the ZafWindow level.

Refer to ZafPullDownMenu for an example of how to create ZafPopUpItem objects.

Destructor

```
virtual ~ZafPopUpItem(void);
```

The destructor is used to free the memory associated with a ZafPopUpItem object, including all the data object pieces (such as StringData()) that are Destroyable(). It chains to the ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafPopUpItem object, since it is automatically destroyed when its parent pop-up menu is destroyed. For more information on child object deletion, see ZafWindow::~ZafWin-dow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Add

```
virtual ZafWindowObject *Add(ZafWindowObject *object,
   ZafWindowObject *position =
   ZAF_NULLP(ZafWindowObject));
```

operator +

```
ZafPopUpItem &operator+(ZafWindowObject *object);
```

This function and operator are used to create sub-menu items by adding ZafPopUpItem objects to the ZafPopUpItem object. The functionality is provided by the ZafPopUpMenu class through the menu member. *object* is a pointer to the ZafPopUpItem object to be added to the ZafPopUpItem object's sub-menu. *position* specifies which ZafPopUpItem object already in the menu that *object* should appear before. If *position* is null, *object* is added to the end of the menu. See ZafWindow::Add() for more information.

Count

```
int Count(void) const;
```

Count() returns the number of ZafPopUpItem objects in the sub-menu, or 0 if there is no sub-menu. See ZafList::Count() for more information.

Current

```
ZafWindowObject *Current(void) const;
```

Current() returns the current ZafPopUpItem object in the sub-menu, if there is one. The Current() item does not necessarily have focus. Some native environment implementations of menus do not allow the menu to ever have focus. See ZafList::Current() for more information.

Destroy

```
virtual void Destroy(void);
```

Destroy() causes all the ZafPopUpItem objects in the sub-menu to be destroyed, if there is one. This is useful if a sub-menu is to be recreated from scratch. See ZafList::Destroy() for more information.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events that get sent to the ZafPopUpItem object, either by processing the events itself, or by passing the event down for base class processing. Refer to ZafWindowObject for complete details. Following are events that are handled by ZafPopUpItem in addition to those handled by its base classes:

Event	Action
`S_ADD_OBJECT`	Causes event.windowObject to be added to the sub-menu
`S_SUBTRACT_OBJECT`	Causes event.windowObject to be subtracted from the sub-menu

First

```
ZafWindowObject *First(void) const;
```

The First() function returns the first ZafPopUpItem object in the sub-menu, if any. See ZafList::First() for more information.

FocusObject

```
virtual ZafWindowObject *FocusObject(void) const;
```

FocusObject() returns the ZafPopUpItem object in the sub-menu that has focus, if there is one. Some native environment implementations of menus do not allow the menu to ever have focus, so this function will always return null in these cases. See ZafWindow::FocusObject() for more information.

Get

```
ZafWindowObject *Get(int index);
```

Get() returns the ZafPopUpItem object at *position* index in the sub-menu, if there is one. *index* is zero-based, meaning the first ZafPopUpItem object in the sub-menu is at position 0. See ZafList::Get() for more information.

GetObject

```
virtual ZafWindowObject *GetObject(ZafNumberID numberID);
virtual ZafWindowObject *GetObject(const ZafIChar
   *stringID);
```

GetObject() return the ZafPopUpItem object in the sub-menu with either the *numberID* of *numberID* (if there is one), or the stringID of stringID, if it is found. See ZafWindowObject::GetObject() for more information.

Index

```
int Index(ZafWindowObject const *element);
```

If there is a sub-menu, the Index() function returns the zero-based index of the ZafPopUpItem object *element* in the sub-menu. If there is no sub-menu or *element* is not found in the sub-menu, Index() returns -1. See ZafList::Index() for more information.

ItemType

```
ZafPopUpItemType ItemType(void) const;
virtual ZafPopUpItemType SetItemType(ZafPopUpItemType
   itemType);
```

ItemType() specifies the menu item type of a ZafPopUpItem object. The default value of this attribute is ZAF_NORMAL_ITEM, but the user may call SetItemType() to make changes. Below is a list of possible menu item types:

ZafPopUpItemType	Description
ZAF_NORMAL_ITEM	Creates a normal menu item

ZafPopUpItemType	Description
`ZAF_ABOUT_OPTION`	Creates an about menu item (on the Macintosh, placed in the Apple menu)
`ZAF_CLOSE_OPTION`	Creates an S_CLOSE menu item with the appropriate text, hotkey and SendMessage() information
`ZAF_COPY_OPTION`	Creates an S_COPY menu item with the appropriate text, hotkey and SendMessage() information
`ZAF_CUT_OPTION`	Creates an S_CUT menu item with the appropriate text, hotkey and SendMessage() information
`ZAF_EXIT_OPTION`	Creates an S_EXIT menu item with the appropriate text, hotkey and SendMessage() information
`ZAF_MAXIMIZE_OPTION`	Creates an S_MAXIMIZE menu item in system menus
`ZAF_MINIMIZE_OPTION`	Creates an S_MINIMIZE menu item in system menus
`ZAF_MOVE_OPTION`	Creates an S_MOVE_MODE menu item in system menus
`ZAF_PASTE_OPTION`	Creates an S_PASTE menu item with the appropriate text, hotkey and SendMessage() information
`ZAF_RESTORE_OPTION`	Creates an S_RESTORE menu item in system menus
`ZAF_SEPARATOR`	Creates a Disabled() and Noncurrent() separator line menu item
`ZAF_SIZE_OPTION`	Creates an S_SIZE_MODE menu item in system menus
`ZAF_SWITCH_OPTION`	Creates a switch menu item in system menus

Last

`ZafWindowObject *`**`Last`**`(void) const;`

Last() returns the last ZafPopUpItem object in the sub-menu, if any. See ZafList::Last() for more information.

menu

```
ZafPopUpMenu menu;
```

The menu member, used internally by the ZAF libraries to maintain the ZafPopUpItem objects added to the ZafPopUpItem object (forming the sub-menu), should normally not be accessed by the programmer. See ZafPopUpMenu for more information.

Sort

```
virtual void Sort(void);
```

Sort() causes the ZafPopUpItem objects in the sub-menu (if there is one) to be sorted according to the function returned by CompareFunction(). See ZafList::CompareFunction() for more information.

Subtract

operator -

```
virtual ZafWindowObject *Subtract(ZafWindowObject
    *object);
ZafPopUpItem &operator-(ZafWindowObject *object);
```

This function and operator are used for subtracting (or removing) ZafPopUpItem objects from the ZafPopUpItem object's sub-menu. The functionality is provided by the ZafPopUpMenu class through the menu member. *object* is a pointer to the ZafPopUpItem object to be subtracted. See ZafWindow::Subtract() for more information.

ZafPopUpMenu

Inheritance `ZafPopUpMenu : ZafWindow : ((ZafWindowObject : ZafElement), ZafList)`

Declaration `#include <z_popup.hpp>`

Description The ZafPopUpMenu object is a pop-up menu object that supports multiple-leveled menu hierarchies. As with all other ZAF classes, the ZafPopUpMenu class utilizes the native pop-up menu API if available, so the look-and-feel is exactly what the end user expects. The pop-up menu object may be added to a ZafWindowManager object to provide a detached pop-up menu on the screen that disappears when the user selects an item.

If the pop-up menu is not added to a ZafWindowManager object, it is completely managed internally to the ZAF libraries, and should not be accessed by the programmer. Each ZafPullDownItem and ZafPopUpItem object has a ZafPopUpMenu member associated with it to handle support for adding ZafPopUpItem objects. Only ZafPopUpItem objects may be added to a ZafPopUpMenu object.

Constructors All ZafPopUpMenu constructors initialize the member variables associated with an instantiated ZafPopUpMenu object. The default values set by the ZafPopUpMenu and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafPopUpMenu. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`true`†
`Sizeable()`	`false`†
`Temporary()`	`true`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`true`†

Member Initializations

`Disabled()`	`false`†
`Noncurrent()`	`false`†
`ParentPalette()`	`false`†
`RegionType()`	`ZAF_INSIDE_REGION`†
ZafElement	
`ClassID()`	`ID_ZAF_POP_UP_MENU`
`ClassName()`	`"ZafPopUpMenu"`

ZafPopUpMenu`(int left, int top);`

This constructor is useful in straight-code situations. If the pop-up menu is to be added to a ZafWindowManager object, the *left* and *top* parameters specify the position where the left and top of the menu will be placed on the screen, respectively. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. Otherwise, the parameters are ignored.

ZafPopUpMenu`(const ZafPopUpMenu &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafPopUpMenu object and copies the object's information.

ZafPopUpMenu`(const ZafIChar *name, ZafObjectPersistence`
`&persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following shows how to create a ZafPopUpMenu object:

```
// Create and populate the edit menu.
ZafPopUpMenu *editMenu = new ZafPopUpMenu(10, 10);
editMenu->Add(new ZafPopUpItem("Undo"));
editMenu->Add(new ZafPopUpItem("", ZAF_SEPARATOR));
editMenu->Add(new ZafPopUpItem("", ZAF_CUT_OPTION));
editMenu->Add(new ZafPopUpItem("", ZAF_COPY_OPTION));
editMenu->Add(new ZafPopUpItem("", ZAF_PASTE_OPTION));
// Add the edit menu to the screen.
windowManager->Add(editMenu);
```

Destructor

virtual ~**ZafPopUpMenu**(void);

The destructor is used to free the memory associated with a ZafPopUpMenu object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafPopUpMenu object, since it is automatically destroyed when its parent menu bar is destroyed. However, if the ZafPopUpMenu object is added to the window manager, it will have to be destroyed when it is no longer needed, since it Destroyable() is false in this case. For more information on child object deletion, see ZafWindow::~ZafWindow().

ZafPositionStruct

Assign	HzShift	VtShift
column	Import	operator ==
ConvertCoordinates	line	operator !=
Export	Position	

Inheritance

`ZafPositionStruct : ZafCoordinateStruct`

Declaration

`#include <z_pos.hpp>`

Description

ZafPositionStruct provides support for storing a position in 2-dimensional space. Various different coordinate systems may be specified for the position using the base ZafCoordinateStruct. See ZafCoordinateStruct for more information.

Members

Assign

```
void Assign(int column, int line, ZafCoordinateType type =
   ZAF_COORD_DEFAULT);
```

Assign() sets the position to *column* along the x-axis, and to *line* along the y-axis. If *type* is ZAF_COORD_DEFAULT, coordinateType is unchanged; otherwise, coordinateType is set to *type*.

column
line

```
int column, line;
```

column and *line* store the position's values along the x-axis and y-axis, respectively.

ConvertCoordinates

```
void ConvertCoordinates(ZafCoordinateType newType);
```

ConvertCoordinates() converts the position to the *newType* coordinateSystem.

Export

```
void Export(POINT &point) const;
void Export(Point &point) const;
```

Export() exports the position to *point* in the native environment's position type. For example, in Microsoft Windows, the built-in type POINT is used, and on the Macintosh, the built-in type Point is used.

HzShift

```
void HzShift(int shift);
```

HzShift() modifies the position along the x-axis by the amount specified in *shift*. If *shift* is positive, the position moves in the positive direction. If *shift* is negative, the position moves in the negative direction.

Import

```
void Import(const POINT &point);
void Import(const Point &point);
```

Import() imports the position from *point* in the native environment's position type. For example, in Microsoft Windows, the built-in type POINT is used, and on the Macintosh, the built-in type Point is used.

Position

```
ZafPositionStruct Position(ZafCoordinateType type);
```

Position() returns the position converted to the *type* coordinate system. The original position is not modified.

VtShift

```
void VtShift(int shift);
```

VtShift() modifies the position along the y-axis by the amount specified in *shift*. If *shift* is positive, the position moves in the positive direction. If *shift* is negative, the position moves in the negative direction.

operator ==

```
bool operator==(const ZafPositionStruct &position) const;
```

This operator returns true if *position* is equal to this position object; otherwise it returns false. If the coordinate systems are different, a converted version of *position* is used in the comparison.

operator !=

```
bool operator!=(const ZafPositionStruct &position) const;
```

This operator returns true if *position* is not equal to this position object; otherwise it returns false. If the coordinate systems are different, a converted version of *position* is used in the comparison.

ZafProgressBar

Current	Maximum	ProgressType
Decrement	Minimum	Step
Delta	ProgressData	TextStyle
Increment	ProgressStyle	

Inheritance `ZafProgressBar : ZafWindowObject : ZafElement`

Declaration `#include <z_prgrss.hpp>`

Description The ZafProgressBar object is a static informational object generally used to indicate the progress of some operation. The progress may be indicated in percentages or some other integral unit of measurement. The ZafProgressBar object allows no user interaction, and is intended for use only to display information.

Constructors All ZafProgressBar constructors initialize the member variables associated with an instantiated ZafProgressBar object. The default values set by the ZafProgressBar and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafProgressBar. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafProgressBar

ProgressData()	null
ProgressStyle()	ZAF_PROGRESS_NATIVE
ProgressType()	ZAF_PROGRESS_HORIZONTAL
TextStyle()	ZAF_PROGRESS_TEXT_VALUE

ZafWindowObject

AcceptDrop()	false†
CopyDraggable()	false†
Focus()	false†
HelpContext()	null†
LinkDraggable()	false†
MoveDraggable()	false†
Noncurrent()	true†
OSDraw()	false
ParentDrawBorder()	false†
ParentDrawFocus()	false†

Member Initializations

`ParentPalette()`	`false`†
`Selected()`	`false`†
`UserFunction()`	`null`†
ZafElement	
`ClassID()`	`ID_ZAF_PROGRESS_BAR`
`ClassName()`	`"ZafProgressBar"`

ZafProgressBar`(int left, int top, int width, int height,`
`ZafScrollData *scrollData);`

This constructor is useful in straight-code situations. The *left* and *top* parameters specify the position where the left and top of the object will be placed on its parent. The *width* and *height* parameters specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. The *scrollData* parameter specifies the ProgressData() object. If the *scrollData* parameter is null, this constructor will create a ProgressData() object automatically, with the ZafScrollData class default information.

ZafProgressBar`(const ZafProgressBar &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafProgressBar object and copies the object's information. If *copy*'s data objects are StaticData() then the new ZafProgressBar object simply points to the original data objects, otherwise copies are made for the new ZafProgressBar object. This behavior allows a programmer to use static data for more than one ZafProgressBar object.

ZafProgressBar`(const ZafIChar *name,`
`ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following shows how to create a ZafProgressBar:

```
// Create a sample window with a progress bar.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 4);
// Create the progress data for 0-100% with 20% intervals.
ZafScrollData *progressData = new ZafScrollData(0, 100, 0, 20);
```

```
// Create the progress bar to display percentages.
ZafProgressBar *progressBar = new ZafProgressBar(5, 1, 30, 1,
    progressData);
progressBar->SetTextStyle(ZAF_PROGRESS_TEXT_PERCENT);
// Add the progress bar to the window.
window1->Add(progressBar);
```

Destructor

`virtual ~`**`ZafProgressBar`**`(void);`

This destructor is used to free the memory associated with a ZafProgressBar object, including ProgressData(), if it is Destroyable(). It chains to the Zaf-WindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafProgressBar object, since it is automatically destroyed when it's parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Current

`long `**`Current`**`(void) const;`
`long `**`SetCurrent`**`(long current);`

The current value of the progress bar appears as a numerical value in the middle of the progress bar when the progress bar supports textual information. Current() returns the current value of the progress bar by calling Progress-Data()->Current(). The current value of the progress bar may be set by calling SetCurrent(), which simply calls ProgressData()->SetCurrent().

Decrement

`long `**`Decrement`**`(long value);`

Decrement() decrements the progress bar by the amount Delta() by passing *value* to ProgressData()->Decrement(). The current value of the progress bar is returned.

Delta

`long `**`Delta`**`(void) const;`
`long `**`SetDelta`**`(long current);`

The delta value of the progress bar is the amount that the progress bar increments or decrements each time it is updated. Delta() returns the delta value of the progress bar by calling ProgressData()->Delta(). The delta value of the progress bar may be set by calling SetDelta(), which simply calls Progress-Data()->SetDelta().

Increment

```
long Increment(long value);
```

Increment() increments the progress bar by the amount Delta() by passing *value* to ProgressData()->Increment(). The current value of the progress bar is returned.

Maximum

```
long Maximum(void) const;
long SetMaximum(long maximum);
```

The maximum value of the progress bar is the value at which the progress bar quits updating, and the operation whose progress it is displaying is considered done. Maximum() returns the maximum value of the progress bar by calling ProgressData()->Maximum(). The maximum value of the progress bar may be set by calling SetMaximum(), which simply calls ProgressData()->SetMaximum().

Minimum

```
long Minimum(void) const;
long SetMinimum(long minimum);
```

The minimum value of the progress bar is the value at which the progress bar begins updating, and the operation whose progress it is displaying is considered to be starting. Minimum() returns the minimum value of the progress bar by calling ProgressData()->Minimum(). The minimum value of the progress bar may be set by calling SetMinimum(), which simply calls ProgressData()->SetMinimum().

ProgressData

```
ZafScrollData *ProgressData(void) const;
bool SetProgressData(ZafScrollData *progress);
```

ProgressData() specifies the ZafScrollData object that contains progress parameters.

The ProgressData() object is the piece of the ZafProgressBar object where the actual data is stored. ProgressData() stores the minimum, maximum, current, delta and showing values for the progress bar (see ZafScrollData for more information). The ProgressData() piece may be shared among several ZafProgressBar objects, or it may belong to a single ZafProgressBar object. If shared among several ZafProgressBar objects, all the associated ZafProgressBar objects will be updated when the ProgressData() piece changes. SetProgress-Data() may be used to associate a ProgressData() object with a ZafProgressBar object. For more information on data sharing in ZAF, see ZafDataManager. SetProgressData() will delete the previous ProgressData() object if it is Destroyable() and no other object uses it.

The return value for ProgressData() is a pointer to the ProgressData() object associated with the ZafProgressBar object. The return value for SetProgress-Data() is normally ZAF_ERROR_NONE.

ProgressStyle

```
ZafProgressStyle ProgressStyle(void) const;
ZafProgressStyle SetProgressStyle(ZafProgressStyle
    progressStyle);
```

A ZafProgressBar object may be one of four different styles, according to the ProgressStyle() attribute. The default value of this attribute is ZAF_PROGRESS_NATIVE, but the user may call SetProgressStyle() to change it. The possible values of this attribute are:

ProgressStyle()	Description
ZAF_PROGRESS_NATIVE	Appears the same as a progress bar on the native environment
ZAF_PROGRESS_INDENTED	Appears bevelled into the plane of its parent
ZAF_PROGRESS_FLAT	Appears at the same level as the plane of its parent
ZAF_PROGRESS_RAISED	Appears raised above the plane of its parent

ProgressType

```
ZafProgressType ProgressType(void) const;
ZafProgressType SetProgressType(ZafProgressType
    progressType);
```

A ZafProgressBar object may be oriented either horizontally or vertical, according to the ProgressType() attribute. The default value of this attribute is ZAF_PROGRESS_HORIZONTAL, but the user may call SetProgressType() to change it to ZAF_PROGRESS_VERTICAL.

Step

```
long Step(void) const;
long SetStep(long step);
```

The step value of the progress bar is the same as the delta value. See Delta() for more information.

TextStyle

```
ZafProgressTextStyle TextStyle(void) const;
ZafProgressTextStyle SetTextStyle(ZafProgressTextStyle
   style);
```

A ZafProgressBar object may display its current value numerically at the same time as it displays a graphical bar, or it may only display its current value as a graphical bar, according to the TextStyle() attribute. The default value of this attribute is ZAF_PROGRESS_TEXT_VALUE, but the user may call SetTextStyle() to change it. The possible values of this attribute are:

TextStyle()	**Description**
ZAF_PROGRESS_TEXT_NONE	Does not display the current value numerically
ZAF_PROGRESS_TEXT_VALUE	Displays the current value numerically
ZAF_PROGRESS_TEXT_PERCENT	Displays the current value as a percentage

ZafPrompt

AutoSize	HzJustify	TransparentBackground
HotKeyChar	SetHotKey	VtJustify
HotKeyIndex	StringData	

Inheritance `ZafPrompt : ZafWindowObject : ZafElement`

Declaration `#include <z_prompt.hpp>`

Description The ZafPrompt object is a single-line static text object generally used as a label for an adjacent field. The ZafPrompt object allows almost no user interaction, and is intended for use only to display information.

Note that ZafPrompt utilizes the Bordered() attribute differently than other window objects. With ZafPrompt, the Bordered() attribute means the prompt is to be aligned as if it were a Bordered() object, so that the prompt's text is aligned with an adjoining Bordered() field's text. The prompt object, however, does not display a border. For additional information see ZafWindowObject::Bordered().

Constructors All ZafPrompt constructors initialize the member variables associated with an instantiated ZafPrompt object. The default values set by the ZafPrompt and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafPrompt. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafPrompt

AutoSize()	true
HotKeyChar()	'\0'
HotKeyIndex()	-1
HzJustify()	ZAF_HZ_LEFT
StringData()	null
TransparentBackground()	false
VtJustify()	ZAF_VT_TOP

ZafWindowObject

AcceptDrop()	false†
Bordered()	true
Changed()	false†
CopyDraggable()	false†

Member Initializations

`Focus()`	`false`†
`HelpContext()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`RegionType()`	`ZAF_INSIDE_REGION`†
`UserFunction()`	`null`†
ZafElement	
`ClassID()`	`ID_ZAF_PROMPT`
`ClassName()`	`“ZafPrompt”`

```
ZafPrompt(int left, int top, int width, const ZafIChar
   *text);
```

This constructor is useful in straight-code situations, particularly if you wish the ZafPrompt object to create, maintain and destroy its own ZafStringData object automatically. The *left* and *top* parameters specify the position where the left and top of the object will be placed on its parent. The *width* parameter specifies the width of the object (height defaults to 1 cell.). All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. The *text* parameter is the string you wish to initially appear in the new ZafPrompt object.

```
ZafPrompt(int left, int top, int width, ZafStringData
   *stringData = ZAF_NULLP(ZafStringData));
```

This constructor is useful in straight-code situations where you have already created a ZafStringData object. This constructor could be used to maintain data pieces yourself, rather than having the ZafPrompt class create and maintain the data pieces automatically. For example, to maintain a database of ZafStringData objects and tie them into ZafPrompt objects, maintain your own ZafStringData objects and create ZafPrompt objects using your ZafStringData objects by passing them into the stringData parameter of this constructor. For more information on using ZafStringData objects, see ZafStringData. The *left*, *top* and *width* parameters are the same as the previous constructor.

ZafPrompt(const ZafPrompt &copy);

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafPrompt object and copies the object's information. If the *copy*'s data objects are StaticData() then the new ZafPrompt object simply points to the original data objects, otherwise, a copy is made for the new ZafPrompt object. This behavior allows a programmer to share data between ZafPrompt objects.

ZafPrompt(const ZafIChar *name, ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Below is an example illustrating creation techniques for ZafPrompt:

```
// Create a sample window with a prompt and a string.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
window1->Add(new ZafPrompt(0, 1, 10, "String:"));
window1->Add(new ZafString(11, 1, 10, "String", 10));
...
// Create a sample window with a prompt and a string.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
ZafStringData *stringData1 = new ZafStringData("String:");
window2->Add(new ZafPrompt(0, 1, 10, stringData1));
window2->Add(new ZafString(11, 1, 10, "String", 10));
```

Destructor

virtual ~**ZafPrompt**(void);

This destructor is used to free the memory associated with a ZafPrompt object, including StringData() if it is Destroyable(). It chains to the ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafPrompt object, since it is automatically destroyed when it's parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoSize

bool **AutoSize**(void) const;
virtual bool **SetAutoSize**(bool setAutoSize);

If AutoSize() is true, the prompt will automatically adjust the size of its background area so as to exactly match the size of its displayed text. This is particularly useful if the prompt has a helptip or if the prompt's background color is different from the window background. The original region (passed into the constructor or read from the persistent object file) is preserved internally by ZAF and is used if region computations are required by later programmer interaction with the prompt.

If AutoSize() is false, the prompt will display with its original region. The default value of this attribute is true, but the user may call SetAutoSize() to change it.

HotKeyChar
HotKeyIndex
SetHotKey

```
ZafIChar HotKeyChar(void) const;
int HotKeyIndex(void) const;
virtual ZafIChar SetHotKey(ZafIChar hotKeyChar, int index
   = -1);
```

A prompt's hot key character (*hotKeyChar*) is the character that when typed with a modifier key (such as <ALT> or <Command>) causes the next object in tabbing order is given focus. The hot key *index* is the zero-based index into the prompt's text that specifies the character to be visually displayed as the hot key character, usually with an underline.

It is important to note that the hot key character does not cause any display modification, and the hot key index does not cause any action to be performed when that character is typed with the modifier key. The default value of HotKeyChar() is 0, indicating that there is no hot key character associated with the prompt, and the default value of HotKeyIndex() is -1, indicating that no character is to be displayed as the hot key character on the prompt. The user may call SetHotKey() to change the HotKeyChar() and the HotKeyIndex() attributes. The *hotKeyChar* parameter specifies the hot key character, and the *index* parameter specifies the hot key index.

The following code shows hot to create a prompt and string pair with a hot key:

```
// Create a prompt and string pair with a hot key.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
ZafPrompt *prompt1 = new ZafPrompt(0, 1, 10, "Name:");
prompt1->SetHotKey('N', 0);
window1->Add(prompt1);
// The string following the prompt gets focus when the hot
// key is typed.
window1->Add(new ZafString(11, 1, 10, "", 10));
```

HzJustify

```
ZafHzJustify HzJustify(void) const;
virtual ZafHzJustify SetHzJustify(ZafHzJustify
   hzJustify);
```

HzJustify() controls the prompt's horizontal justification, and is ZAF_HZ_LEFT by default. The user may call SetHzJustify() to change to ZAF_HZ_RIGHT or ZAF_HZ_CENTER.

StringData

```
ZafStringData *StringData(void) const;
virtual ZafError SetStringData(ZafStringData *string);
```

The StringData() object is where the actual data is stored. The StringData() piece may be shared among several ZafPrompt objects, or it may belong to a single ZafPrompt object. If shared among several ZafPrompt objects, all the associated ZafPrompt objects will be updated when the StringData() piece changes. SetStringData() may be used to associate a StringData() object with a ZafPrompt object. For more information on data sharing in ZAF, see ZafData-Manager. SetStringData() will delete the previous StringData() object if it is Destroyable() and no other object uses it.

The return value for StringData() is a pointer to the StringData() object associated with the ZafPrompt object. The return value for SetStringData() is normally ZAF_ERROR_NONE.

Transparent-Background

```
bool TransparentBackground(void) const;
virtual bool SetTransparentBackground(bool
   transparentBackground);
```

If TransparentBackground() is true, the prompt does not erase its background area, but only draws its text. This is useful if the region the prompt overlaps should show through. If TransparentBackground() is false, the prompt will erase its background area. The default value of this attribute is false, but the user may call Set TransparentBackground() to change it.

VtJustify

```
ZafVtJustify VtJustify(void) const;
virtual ZafVtJustify SetVtJustify(ZafVtJustify
   vtJustify);
```

VtJustify() controls the prompt's vertical justification, and is ZAF_VT_TOP by default. The user may call SetVtJustify() to change it to ZAF_VT_CENTER or ZAF_VT_BOTTOM.

ZafPullDownItem

Add	FocusObject	Sort
Count	Get	Subtract
Current	GetObject	operator +
Destroy	Index	operator -
Event	Last	
First	menu	

Inheritance `ZafPullDownItem : ZafButton : ZafWindowObject : ZafElement`

Declaration `#include <z_plldn.hpp>`

Description ZafPullDownItem objects are the items on a ZafPullDownMenu bar. ZafPullDownItem objects may only be added to a ZafPullDownMenu object, and only ZafPopUpItem objects may be added to a ZafPullDownItem object.

Constructors All ZafPullDownItem constructors initialize the member variables associated with an instantiated ZafPullDownItem object. The default values set by the ZafPullDownItem and its base class constructors follow if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafPullDownItem. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafPullDownItem

`menu`	`ZafPopUpMenu(0, 0)`
`menu.Destroyable()`	`false`
`menu.parent`	`this`
`menu.StringID()`	`“menu”`
`menu.Temporary()`	`true`

ZafButton

`AllowDefault()`	`false`†
`AllowToggling()`	`false`†
`AutoRepeatSelection()`	`false`†
`AutoSize()`	`false`†
`BitmapData()`	`ZAF_NULLP(ZafBitmapData)`†
`ButtonType()`	`ZAF_FLAT_BUTTON`†
`Depressed()`	`false`†
`Depth()`	`0`†

Member Initializations

`HzJustify()`	`ZAF_HZ_LEFT`†
`SelectOnDoubleClick()`	`false`†
`SelectOnDownClick()`	`false`†
`SendMessageText()`	`null`†
`SendMessageWhenSe-lected()`	`false`†
`Value()`	`0`
`VtJustify()`	`ZAF_VT_CENTER`†
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`CopyDraggable()`	`false`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`RegionType()`	`ZAF_INSIDE_REGION`†
`Selected()`	`false`†
`SupportObject()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_PULL_DOWN_ITEM`
`ClassName()`	`“ZafPullDownItem”`

`ZafPullDownItem``(const ZafIChar *text);`

This constructor is useful in straight-code situations, particularly if you wish the ZafPullDownItem object to create, maintain and destroy its own ZafString-Data object automatically. You simply pass into the *text* parameter the text you wish to appear in the new ZafPullDownItem object.

`ZafPullDownItem``(ZafStringData *stringData);`

This constructor is also useful in straight-code situations, particularly if you have already created a ZafStringData object to be associated with the ZafPull-DownItem object. This constructor could be used to maintain string data pieces yourself, rather than having the ZafPullDownItem class create and maintain the string data pieces automatically. For example, to maintain a database of ZafStringData objects and tie them into ZafPullDownItem objects, maintain your own ZafStringData objects and create ZafPullDownItem objects using your ZafStringData objects. For more information see ZafStringData. The *stringData* parameter specifies the string data object to be associated with the ZafPullDownItem object.

```
ZafPullDownItem(const ZafPullDownItem &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It copies the information from another ZafPullDownItem object, *copy*. If the data objects are StaticData() then the new ZafPullDownItem object points to the original data objects, otherwise a copy is made for the new ZafPullDownItem object. This allows a programmer to use static data for more than one ZafPullDownItem object.

```
ZafPullDownItem(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. The parameters and values of this constructor are deferred to the ZafWindow section of this manual, since most persistence is done at the ZafWindow level.

Refer to ZafPullDownMenu for an example of how to create a ZafPullDown-Item object:

Destructor

```
virtual ~ZafPullDownItem(void);
```

The destructor is used to free the memory associated with a ZafPullDownItem object, including all the data object pieces that are Destroyable(). It chains to the ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafPullDownItem object, since it is automatically destroyed when its parent menu bar is destroyed. For more information on child object deletion, see ZafWin-dow::~ZafWindow().

Members

Add

```
virtual ZafWindowObject *Add(ZafWindowObject *object,
   ZafWindowObject *position =
   ZAF_NULLP(ZafWindowObject));
```

operator +

```
ZafPullDownItem &operator+(ZafWindowObject *object);
```

This function and operator are used for adding ZafPopUpItem objects to the ZafPullDownItem object. The functionality is provided by the ZafPopUp-Menu class through the menu member. *object* is a pointer to the ZafPopUpI-tem object to be added to the ZafPullDownItem object. *position* specifies the

ZafPopUpItem object (already in the menu) that object should appear before. If *position* is null, *object* is added to the end of the menu. See ZafWindow::Add() for more information.

Count

`int **Count**(void) const;`

Count() returns the number of ZafPopUpItem objects in the menu. See ZafList::Count() for more information.

Current

`ZafWindowObject ***Current**(void) const;`

Current() returns the current ZafPopUpItem object in the menu, if there is one. The Current() item does not necessarily have focus. Some native environment implementations of menus do not allow the menu to ever have focus. See ZafList::Current() for more information.

Destroy

`virtual void **Destroy**(void);`

Destroy() causes all the ZafPopUpItem objects in the menu to be destroyed. This is useful if a menu is to be recreated from scratch. See ZafList::Destroy() for more information.

Event

`virtual ZafEventType **Event**(const ZafEventStruct &event);`

This overloaded function handles all events that get sent to the ZafPullDownItem object, either by processing the events itself, or by passing the event down for base class processing. Refer to ZafWindowObject for complete details. Following are events that are handled by ZafPullDownItem in addition to those handled by its base classes:

Event	Action
S_ADD_OBJECT	Causes event.windowObject to be added to the menu
S_SUBTRACT_OBJECT	Causes event.windowObject to be subtracted from the menu

First

`ZafWindowObject ***First**(void) const;`

First() returns the first ZafPopUpItem object in the menu, if any. See ZafList::First() for more information.

FocusObject

```
virtual ZafWindowObject *FocusObject(void) const;
```

FocusObject() returns the ZafPopUpItem object in the menu that has focus, if one does. Some native environment implementations of menus do not allow the menu to ever have focus, so this function will always return null in these cases. See ZafWindow::FocusObject() for more information.

Get

```
ZafWindowObject *Get(int index);
```

Get() returns the ZafPopUpItem object at position *index* in the menu, if there is one. The index parameter is zero-based, meaning the first ZafPopUpItem object is at position 0. See ZafList::Get() for more information.

GetObject

```
virtual ZafWindowObject *GetObject(ZafNumberID numberID);
virtual ZafWindowObject *GetObject(const ZafIChar
   *stringID);
```

GetObject() returns the ZafPopUpItem object with either the numberID of *numberID*, or the stringID of *stringID*, if it is found. See ZafWindowObject::GetObject() for more information.

Index

```
int Index(ZafWindowObject const *element);
```

Index() returns the zero-based index of the ZafPopUpItem object *element* in the menu. If *element* is not found in the menu, Index() returns -1. See ZafList::Index() for more information.

Last

```
ZafWindowObject *Last(void) const;
```

Last() returns the last ZafPopUpItem object in the menu, if there is one. See ZafList::Last() for more information.

menu

```
ZafPopUpMenu menu;
```

The menu member, used internally by the ZAF libraries to maintain the ZafPopUpItem objects added to the ZafPullDownItem object, should normally not be accessed by the programmer. See ZafPopUpMenu for more information.

Sort

```
virtual void Sort(void);
```

Sort() causes the ZafPopUpItem objects in the menu to be sorted by the function returned by menu.CompareFunction(). See ZafList::CompareFunction() for more information.

Subtract

operator -

```
virtual ZafWindowObject *Subtract(ZafWindowObject
    *object);
ZafPullDownItem &operator-(ZafWindowObject *object);
```

This function and operator are used for subtracting ZafPopUpItem objects from the ZafPullDownItem object. The functionality is provided by the ZafPopUpMenu class through the menu member. *object* is a pointer to the ZafPopUpItem object to be subtracted from the ZafPullDownItem object. See ZafWindow::Subtract() for more information.

ZafPullDownMenu

Inheritance `ZafPullDownMenu : ZafWindow : ((ZafWindowObject : ZafElement), ZafList)`

Declaration `#include <z_plldn.hpp>`

Description The ZafPullDownMenu object is a menu bar object that supports multiple-leveled menu hierarchies. As with all other ZAF classes, the ZafPullDownMenu class utilizes the native menu bar API if available, so the look-and-feel is exactly what the end user expects. For example, the menu bar on the Macintosh is at the top of the screen, rather than on the window itself, as with Microsoft Windows.

The menu bar object itself only reserves space for the menu items, so it is useful only when menu items are added to it. Only ZafPullDownItem objects may be added to a ZafPullDownMenu object.

Constructors All ZafPullDownMenu constructors initialize the member variables associated with an instantiated ZafPullDownMenu object. The default values set by the ZafPullDownMenu and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafPullDownMenu. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindow	
`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`true`†
`SelectionType()`	`ZAF_SINGLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`true`†
`Disabled()`	`false`†

Member Initializations

`Noncurrent()`	`false`†
`ParentPalette()`	`false`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`SupportObject()`	`true`†
ZafElement	
`ClassID()`	`ID_ZAF_PULL_DOWN_MENU`
`ClassName()`	`"ZafPullDownMenu"`
`SetNumberID()`	`ZAF_NUMID_PULL_DOWN_MENU`
`SetStringID()`	`"ZAF_NUMID_PULL_DOWN_MENU"`

ZafPullDownMenu(void);

This constructor is useful in straight-code situations. Since the ZafPullDown-Menu object is automatically placed at the appropriate position on the window or on the screen according to the native environment, there are no parameters to this constructor.

ZafPullDownMenu(const ZafPullDownMenu &copy);

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafPullDownMenu object and copies the object's information.

```
ZafPullDownMenu(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following shows how to create a ZafPullDownMenu object:

```
// Create a sample window with a menu bar.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);
// Create the menu bar and a file menu.
ZafPullDownMenu *menuBar = new ZafPullDownMenu();
// Create and populate the file menu.
ZafPullDownItem *fileMenu = new ZafPullDownItem("File");
fileMenu->Add(new ZafPopUpItem("New"));
fileMenu->Add(new ZafPopUpItem("Open"));
fileMenu->Add(new ZafPopUpItem("", ZAF_SEPARATOR));
fileMenu->Add(new ZafPopUpItem("", ZAF_EXIT_OPTION));
```

```
// Add the file menu to the menu bar.
menuBar->Add(fileMenu);
// Add the menu bar to the window.
window1->Add(fileMenu);
```

Destructor `virtual ~`**`ZafPullDownMenu`**`(void);`

The destructor is used to free the memory associated with a ZafPullDown-Menu object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafPullDownMenu object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWin-dow().

ZafQueueBlock

Inheritance `ZafQueueBlock :` ZafListBlock `:` ZafList

Declaration `#include <z_evtmgr.hpp>`

Description ZafQueueBlock is a container object used by ZafEventManager to maintain a queue block of ZafEventStruct objects. ZafQueueElement is used to contain the actual ZafEventStruct objects. Only ZafQueueElement objects may be added to a ZafQueueBlock, and it will generally not be used by the programmer, as ZafEventManager maintains a ZafQueueBlock internally.

Constructors All ZafQueueBlock constructors initialize the member variables associated with an instantiated ZafQueueBlock object.

```
ZafQueueBlock(int noOfElements);
```

This constructor creates a ZafQueueBlock of *noOfElements* ZafQueueElements. It is used only by ZafEventManager.

Destructor

```
virtual ~ZafQueueBlock(void);
```

The destructor is used to free the memory associated with a ZafQueueBlock object, including all the ZafQueueElement objects associated with it. It chains to the ZafListBlock and ZafList destructors.

ZafQueueElement

event

Inheritance

`ZafQueueElement : ZafElement`

Declaration

`#include <z_evtmgr.hpp>`

Description

ZafQueueElement is a container object used by ZafQueueBlock and ZafEvent-Manager to maintain a queue of ZafEventStruct objects. A ZafQueueElement may only be added to a ZafQueueBlock, and generally will not be used by the programmer, as ZafEventManager maintains a ZafQueueBlock internally.

Constructors

All ZafQueueElement constructors initialize the member variables associated with an instantiated ZafQueueElement object.

`ZafQueueElement(void);`

This constructor creates a ZafQueueElement, and is used only by ZafQueue-Block.

Destructor

`virtual ~ZafQueueElement(void);`

The destructor is used to free the memory associated with a ZafQueueElement object. It chains to the ZafElement destructor.

Members

event

`ZafEventStruct event;`

The event member stores the actual event associated with the ZafQueueEle-ment object. It is initialized by ZafEventManager::Get(), and retrieved by ZafEventManager::Put().

ZafReal

Event	RealData

Inheritance `ZafReal : ZafString : ZafWindowObject : ZafElement`

Declaration `#include <z_real1.hpp>`

Description ZafReal is a single-line real number (floating point) object that allows user input through the keyboard. ZafReal is fully internationalized to display and input using any format.

All ZafReal objects refer to data contained in a ZafRealData object (refer to this class for additional essential information).

Formats ZafString and derived classes parse input and display output based on default or programmer-defined input and output formats. Programmers may use the SetInputFormat() and SetOutputFormat() families of functions to change the default format. These functions are documented in the ZafString reference.

Each class derived from ZafFormatData handles a different set of formatting arguments, in addition to those supported by its base classes. ZafRealData (and therefore ZafReal) handles the following arguments in addition to those used by ZafInteger and ZafString:

Format Argument	Substitution
%[ww.dd]A	Optional arguments in “[]”: *ww* indicates the minimum width of the output (left-padded with spaces if necessary). *dd* indicates the mandatory number of digits after the decimal (right-padded with zeros if necessary). *A* is a proxy for any of the arguments below. For example, a complete format argument might be: "%10.2f"
%f, %F	Signed floating point value
%e	Signed floating point value with lower-case exponent
%E	Signed floating point value with upper-case exponent
%g	Signed floating point value using the most compact of either %f or %e format
%G	Signed floating point value using the most compact of either %F or %E format

Constructors All ZafReal constructors initialize the member variables associated with an instantiated ZafReal object. The default values set by the ZafReal and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafReal. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafReal

`RealData()`	`null`

ZafString

`LowerCase()`	`false`†
`Password()`	`false`†
`StringData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†

ZafElement

`ClassID()`	`ID_ZAF_REAL`
`ClassName()`	`"ZafReal"`

```
ZafReal(int left, int top, int width, double value);
```

This constructor is useful in straight-code situations, particularly if the ZafReal object is to create, maintain and destroy its own ZafRealData object automatically. *left*, *top*, and *width* specify the position and size of the object on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *value* is the value that initially appears in the new ZafReal object.

```
ZafReal(int left, int top, int width, ZafRealData
   *realData = ZAF_NULLP(ZafRealData));
```

This constructor is useful in straight-code situations where a ZafRealData object has already been created. This constructor could be used when manually maintaining a ZafRealData object, rather than having the ZafReal class create and maintain the data object automatically. For more information on using ZafRealData objects, see ZafRealData. *left*, *top*, and *width* are the same as the previous constructor.

ZafReal(const ZafReal &copy);

The copy constructor calls the overloaded Duplicate() to create a new ZafReal object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafReal object simply points to the original data, otherwise StaticData() copies are made.

ZafReal(const ZafIChar *name, ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafReal creation techniques follow:

```
// Create a sample window with real number objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);

// Create real numbers and pass in the values directly.
window1->Add(new ZafReal(0, 1, 25, 3.1415927));
window1->Add(new ZafReal(0, 2, 25, 360.0));
...

// Create a sample window with real number objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);

// Create real number data objects.
ZafRealData *realData1 = new ZafRealData(3.1415927);
ZafRealData *realData2 = new ZafRealData(360.0);

// Create real numbers that use the data previously created.
window2->Add(new ZafReal(0, 1, 25, realData1));
window2->Add(new ZafReal(0, 2, 25, realData2));
```

Destructor

virtual ~**ZafReal**(void);

The destructor is used to free the memory associated with a ZafReal object, including all data objects that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafReal object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

virtual ZafEventType **Event**(const ZafEventStruct &event);

Event

This overloaded function receives all events that get sent to the ZafReal object and either handles them or passes them to ZafString, its immediate base class. See ZafWindowObject for more information.

ZafReal specifically handles the following events:

Event	Description
`N_RESET_I18N`	causes the object to redisplay its data according to the new internationalization values
`S_COPY_DATA`	causes the object to copy event.windowObject's RealData() if event.windowObject is a ZafReal object
`S_SET_DATA`	causes the object to create a new RealData() object, then copy into it event.windowObject's RealData() if event.windowObject is non-null and is a ZafReal object

RealData

```
ZafRealData *RealData(void) const;
virtual ZafError SetRealData(ZafRealData *number);
```

*RealData() contains the actual information used by ZafReal. The RealData() object may be used by one or more ZafReal objects, or other objects. If shared, all associated ZafReal objects will be notified when the RealData() changes. For more information on data sharing in ZAF, see ZafDataManager. SetRealData() will delete the previous RealData() object if it is Destroyable() and no other object uses it.

RealData() returns a pointer to the RealData() object associated with the ZafReal object. The return value for SetRealData() is normally ZAF_ERROR_NONE. See the Constructors code snippet for an example using ZafRealData objects with ZafReal.

ZafRealData

Clear	operator ++	operator *=
double	operator --	operator /=
FormattedText	operator =	operator %=
SetReal	operator +=	
Value	operator -=	

Inheritance

`ZafRealData : ZafFormatData : ZafData : ZafElement, ZafNotification`

Declaration

```
#include <z_real.hpp>
```

Description

ZafRealData objects can be used to store and manipulate 64-bit doubles.

ZafRealData combines number encapsulation with data and object notification from ZafData. ZafRealData objects are normally used as the data portion of ZafReal user interface objects but they may also be used independently.

ZafRealData supports the use of printf-style formatting and parsing arguments during string operations. Refer to standard library documentation for detailed information on printf functions and conversion characters.

Constructors

ZafRealData constructors allocate space to hold the instance data, and initialize the member variables associated with a new ZafRealData object.

The default values set by ZafRealData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafRealData

`Value()`	`(varies with constructor)`

ZafElement

`ClassID()`	`ID_ZAF_REAL_DATA`
`ClassName()`	`"ZafRealData"`

`ZafRealData``(void);`

The basic constructor allocates a ZafRealData instance and initializes its value to 0.

ZafRealData(double value);

This constructor allocates a ZafRealData instance and initialize its contents to *value*.

ZafRealData(const ZafIChar *string, const ZafIChar
    *format = ZAF_NULLP(ZafIChar));

This constructor allocates a ZafRealData instance and initializes its value to the numeric equivalent of *string*. The conversion uses the printf-style specifier *format* to interpret the string. If *format* is null ZafRealData uses its locale-specific default format.

ZafRealData(const ZafRealData &copy);

This constructor is the copy constructor. It allocates a new ZafRealData instance and copies all member data from *copy*.

ZafRealData(const ZafIChar *name, ZafDataPersistence
    &persist);

This constructor is the persistent constructor. It allocates a new ZafRealData instance and reads most member data from directory *name* in the persistent data file referred to by *persist*. The StringID() of the new data is *name*.

```
// Sample ZafRealData creation techniques
double value = 10.0;
ZafRealData real1(value);
ZafRealData copyReal = real1;
ZafRealData zeroReal;
```

Destructor

virtual ~**ZafRealData**(void);

The virtual destructor is used to free the memory associated with an instantiated ZafRealData object. Unless a ZafRealData object is marked as StaticData() it will be automatically destroyed when all ZafReal objects that refer to it are destroyed.

Members

Clear

virtual void **Clear**(void);

Clear() sets the value of a ZafRealData object to zero.

double

```
operator double();
```

See Value().

FormattedText

```
virtual int FormattedText(ZafIChar *buffer, int
   maxLength, const ZafIChar *format = 0) const;
```

FormattedText() fills *buffer* with a string representation of the ZafRealData using the printf-style specifier *format* to build the string. A locale-specific default format is used if *format* is not included. Buffer contents will be truncated if they exceed *maxLength* characters. FormattedText() returns the integer value it receives from its call to sprintf().

```
// Show results of FormattedText().
ZafIChar buffer[256];

ZafRealData myreal(1234.56);
myreal.FormattedText(buffer, 256);
printf("real - %s\n", buffer);
myreal.FormattedText(buffer, 256, "%+8.3g");
printf("real - %s\n", buffer);

==========
real - 1234.5600
real - +1234.560
```

SetReal

```
virtual ZafError SetReal(double value);
virtual ZafError SetReal(const ZafIChar *buffer, const
   ZafIChar *format);
virtual ZafError SetReal(const ZafRealData &real);
```

SetReal() functions set the numeric value of the ZafRealData object from doubles, another ZafRealData, or an interpreted string. Refer to FormattedText() for more information on ZafRealData/string conversions. Overloaded operator = offers similar functionality to SetBignum and is more commonly used.

Value
double

```
double Value(void) const;
operator double();
```

Value() returns the value of a ZafRealData object as a double. The convenience operator double(), which returns Value(), is more commonly used. Refer to ZafIntegerData for sample code showing the different usages of these two functions.

operator ++

```
ZafRealData operator++(void);
ZafRealData operator++(int);
```

These pre- and post-operators increment the ZafRealData object's value by 1.

operator --

```
ZafRealData operator--(void);
ZafRealData operator--(int);
```

These pre- and post-operators decrement the ZafRealData object's value by 1.

operator =

```
ZafRealData &operator=(double value);
```

This operator assigns the ZafRealData object's value to the input *value*.

operator +=
operator -=

```
ZafRealData &operator+=(double value);
ZafRealData &operator-=(double value);
```

These operators increments or decrement the ZafRealData object's value by the input *value*.

*operator *=*

```
ZafRealData &operator*=(double value);
```

This operator multiplies the ZafRealData object's value by the input *value* and uses the resulting product to set the ZafRealData object's value.

operator /=

```
ZafRealData &operator/=(double value);
```

This operator divides the ZafRealData object's value by the input *value* and uses the resulting quotient to set the ZafRealData object's value.

operator %=

```
ZafRealData &operator%=(double value);
```

This operator divides the ZafRealData object's value by the input *value* and uses the resulting remainder to set the ZafRealData object's value.

ZafRegionStruct

Assign	ImportPixel	VtShift
bottom	ImportPoint	Width
ConvertCoordinates	left	operator ==
Encompassed	Overlap	operator !=
ExportPixel	Region	operator ++
ExportPoint	right	operator --
Height	top	operator +=
HzShift	Touching	operator -=

Inheritance `ZafRegionStruct : ZafCoordinateStruct`

Declaration `#include <z_region.hpp>`

Description

ZafRegionStruct provides support for storing a two-dimensional rectangular region. Various different coordinate systems may be specified for the region using the base ZafCoordinateStruct. See ZafCoordinateStruct for more information.

Members

Assign

```
void Assign(int left, int top, int width, int height,
   ZafCoordinateType type = ZAF_COORD_DEFAULT);
```

Assign() sets the region's boundaries to *left*, *top*, *width*, and *height*. If *type* is ZAF_COORD_DEFAULT, coordinateType is unchanged; otherwise, coordinateType is set to *type*.

ConvertCoordinates

```
void ConvertCoordinates(ZafCoordinateType newType);
```

ConvertCoordinates() converts the region to the *newType* coordinateSystem.

Encompassed

```
bool Encompassed(const ZafRegionStruct &region) const;
```

Encompassed() returns true if *region* is encompassed by this region; otherwise it returns false. A region is encompassed within another if each of the four boundaries is either inside or equal to the encompassing region's boundaries. If the coordinate systems are different, a converted version of *region* is used in the comparison.

ExportPixel
ExportPoint
ImportPixel
ImportPoint

```
void ExportPixel(OSRegion &rect) const;
void ExportPoint(OSRegion &rect) const;
void ImportPixel(const OSRegion &rect);
void ImportPoint(const OSRegion &rect);
```

On environments whose coordinate system is based on infinitely small points (rather than pixels, which have finite size on the screen) such as Macintosh and Microsoft Windows, conversion is necessary when passing a region between ZAF and the native API.

Since ZAF's coordinate systems are based on pixels, ExportPixel() exports the region to *rect* as a pixel-based rectangle in the native environment's rectangle type without any conversion and ImportPixel() imports the region from *rect* as a pixel-based rectangle in the native environment's rectangle type without any conversion. ExportPoint() exports the region to rect as a point-based rectangle in the native environment's rectangle type by adding one to the right and bottom boundaries of the ZafRegionStruct object and ImportPoint() imports the region from *rect* as a point-based rectangle in the native environment's rectangle type by subtracting one from the right and bottom boundaries of the native rectangle.

Height

```
int Height(void) const;
```

Height() returns the height of the region.

HzShift

```
void HzShift(int shift);
```

HzShift() modifies the region along the x-axis by the amount specified in *shift*. If *shift* is positive, the region moves in the positive direction. If *shift* is negative, the region moves in the negative direction.

left
top
right
bottom

```
int left, top, right, bottom;
```

left, *top*, *right*, and *bottom* store the boundaries of the region.

Overlap

```
bool Overlap(const ZafRegionStruct &region) const;
bool Overlap(const ZafPositionStruct &position) const;
bool Overlap(const ZafPositionStruct &position, int
   columnShift, int lineShift) const;
bool Overlap(const ZafRegionStruct &region,
   ZafRegionStruct &result) const;
```

Overlap() returns true if the arguments specified overlap the region; otherwise it returns false. If the coordinate systems are different, a converted version of *region* or *position* is used in the comparison. *region* and *position* specify the object to be compared. *columnShift* and *lineShift* specify the amount using the same coordinate system as this region that *position* is shifted before comparing. The original *region* or *position* is not modified. In the fourth method, the intersection of the two regions are returned in result if the regions overlap.

Region

```
ZafRegionStruct Region(ZafCoordinateType type);
```

Region() returns the region converted to the *type* coordinate system. The original region is not modified.

Touching

```
bool Touching(const ZafPositionStruct &position) const;
```

Touching() returns true if *position* lies exactly on one of the four boundaries of this region; otherwise it returns false. If the coordinate systems are different, a converted version of *position* is used in the comparison.

VtShift

```
void VtShift(int shift);
```

VtShift() modifies the region along the y-axis by the amount specified in *shift*. If *shift* is positive, the region moves in the positive direction. If *shift* is negative, the region moves in the negative direction.

Width

```
int Width(void) const;
```

Width() returns the width of the region.

operator ==

```
bool operator==(const ZafRegionStruct &region) const;
```

This operator returns true if *region* is equal to this region object; otherwise it returns false. If the coordinate systems are different, a converted version of *region* is used in the comparison.

operator !=

```
bool operator!=(const ZafRegionStruct &region) const;
```

This operator returns true if *region* is not equal to this region object; otherwise it returns false. If the coordinate systems are different, a converted version of *region* is used in the comparison.

operator ++

```
ZafRegionStruct operator++(void);
ZafRegionStruct operator++(int);
```

The prefix and postfix versions of this operator enlarge the region by subtracting one from the left and top boundaries and by adding one to the right and bottom boundaries.

operator --

```
ZafRegionStruct operator--(void);
ZafRegionStruct operator--(int);
```

The prefix and postfix versions of this operator shrink the region by adding one to the left and top boundaries and by subtracting one from the right and bottom boundaries.

operator +=

```
ZafRegionStruct &operator+=(int offset);
```

This operator enlarges the region by subtracting *offset* from the left and top boundaries and by adding *offset* to the right and bottom boundaries.

operator -=

```
ZafRegionStruct &operator-=(int offset);
```

This operator shrinks the region by adding *offset* to the left and top boundaries and by subtracting *offset* from the right and bottom boundaries.

ZafRelativeConstraint

Center	OppositeSide	Stretch
Event	Ratio	Type

Inheritance `ZafRelativeConstraint : ZafConstraint : ZafElement`

Declaration `#include <z_gmgr.hpp>`

Description ZafRelativeConstraint allows a window object to be placed on its parent window object relative to a ratio of the parent's available region (see Ratio() for more information). ZafRelativeConstraint objects must be added to the ZafGeometryManager object that has been added to the managed object's parent (see ZafGeometryManager for more information).

Constructors All ZafRelativeConstraint constructors initialize the member variables associated with an instantiated ZafRelativeConstraint object. The default values set by the ZafRelativeConstraint and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafRelativeConstraint

`Center()`	`false`
`OppositeSide()`	`false`
`Ratio()`	`0`
`Stretch()`	`false`
`Type()`	`user-supplied parameter`

ZafElement

`ClassID()`	`ID_ZAF_RELATIVE_CONSTRAINT`
`ClassName()`	`"ZafRelativeConstraint"`

```
ZafRelativeConstraint(ZafWindowObject *object,
   ZafRelativeConstraintType type);
```

This constructor is useful in straight-code situations to create a ZafRelativeConstraint object. *object* specifies the window object the constraint applies to, and *type* specifies the type of relative constraint. See ZafConstraint::Object() and ZafRelativeConstraint::Type() for more information.

ZafRelativeConstraint(const ZafRelativeConstraint &copy);

The copy constructor creates a new ZafRelativeConstraint object and initializes its data from *copy*.

ZafRelativeConstraint(const ZafIChar *name,
   ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a relative constraint follows:

```
// Create a window with a geometry-managed child.
ZafWindow *win1 = new ZafWindow(1, 1, 60, 8);
ZafGeometryManager *geo = new ZafGeometryManager;


// The button will occupy the bottom right third of the window.
ZafButton *bottomRight = new ZafButton(15, 2, 15, 1, new
    ZafStringData("bottom right"));

//Attach directly to right side.
ZafAttachment *attach = new ZafAttachment(bottomRight,
    ZAF_ATCF_RIGHT);
attach->SetOffset(0);
geo->Add(attach);

//Attach directly to bottom.
attach = new ZafAttachment(bottomRight, ZAF_ATCF_BOTTOM);
attach->SetOffset(0);
geo->Add(attach);

//Attach left to imaginary 66% vertical divider line in window.
ZafRelativeConstraint *rel = new
    ZafRelativeConstraint(bottomRight, ZAF_RLCF_LEFT);
rel->SetRatio(66);
rel->SetStretch(true);
geo->Add(rel);

//Attach top to imaginary 66% horizontal divider line in window.
rel = new ZafRelativeConstraint(bottomRight, ZAF_RLCF_TOP);
rel->SetRatio(66);
rel->SetStretch(true);
geo->Add(rel);

// Add the button and geometry manager to the window.
win1->Add(bottomRight);
```

```
win1->Add(geo);
```

Destructor

```
virtual ~ZafRelativeConstraint(void);
```

The destructor is used to free the memory associated with a ZafRelativeConstraint object. It chains to the ZafConstraint and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafRelativeConstraint object, since it is automatically destroyed when its parent geometry manager is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Center

```
bool Center(void) const;
int SetCenter(bool center);
```

If Center() is true, then Object() is centered at Ratio(). For example, if Type() is ZAF_RLCF_LEFT, Ratio() is 50, and Center() is true, then Object() will be centered horizontally on its parent. If Center() is false, then the left edge of Object() would be horizontally at the center of its parent. This attribute defaults to false, but the programmer may change it with SetCenter().

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events sent to the ZafRelativeConstraint object. The events handled by ZafRelativeConstraint are as follows:

ZafEventType	**Description**
S_COMPUTE_SIZE	causes the constraint to compute and modify the size or position of its window object
S_INITIALIZE	causes the constraint to initialize its numberID, stringID, and Object()

OppositeSide

```
bool OppositeSide(void) const;
bool SetOppositeSide(bool oppositeSide);
```

If OppositeSide() is true, then the opposite side of the parent object is used when computing the position of Object(). For example, if Type() is ZAF_RLCF_LEFT, Ratio() is 33, and OppositeSide() is true, then the left edge of Object() will be placed a third of the way from the right side of the parent. If OppositeSide() is false, then the left edge of Object() would be placed a third of the way from the left side of the parent. This attribute defaults to false, but the programmer may change it with SetOppositeSide().

Ratio

```
int Ratio(void) const;
int SetRatio(int ratio);
```

Ratio() is the percentage used when calculating the relative offset of Object(). Ratio() is specified as a percentage, so 50% is specified as SetRatio(50). For example, if Type() is ZAF_RLCF_LEFT, Ratio() is 50, and OppositeSide() is false, then the left edge of Object() will be centered horizontally on its parent. This attribute defaults to 0, but the programmer may change it with SetRatio().

Stretch

```
bool Stretch(void) const;
bool SetStretch(bool stretch);
```

If Stretch() is true, then the opposite side of Object() than that specified by Type() is not modified. For example, if Type() is ZAF_RLCF_RIGHT, Ratio() is 66, and Stretch() is true, then the right edge of Object() will be placed a third of the way from the right edge of its parent and the left edge of Object() will remain where it is, in effect making it possible to stretch Object(). If Stretch() is false, then the left edge of Object() would be modified so that the width of Object() would remain the same. This attribute defaults to false, but the programmer may change it with SetStretch().

Type

```
ZafRelativeConstraintType Type(void) const;
ZafRelativeConstraintType
   SetType(ZafRelativeConstraintType type);
```

Type() is the relative constraint's type, which specifies the side of Object() used when calculating its position. If OppositeSide() is false, then Type() also specifies the side of the parent object used when calculating the position of Object(). If OppositeSide() is true, then the opposite side of the parent object is used when calculating the position of Object(). The programmer may use SetType() to change this attribute. The possible values for Type() follow:

Type()	Description
`ZAF_RLCF_BOTTOM`	causes the constraint to affect the bottom side of Object()
`ZAF_RLCF_LEFT`	causes the constraint to affect the left side of Object()
`ZAF_RLCF_RIGHT`	causes the constraint to affect the right side of Object()
`ZAF_RLCF_TOP`	causes the constraint to affect the top side of Object()

ZafScrollBar

AutoSize	ScrollData	ScrollType

Inheritance `ZafScrollBar : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_scrll2.hpp>`

Description The ZafScrollBar object provides support for both scroll bars and sliders. Scroll bars are generally used as support objects for other classes that allow scrolling, while sliders generally allow end users to select from a value-range. ZafScrollBar utilizes native scroll bar and slider APIs, if available.

Constructors All ZafScrollBar constructors initialize the member variables associated with an instantiated ZafScrollBar object. The default values set by the ZafScrollBar and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafScrollBar. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafScrollBar

`AutoSize()`	`true`
`ScrollData()`	`null`
`ScrollType()`	`ZAF_VERTICAL_SCROLL`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_SINGLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`false`†

Member Initializations

`ParentPalette()`	`false`†
`SupportObject()`	`true (if not a slider object)`
ZafElement	
`ClassID()`	`ID_ZAF_SCROLL_BAR`
`ClassName()`	`"ZafScrollBar"`

```
ZafScrollBar(ZafScrollBarType scrollType);
```

This constructor is useful in straight-code situations, particularly if the Zaf-ScrollBar object is to be a support object for its parent. In this case, the Zaf-ScrollBar object's data is initialized by the parent object, so no data values are necessary.

scrollType specifies the type of ZafScrollBar object to be created. See ScrollType() for more information.

```
ZafScrollBar(int left, int top, int width, int height,
   long minimum, long maximum, long current, long delta,
   long showing, ZafScrollBarType scrollType =
   ZAF_VERTICAL_SCROLL);
```

This constructor is useful in straight-code situations, particularly if the Zaf-ScrollBar object is to create, maintain, and destroy its own ZafScrollData object automatically.

left and *top* specify the position where the left and top of the object will be placed on its parent, while *width* and *height* specify the width and height of the object. left, top, width, and height are specified in cell coordinates by default, but may be specified using another coordinate system if desired. See ZafWin-dowObject::SetCoordinateType() for more information.

minimum, *maximum*, *current*, *delta*, and *showing* specify the values to be used in the ZafScrollData object automatically created by this constructor. *scrollType* specifies the type of ZafScrollBar object to be created. See Zaf-ScrollData and ScrollData() for more information.

```
ZafScrollBar(int left, int top, int width, int height,
   ZafScrollData *scrollData = ZAF_NULLP(ZafScrollData),
   ZafScrollBarType scrollType = ZAF_VERTICAL_SCROLL);
```

This constructor is also useful in straight-code situations, particularly when a ZafScrollData object, *scrollData*, has already been created to be associated with the ZafScrollBar object. For more information on using ZafScrollData objects, see ZafScrollData. Other parameters have the same meaning as in the previous constructor.

```
ZafScrollBar(const ZafScrollBar &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It allocates a new ZafScrollBar object and initializes its data from *copy*. If the original ZafScrollBar's internal data objects are StaticData() then the new ZafScrollBar object points to the originals, otherwise copies are made.

```
ZafScrollBar(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following example demonstrates how to create ZafScrollBar objects:

```
// Create a vertical list with a support scroll bar.
ZafVtList *vList = new ZafVtList(1, 1, 40, 5);
vList->Add(new ZafScrollBar(0, 0, 0, 0));

// Create a slider control using a ZafScrollData object.
ZafScrollData *scrollData = new ZafScrollData(0, 100, 0, 10,
   10);
window->Add(new ZafScrollBar(1, 1, 40, 1, scrollData,
   ZAF_HORIZONTAL_SLIDER));
```

Destructor

```
virtual ~ZafScrollBar(void);
```

The destructor is used to free the memory associated with a ZafScrollBar object, including all the data object pieces that are Destroyable(). It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not destroy a ZafScrollBar object directly since it is automatically destroyed when its parent object is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoSize

```
bool AutoSize(void) const;
virtual bool SetAutoSize(bool autoSize);
```

If AutoSize() is true, the object will automatically adjust its thickness to match the normal size for each environment. Otherwise, the object will display with the region passed into the constructor. AutoSize() defaults to true.

ScrollData

```
ZafScrollData *ScrollData(void) const;
virtual ZafError SetScrollData(ZafScrollData *scroll);
```

The ScrollData() object contains the actual data used by the ZafScrollBar. ZafScrollData objects may be shared among several ZafScrollBar objects (to save memory, for example) or it may belong to a single ZafScrollBar object. If shared, all the associated objects will be updated when the ScrollData() changes. SetScrollData() may be used to associate a ScrollData() object with a ZafScrollBar object. See ZafDataManager for more information on data sharing. SetScrollData() will delete the previous ScrollData() object if it is Destroyable() and no other object uses it.

ScrollData() returns a pointer to the ScrollData() object associated with the ZafScrollBar. SetScrollData() normally returns ZAF_ERROR_NONE.

ScrollType

```
ZafScrollBarType ScrollType(void) const;
virtual ZafScrollBarType SetScrollType(ZafScrollBarType
    scrollType);
```

ScrollType() specifies the object's type. Each type appears and behaves differently. ScrollType() defaults to ZAF_VERTICAL_SCROLL. Possible values are listed:

ScrollType()	Description
ZAF_CORNER_SCROLL	Corner scroll bar (typically used for spacing when both horizontal and vertical scroll bars are present)
ZAF_HORIZONTAL_SCROLL	Horizontal scroll bar
ZAF_VERTICAL_SCROLL	Vertical scroll bar
ZAF_HORIZONTAL_SLIDER	Horizontal slider control
ZAF_VERTICAL_SLIDER	Vertical slider control
ZAF_SIZEGRIP_SCROLL	Corner scroll bar with size-grip appearance (typically used on ZafWindow objects for a Windows95 look)

ZafScrollData

Clear	Increment	Showing
Current	Maximum	Step
Decrement	Minimum	operator =
Delta	SetScroll	

Inheritance

```
ZafScrollData : (ZafData : (ZafNotification,
   ZafElement)), ZafScrollStruct
```

Declaration

```
#include <z_scrll1.hpp>
```

Description

ZafScrollData objects can be used to store and manipulate scrolling information.

ZafScrollData combines data encapsulation with data and object notification from ZafData. It is most often used in conjunction with the ZafScrollBar user interface object but may be used as a stand-alone object if desired.

Constructors

All ZafScrollData constructors initialize the member variables associated with an instantiated ZafScrollData object. The default values set by the ZafScrollData and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafScrollData

`Current()`	`user-supplied parameter`
`Delta()`	`user-supplied parameter`
`Maximum()`	`user-supplied parameter`
`Minimum()`	`user-supplied parameter`
`Showing()`	`user-supplied parameter`
`Step()`	`same attribute as Delta()`

ZafElement

`ClassID()`	`ID_ZAF_SCROLL_DATA`
`ClassName()`	`"ZafScrollData"`

```
ZafScrollData(long minimum = 0, long maximum = 0, long
   current = 0, long delta = 1, long showing = 1);
```

This constructor allocates a ZafScrollData instance and initializes its contents according to the values passed in. *minimum* is the minimum value the scroll data can be, *maximum* is the maximum value, *current* is the current value, *delta* is the amount the scroll data changes for every scroll, and *showing* is the amount the scroll data changes when paging (page-up or page-down).

ZafScrollData`(ZafScrollStruct &data);`

This constructor allocates a ZafScrollData instance and initializes its data to the values in *data*.

ZafScrollData`(const ZafScrollData &copy);`

The copy constructor creates a new ZafScrollData object and initializes its data from *copy*.

ZafScrollData`(const ZafIChar *name, ZafDataPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following code snippet shows how to create a ZafScrollData object:

```
// Create some ZafScrollData objects.
ZafScrollData scroll1;
ZafScrollData scroll2 = scroll1;
ZafScrollData scroll3(1, 100, 1, 1, 10);
```

Destructor

`virtual ~`**ZafScrollData**`(void);`

This virtual destructor is used to free the memory associated with an instantiated ZafScrollData object. Unless StaticData() is true, a ZafScrollData object will be destroyed automatically when all ZafScrollBar objects that refer to it are destroyed.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Clear

```
virtual void Clear(void);
```

Clear() sets the scroll data values as follows: current is set to 0, delta is set to 1, maximum is set to 0, minimum is set to 0, and showing is set to 1.

Current

```
long Current(void) const;
virtual long SetCurrent(long current);
```

Current() is the current scroll value. It may be changed by calling SetCurrent().

Decrement

```
long Decrement(long value);
```

Decrement() subtracts Delta() from Current(). If the result would be less than Minimum(), then Current() becomes Minimum().

Delta

```
long Delta(void) const;
virtual long SetDelta(long delta);
```

Delta() is the amount that Current() changes during a scroll operation. SetDelta() may be called to change it.

Increment

```
long Increment(long value);
```

Increment() adds Delta() to Current(). If the result would be greater than Maximum(), then Current() becomes Maximum().

Maximum

```
long Maximum(void) const;
virtual long SetMaximum(long maximum);
```

Maximum() is the maximum value that Current() may be. SetMaximum() may be called to change it.

Minimum

```
long Minimum(void) const;
virtual long SetMinimum(long minimum);
```

Minimum() is the minimum value that Current() may be. SetMinimum() may be called to change it.

SetScroll

```
virtual ZafError SetScroll(long minimum, long maximum,
   long current, long delta, long showing);
virtual ZafError SetScroll(const ZafScrollStruct
   &scroll);
```

SetScroll() may be called to modify all of the scrolling values at once. *minimum* is the minimum value the scroll data can be, *maximum* is the maximum value, *current* is the current value, *delta* is the amount the scroll data changes for every scroll, and *showing* is the amount the scroll data changes when paging (page-up or page-down). Since all these values are stored in the ZafScrollStruct, *data* refers to a ZafScrollStruct whose values are to be copied into the ZafScrollData object.

Showing

```
long Showing(void) const;
virtual long SetShowing(long showing);
```

Showing() specifies the amount the scroll data changes when paging (page-up or page-down). SetShowing() may be called to change it.

Step

```
long Step(void) const;
virtual long SetStep(long step);
```

Step() is identical to Delta(), and SetStep() is identical to SetDelta().

operator =

```
ZafScrollData &operator=(const ZafScrollData &scroll);
ZafScrollData &operator=(const ZafScrollStruct &scroll);
```

These operators set the scroll values of the ZafScrollData object to be the same as the *scroll* parameters.

ZafScrollStruct

current	minimum	operator !=
delta	showing	
maximum	operator ==	

Inheritance `Root struct`

Declaration `#include <z_scrll.hpp>`

Description

ZafScrollStruct objects can be used to store and manipulate scrolling information. ZafScrollStruct is most often used in conjunction with the ZafScrollData class but may be used as a stand-alone object if desired.

Members

current

`long` **`current`**`;`

current is the current scroll value, and should always be a value between minimum and maximum. current is analogous to the thumb button on a scroll bar.

delta

`long` **`delta`**`;`

delta is the amount that current changes during a scroll operation. delta may be thought of as the amount the thumb button on a scroll bar moves when one of the arrows is selected.

maximum

`long` **`maximum`**`;`

maximum is the maximum value that current may be, and must be greater than or equal to minimum.

minimum

`long` **`minimum`**`;`

minimum is the minimum value that current may be, and must be less than or equal to maximum.

showing

`long` **`showing`**`;`

showing is the amount that current changes when paging (page-up or page-down).

operator ==

```
bool operator==(const ZafScrollStruct &scroll) const;
```

This operator checks equality of two ZafScrollStruct objects and returns true if all the members are equal.

operator !=

```
bool operator!=(const ZafScrollStruct &scroll) const;
```

This operator checks inequality of two ZafScrollStruct objects and returns true if any one of the members are not equal.

ZafScrolledWindow

HzScrollPos	ScrollWidth
ScrollHeight	VtScrollPos

Inheritance

```
ZafScrolledWindow : ZafWindow : (ZafWindowObject :
   ZafElement), ZafList
```

Declaration

```
#include <z_sclwin.hpp>
```

Description

ZafScrolledWindow provides support for scrolling the client area of a window with support ZafScrollBar objects. All the functionality of the base ZafWindow class is retained. The programmer must specify the size of the window's scrollable area.

Constructors

All ZafScrolledWindow constructors initialize the member variables associated with an instantiated ZafScrolledWindow object. The default values set by the ZafScrolledWindow and its base class constructors follow, if they differ from those set by the base class constructor.

Member Initializations

ZafScrolledWindow

`HzScrollPos()`	`0`
`ScrollHeight()`	`user-supplied parameter`
`ScrollWidth()`	`user-supplied parameter`
`VtScrollPos()`	`0`

ZafElement

`ClassID()`	`ID_ZAF_SCROLLED_WINDOW`
`ClassName()`	`"ZafScrolledWindow"`

```
ZafScrolledWindow(int left, int top, int width, int
   height, int scrollWidth, int scrollHeight, int
   hzScrollPos = 0, int vtScrollPos = 0);
```

This constructor is useful in straight-code situations. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

left and *top* specify the position where the left and top of the object will be placed on the window manager or its parent. *width* and *height* specify the width and height of the client region of the object.

scrollWidth and *scrollHeight* specify the width and height of the scrollable region of the window.

hzScrollPos and *vtScrollPos* specify the initial position of the viewable area of the window.

`**ZafScrolledWindow**(const ZafScrolledWindow &copy);`

The copy constructor creates a new ZafScrolledWindow object and initializes its data from *copy*.

```
ZafScrolledWindow(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a scrolled window follows:

```
// Create a scrolled window.
ZafScrolledWindow *window = new ZafScrolledWindow(1, 1, 50, 10,
   100, 100);
window->AddGenericObjects(new ZafStringData("Scrolled
   Window"));

// Add the scroll bars to the window.
window->Add(new ZafScrollBar(0, 0, 0, 0,
   ZAF_NULLP(ZafScrollData), ZAF_CORNER_SCROLL));
window->Add(new ZafScrollBar(0, 0, 0, 0,
   ZAF_NULLP(ZafScrollData), ZAF_VERTICAL_SCROLL));
window->Add(new ZafScrollBar(0, 0, 0, 0,
   ZAF_NULLP(ZafScrollData), ZAF_HORIZONTAL_SCROLL));

// Add a string to the window.
window->Add(new ZafString(60, 15, 10, new
   ZafStringData("String")));
```

Destructor

`virtual ~**ZafScrolledWindow**(void);`

The destructor is used to free the memory associated with a ZafScrolledWindow object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

ScrollHeight

```
int ScrollHeight(void);
void SetScrollHeight(int height);
```

ScrollHeight() specifies the height of the scrollable area in the same coordinate system as Region(). When ScrollHeight() is larger than Region().Height(), the window's contents may be scrolled vertically. When it is smaller, the vertical scroll bar becomes disabled, since all the window's contents are visible within its vertical client area. SetScrollHeight() may be called to modify the window's scrollable height.

ScrollWidth

```
int ScrollWidth(void);
void SetScrollWidth(int width);
```

ScrollWidth() specifies the width of the scrollable area in the same coordinate system as Region(). When ScrollWidth() is larger than Region().Width(), the window's contents may be scrolled horizontally. When it is smaller, the horizontal scroll bar becomes disabled, since all the window's contents are visible within its horizontal client area. SetScrollWidth() may be called to modify the window's scrollable width.

HzScrollPos

```
int HzScrollPos(void);
void SetHzScrollPos(int pos);
```

HzScrollPos() specifies how much the window has scrolled horizontally. A value of zero means that the left-most contents of the window are at the left of the window's client region. A positive value means that the left-most contents of the window are to the left of the window's client region, and thus are not visible. SetHzScrollPos() may be called to scroll the window's contents horizontally.

VtScrollPos

```
int VtScrollPos(void);
void SetVtScrollPos(int pos);
```

VtScrollPos() specifies how much the window has scrolled vertically. A value of zero means that the top-most contents of the window are at the top of the window's client region. A positive value means that the top-most contents of the window are above the window's client region, and thus are not visible. Set-VtScrollPos() may be called to scroll the window's contents vertically.

ZafSpinControl

Delta

Inheritance ZafSpinControl : ZafWindow : (ZafWindowObject : ZafElement), ZafList

Declaration `#include <z_spin.hpp>`

Description ZafSpinControl allows an end-user to automatically increment and decrement another “value” object. Value objects derive from ZafString and define Increment() and Decrement() functions. They include ZafBignum, ZafDate, ZafTime, ZafUTime, ZafInteger, and ZafReal. ZafSpinControl utilizes native spin control APIs, if available.

The user manipulates a spin control by clicking on increment or decrement buttons, or by using the keyboard. Each time the ZafSpinControl is changed it adds or subtracts a “delta” value specified by the programmer until an optional maximum or minimum value is reached. Values may “wrap” at maximum or minimum if desired.

Constructors All ZafSpinControl constructors initialize the member variables associated with an instantiated ZafSpinControl object. The default values set by the ZafSpinControl and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafSpinControl. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafSpinControl

`Delta()`	`user-supplied parameter`
`WrappedData()`	`true`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_SINGLE_SELECTION`†

Member Initializations

`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_SPIN_CONTROL`
`ClassName()`	`"ZafSpinControl"`

ZafSpinControl`(int left, int top, int width, ZafData *delta);`

This constructor is useful in straight-code situations. *left*, *top* and *width* specify the position and size of the ZafSpinControl (which includes its child object). ZafSpinControl objects are always one cell high. *left*, *top*, and *width* are specified in cell coordinates by default, but may be specified using another coordinate system if desired. See ZafWindowObject::SetCoordinateType() for more information.

delta may be an instance of any ZafData subclass, but the spin control's child object must be able to utilize delta when incrementing and decrementing. For more information on using ZafData objects, see ZafData. The following are ZAF classes already supported by ZafSpinControl, listed together with the corresponding delta class that must be used:

ZafSpinControl child object	Corresponding delta object
`ZafBignum`	`ZafBignumData`
`ZafDate`	`ZafDateData`
`ZafInteger`	`ZafIntegerData`
`ZafReal`	`ZafRealData`
`ZafTime`	`ZafTimeData`
`ZafUTime`	`ZafUTimeData`

ZafSpinControl`(const ZafSpinControl &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It allocates a new ZafSpinControl object and initializes its data from *copy*. If the original ZafSpinControl's internal data objects are StaticData() then the new ZafSpinControl object points to the originals, otherwise copies are made.

```
ZafSpinControl(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

The following example demonstrates how to create ZafSpinControl objects:

```
// Create a spin control using a ZafInteger object and
// ZafIntegerData delta.
ZafIntegerData *delta = new ZafIntegerData(1);

// Use the ZafIntegerData delta with the spin control.
ZafSpinControl *spinner = new ZafSpinControl(1, 1, 12, delta);

// Add the ZafInteger field object to the spin control.
spinner->Add(new ZafInteger(0, 0, 0, 1));
window->Add(spinner);
```

Destructor

```
virtual ~ZafSpinControl(void);
```

The destructor is used to free the memory associated with a ZafSpinControl object, including all the data object pieces that are Destroyable(). It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not destroy a ZafSpinControl object directly since it is automatically destroyed when its parent object is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. If the Set*() function does not successfully change the state as requested, however, it will instead return the current state.

Delta

```
const ZafData *Delta(void);
virtual ZafError SetDelta(ZafData *data);
```

The Delta() object contains the actual data used by the ZafSpinControl when spinning its child object. Each time the child object is spun, it is incremented or decremented by the value of Delta(). The Delta() object must be an instance of a class that the spin control's child object supports with its Increment() and Decrement() functions. ZafData objects may be shared among several Zaf-SpinControl objects (to save memory, for example) or they may belong to a single ZafSpinControl object. SetDelta() may be used to associate a Delta()

object with a ZafSpinControl object. See ZafDataManager for more information on data sharing.

Delta() returns a pointer to the Delta() object associated with the ZafSpinControl. SetDelta() normally returns ZAF_ERROR_NONE.

```
bool WrappedData(void) const;
virtual bool SetWrappedData(bool wrappedData);
```

If WrappedData() is true, the spin control wraps from end to beginning or from beginning to end when it reaches the maximum or minimum of the value or of the range. This attribute is true by default, but SetWrappedData() may be called to change it.

ZafStandardArg

RearrangeArgs SetSscanf vsscanf
SetSprintf vsprintf

Inheritance Root class

Declaration `#include <z_stdarg.hpp>`

Description ZafStandardArg provides support for internationalized standard argument functions that work correctly with Unicode strings, as well as ISO strings. ZAF standard functions such as sprintf() and sscanf() utilize ZafStandardArg to internationalize their use of standard arguments. These functions should generally be used in ZAF applications instead of their standard library equivalents. As these functions are all static, and ZafStandardArg has no constructor, no ZafStandardArg object needs to be created by the programmer.

Members

```
static void RearrangeArgs(bool isScanf, void *newBuffer,
    const ZafIChar *format, const va_list ap, ZafIChar
    *newFormat, va_list *toRet);
```

RearrangeArgs

RearrangeArgs() is at the heart of ZAF's internationalization of variable argument lists. It allows a format character to specify which variable argument it matches with, regardless of its order within the format string. This is especially useful when string translations causes the order of translated words to be different. RearrangeArgs() is generally not called by the programmer, since the standard ZAF functions call it when necessary.

isScanf should be true when RearrangeArgs() requires the sscanf() functionality of [...] arguments. *newBuffer* is the buffer used to store the new variable argument list, so it must be large enough to hold them (and the Borland compilers require this buffer to be on the stack). *format* is the original format string and *ap* is the original variable argument list. *newFormat* is the resulting format string, and *toRet* is the resulting variable argument list.

For example, to specify the second variable argument in a format character for a string, "%2s" would be used in the format string. The following code snippet shows how this feature is used within ZAF's sscanf():

```
int sscanf(const ZafIChar *dst, const ZafIChar *format, ...)
{
  // Rearrange the arguments before passing to _vsscanf().
  va_list args;
  va_start(args, format);
#if defined(ZAF_REARRANGEARGS)
```

```
  ZafIChar *newFormat = new ZafIChar[ZAF_MAXPARAMLEN];
  char buff[ZAF_MAXPARAMLEN];   // Borland expects this in the
    stack.
  va_list newArgs;
  ZafStandardArg::RearrangeArgs(true, buff, format, args,
    newFormat, &newArgs);
  int i = ZafStandardArg::_vsscanf(dst, newFormat, newArgs);
  delete []newFormat;
#else
  int i = ZafStandardArg::_vsscanf(dst, format, &args);
#endif
  va_end(args);
  return i;
}
```

SetSprintf

`static void` **`SetSprintf`**`(ZafIChar fmtCH, objectFormat format);`

SetSprintf() adds support for the format character *fmtCH* through the format routine *format*. This routine should normally not be called by the programmer, but is used internally by ZAF. For example, ZafIntegerData adds support for the format character 'd' in the format routine ZafIntegerData::Format() by calling ZafStandardArg::SetSprintf('d', ZafIntegerData::Format). Thereafter, calls to sprintf() using the format character 'd' will be formatted by passing the argument to ZafIntegerData::Format().

SetSscanf

`static void` **`SetSscanf`**`(ZafIChar fmtCH, objectParse parse);`

SetSscanf() adds support for the format character *fmtCH* through the parsing routine *parse*. This routine should normally not be called by the programmer, but is used internally by ZAF. For example, ZafIntegerData adds support for the format character 'd' in the parsing routine ZafIntegerData::Parse() by calling ZafStandardArg::SetSscanf('d', ZafIntegerData::Parse). Thereafter, calls to sscanf() using the format character 'd' will be parsed by passing the argument to ZafIntegerData::Parse().

vsprintf

`static int` **`vsprintf`**`(ZafIChar *buffer, const ZafIChar *format, va_list *argList);`

`static int` **`_vsprintf`**`(ZafIChar *fp, const ZafIChar *fmt, va_list *ap);`

vsprintf() calls RearrangeArgs() if the macro ZAF_REARRANGEARGS is defined, then calls _vsprintf() with the fixed arguments. If ZAF_REARRANGEARGS is not defined, then vsprintf() simply calls _vsprintf() with the same arguments. *buffer* is the output buffer, *format* is the format string, and *argList* is the list of variable arguments. See the compiler's documentation for the standard function vsprintf() for more information.

In addition to the normal format options supported by the standard library vsprintf(), ZAF's vsprintf() provides a few more:

Format option	**Description**
`%Z[$@+-,]B`	allows a ZafBignumData pointer to be an argument (see ZafBignumData::FormattedText() for more information)
`%ZU`	allows a ZafUTimeData pointer to be an argument

These format options are normally only used internally by ZAF. The following code snippet shows the preferred method of using sprintf() with a complex data object:

```
// Load outputString with a bignum.
ZafBignumData bignum(123.456);
ZafIChar bignumString[64], outputString[64];
bignum.FormattedText(bignumString, strlen(bignumString),
    "%$@B");
sprintf(outputString, "Bignum: %s", bignumString);
```

vsscanf

```
static int vsscanf(const ZafIChar *buffer, const ZafIChar
    *format, va_list *argList);
static int _vsscanf(const ZafIChar *fp, const ZafIChar
    *fmt, va_list *ap);
```

vsscanf() calls RearrangeArgs() if the macro ZAF_REARRANGEARGS is defined, then calls _vsscanf() with the fixed arguments. If ZAF_REARRANGEARGS is not defined, then vsscanf() simply calls _vsscanf() with the same arguments. *buffer* is the input buffer, *format* is the format string, and *argList* is the list of variable arguments. See the compiler's documentation for the standard function vsscanf() for more information.

ZafStatusBar

Inheritance

`ZafStatusBar : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_status.hpp>`

Description

The ZafStatusBar object is generally used for informational purposes. For example, a string field on a status bar may display help messages (see ZafHelp-Tips for more information). Many objects available in ZAF may be placed on a status bar, but any object placed on a status bar will act Noncurrent(), since the status bar is Noncurrent(), meaning that it does not receive focus.

Constructors

All ZafStatusBar constructors initialize the member variables associated with an instantiated ZafStatusBar object. The default values set by the ZafStatusBar and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafStatusBar. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_SINGLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`true`
`Focus()`	`false`†
`Noncurrent()`	`true`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`SupportObject()`	`true`†
`UserFunction()`	`null`†

Member Initializations

ZafElement	
`ClassID()`	`ID_ZAF_STATUS_BAR`
`ClassName()`	`"ZafStatusBar"`

`ZafStatusBar``(int left, int top, int right, int bottom);`

This constructor is useful in straight-code situations. The *left*, *top*, *right* and *bottom* parameters specify the left, top, right and bottom of the object, respectively. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. Currently, the *left* and *right* parameters are ignored since the status bar automatically fills the bottom edge of its parent's client region, but they may be used in the future. Note that the ZafStatusBar object is always positioned on the bottom of its parent window's client region, so the *top* and *bottom* parameters are only used in calculating the height of the status bar.

`ZafStatusBar``(const ZafStatusBar &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafStatusBar object and copies the object's information.

`ZafStatusBar``(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a status bar follows:

```
// Create a sample window with a status bar and a string.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);
// Create a status bar.
ZafStatusBar *statusBar = new ZafStatusBar(0, 0, 80, 1);
// Add a string that occupies the entire status bar.
ZafString *bigString = new ZafString(0, 0, 0, "Big Sample
    String", -1);
bigString->SetRegionType(ZAF_AVAILABLE_REGION);
statusBar->Add(bigString);
// Add the status bar to the window.
window1->Add(statusBar);
```

Destructor

```
virtual ~**ZafStatusBar**(void);
```

The destructor is used to free the memory associated with a ZafStatusBar object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafStatusBar object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

ZafStorage

ChDir	GetCWD	Remove
Close	MkDir	Rename
Create	Open	RmDir
FindClose	OpenCreate	Save
FindFirst	ReadOnly	SaveAs
FindNext	ReadWrite	Version

Inheritance `ZafStorage : ZafFileSystem : ZafElement`

Declaration `#include <z_store.hpp>`

Description

ZafStorage and ZafStorageFile provide support for persistence in ZAF. Any information may be portably stored with ZafStorage, and most ZAF classes provide built-in support for persistence through ZafStorage.

ZafStorage may be thought of as a file system. The ZafStorage class has a similar design to the Unix file system. There can be many ZafStorageFiles and levels of subdirectories. ZafStorage allows ZafStorageFiles to be copied, deleted, and moved across directories.

ZafStorage is typically used for persistent objects (usually created in Zinc Designer) and for storing internationalization data. It is also commonly used as a simple database.

Constructors

All ZafStorage constructors initialize the member variables associated with an instantiated ZafStorage object. Default values set by the ZafStorage follow.

Member Initializations

ZafStorage	
`Version()`	0

```
ZafStorage(const ZafIChar *name, ZafFileMode mode =
   ZAF_FILE_READWRITE);
```

This constructor initializes the members associated with a ZafStorage object and opens the disk file specified by *name*. The file is opened using the *mode* file mode (see the ZafFile constructor for more information). This constructor chains to the ZafFileSystem and ZafElement constructors.

```
ZafStorage(void);
```

This constructor initializes the members associated with a ZafStorage object and opens a temporary storage object that is useful to store and retrieve temporary information. This constructor chains to the ZafFileSystem and ZafElement constructors.

Destructor

```
virtual ~ZafStorage(void);
```

This virtual destructor is used to free the memory associated with an instantiated ZafStorage object and chains to the ZafFileSystem and ZafElement destructors.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

ChDir

```
virtual int ChDir(const ZafIChar *newPath, ZafStringID
    stringID = ZAF_NULLP(ZafIChar), ZafNumberID numberID =
    0);
```

ChDir() changes the current ZafStorage directory. *newPath* specifies the path name of the directory to be changed to. *stringID* specifies the string identification constant associated with the directory and *numberID* specifies the numeric identification constant associated with the directory. ChDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Close

```
virtual void Close(ZafFile *file);
```

Close() closes *file*, which is a ZafStorageFile previously opened with Open().

Create

```
bool Create(void) const;
```

If Create() is true, the ZafStorage object is created, even if it already exists.

FindClose

```
virtual int FindClose(ZafFileInfoStruct &fileInfo);
```

FindClose() finalizes a find operation begun with FindFirst(). *fileInfo* is the same ZafFileInfoStruct object used by FindFirst() and FindNext(), and memory allocated in *fileInfo* is deleted by FindClose(). FindClose() returns 0 if the operation was successful; otherwise it returns -1.

FindFirst

```
virtual int FindFirst(ZafFileInfoStruct &fileInfo, const
   ZafIChar *searchName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

FindFirst() initializes a find operation. FindFirst() searches for a ZafStorageFile with the search pattern specified by *searchName*, or with the string identification constant specified by *stringID*, or with the numeric identification constant specified by *numberID*. *searchName* may contain wildcards. For example, "?" means any single character, and "*" means any string of characters. *fileInfo* is a ZafFileInfoStruct object allocated by the programmer, and *fileInfo* is initialized by FindFirst(). FindFirst() returns 0 if a ZafStorageFile was found; otherwise it returns -1.

FindNext

```
virtual int FindNext(ZafFileInfoStruct &fileInfo, const
   ZafIChar *searchName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

FindNext() continues a find operation initiated by FindFirst(). FindNext() searches for the next ZafStorageFile with the same values for *searchName*, *stringID*, or *numberID* as were specified in the call to FindFirst(). *fileInfo* is the same ZafFileInfoStruct object passed to FindFirst(). FindNext() returns 0 if a ZafStorageFile was found; otherwise it returns -1.

GetCWD

```
virtual int GetCWD(ZafIChar *pathName, int pathLength);
```

GetCWD() copies the path name of the current storage directory (without a terminating path separating character) into the buffer specified by *pathName*. *pathName* must be allocated by the programmer, and *pathLength* specifies the number of ZafIChar characters in *pathName*. GetCWD() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

MkDir

```
virtual int MkDir(const ZafIChar *pathName, ZafStringID
   stringID = ZAF_NULLP(ZafIChar), ZafNumberID numberID =
   0);
```

MkDir() creates a new storage directory. *pathName* specifies the path name of the directory to be created. *stringID* specifies the string identification constant associated with the directory and *numberID* specifies the numeric identification constant associated with the directory. MkDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Open

```
virtual ZafFile *Open(const ZafIChar *fileName, const
   ZafFileMode mode, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

Open() opens the ZafStorageFile specified by *fileName*. *mode* specifies the mode the ZafStorageFile is opened with (see the ZafFile constructor for more information). *stringID* specifies the string identification constant associated with the ZafStorageFile and *numberID* specifies the numeric identification constant associated with the ZafStorageFile. A pointer to the ZafStorageFile opened is returned.

OpenCreate

```
bool OpenCreate(void) const;
```

If OpenCreate() is true, the ZafStorage object is opened if it exists, or it is created if it doesn't exist.

ReadOnly

```
bool ReadOnly(void) const;
```

If ReadOnly() is true, the ZafStorage object and its ZafStorageFile objects cannot be written.

ReadWrite

```
bool ReadWrite(void) const;
```

If ReadWrite() is true, the ZafStorage object and its ZafStorageFile objects may be read and written.

Remove

```
virtual int Remove(const ZafIChar *fileName);
```

Remove() deletes the ZafStorageFile specified by *name*. Remove() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Rename

```
virtual int Rename(const ZafIChar *oldName, const
   ZafIChar *newName, ZafStringID stringID =
   ZAF_NULLP(ZafIChar), ZafNumberID numberID = 0);
```

Rename() renames the storage file or directory specified by *oldName* to *newName*. A non-null *stringID* specifies the string identification constant to be copied to the file or directory. A non-zero *numberID* specifies the numeric identification constant to be copied to the file or directory. If *oldName* and *newName* are the same, *stringID* and *numberID* are still copied to the file or directory (if not null and 0, respectively). Rename() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

RmDir

```
virtual int RmDir(const ZafIChar *pathName, bool
    deleteContents = false);
```

RmDir() deletes a storage directory. *pathName* specifies the path name of the directory to be deleted. If *deleteContents* is false, RmDir() will only delete the directory if it is empty; otherwise, RmDir() will delete the contents of the directory along with the directory itself. RmDir() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

Save

```
int Save(int backups = 0);
```

Save() causes the ZafStorage object's Changed() ZafStorageFile objects to be saved permanently. The ZafStorage object keeps its name for the operation. *backups* specifies the number of backups the ZafStorage object keeps of itself. Save() returns 0 on success, and -1 on failure. Error() is also set to an appropriate value.

SaveAs

```
int SaveAs(const ZafIChar *newName, int backups = 0);
```

SaveAs() changes its name to *newName*, then calls Save(), passing it backups. SaveAs() returns whatever Save() returns.

Version

```
ZafVersion Version(void) const;
ZafVersion SetVersion(ZafVersion version);
```

Version() returns the version of the ZafStorage object. The high byte contains the major version number, and the low byte contains the minor version number. SetVersion() may be called to change it, but SetVersion() is an advanced routine and should normally not be called by the programmer. The definition of ZafVersion follows:

```
typedef ZafInt16 ZafVersion;
```

The following code snippet shows how to get the version of a ZafStorage object:

```
// Make sure the version of the ZafStorage is at least 5.0.
ZafVersion version = storage->Version();
if ((version >> 8) < 5)
  break;
```

ZafStorageFile

Changed	ReadData	WriteData
Data	Seek	
Length	Tell	

Inheritance

`ZafStorageFile : ZafFile : ZafElement`

Declaration

```
#include <z_store.hpp>
```

Description

ZafStorage and ZafStorageFile provide support for persistence in ZAF. Any information may be portably stored with ZafStorage, and most ZAF classes provide built-in support for persistence through ZafStorage. ZafStorageFile is used exclusively with ZafStorage for persistence support. See ZafStorage for more information.

Constructor

```
ZafStorageFile(ZafFileMode mode, char *initData =
   ZAF_NULLP(char), int initDataSize = 0);
```

This constructor is protected, and is only called from ZafStorage::Open(). It initializes the members associated with a ZafStorageFile object, and chains to the ZafFile and ZafElement constructors. *mode* specifies the mode in which the storage file is opened (see the ZafFile constructor for more information). *initData* specifies the data that the ZafStorageFile object is initialized with, and *initDataSize* specifies the number of bytes in *initData*.

Destructor

```
virtual ~ZafStorageFile(void);
```

This virtual destructor is protected, and is only called from ZafStorage::Close(). It frees the memory associated with an instantiated ZafStorage-File object and chains to the ZafFile and ZafElement destructors.

Members

Changed

```
bool Changed(void);
```

Changed() returns true if the contents of the storage file have changed since it was opened; otherwise it returns false.

Data

```
const char *Data(void);
```

Data() returns a pointer the internal data buffer for the storage file. This is an advanced function, and should not be called by the programmer.

Length

```
virtual ZafOffset Length(void) const;
```

Length() returns the length of the storage file in bytes, or it returns -1 if an error occurs.

ReadData

`virtual int **ReadData**(void *buffer, int size);`

ReadData() reads data from the storage file. The data is read into *buffer*, which must have already been allocated by the programmer, and *size* specifies the number of bytes to read. On success, ReadData() returns the number of bytes read into *buffer*; otherwise zero is returned. Error() is also set to an appropriate value.

Seek

`virtual int **Seek**(ZafOffset offset, ZafSeek location);`

Seek() moves the file pointer of the storage file. *location* specifies the position in the file from where offset specifies. Possible values of location and what they mean follow:

ZafSeek	ZafOffset
ZAF_SEEK_START	The offset is measured from the beginning of the file toward the end of the file
ZAF_SEEK_CURRENT	A positive offset is measured from the current file pointer, and a negative offset is measured toward the beginning of the file.
ZAF_SEEK_END	The offset is measured from the end of the file toward the beginning of the file

Seek() returns 0 if successful, and -1 if an error occurs (in which case Error() is also set appropriately).

Tell

`virtual ZafOffset **Tell**(void) const;`

Tell() returns the current offset of the file pointer in the storage file, or it returns -1 if an error occurs.

WriteData

`virtual int **WriteData**(const void *buffer, int size);`

WriteData() writes data to a storage file. *buffer* is a pointer to the data to be written, and *size* specifies the number of bytes to write. On success, WriteData() returns the number of bytes written; otherwise zero is returned. Error() is also set to an appropriate value.

ZafString

AutoClear	LowerCase	SetSelected
CursorOffset	OutputFormatData	StringData
Decrement	OutputFormatText	Text
DefaultValidateFunction	Password	Unanswered
Event	RangeData	UpperCase
HzJustify	RangeText	Validate
Increment	SetInputFormat	VariableName
InputFormatData	SetOutputFormat	ViewOnly
Invalid	SetRange	

Inheritance `ZafString : ZafWindowObject : ZafElement`

Declaration `#include <z_str1.hpp>`

Description

The ZafString object is a single-line text object that allows user input through the keyboard. Other user interaction is also supported such as copy/cut/paste. Several formatting options are available in ZafString objects such as password, upper-case, lower-case, and variable-name.

The ZafString class is used as a base class for other single-line text classes such as ZafFormattedString, ZafInteger, and ZafReal. These classes inherit much of the base functionality provided by ZafString.

Constructors

All ZafString constructors initialize the member variables associated with an instantiated ZafString object. Default values set by the ZafString follow, as well as base class values when overridden by ZafString.

Member Initializations

ZafString

`AutoClear()`	`true`
`HzJustify()`	`ZAF_HZ_LEFT`
`InputFormatData()`	`null`
`Invalid()`	`false`
`LowerCase()`	`false`
`OutputFormatData()`	`null`
`Password()`	`false`
`RangeData()`	`null`
`StringData()`	`null`
`Unanswered()`	`false`

Member Initializations

`UpperCase()`	`false`
`VariableName()`	`false`
`ViewOnly()`	`false`
ZafWindowObject	
`Bordered()`	`true`
`memberUserFunction`	`ZafString:: DefaultValidateFunction`
`zafRegion.bottom`	`top`
ZafElement	
`ClassID()`	`ID_ZAF_STRING`
`ClassName()`	`"ZafString"`

```
ZafString(int left, int top, int width, const ZafIChar
    *text, int maxLength);
```

This constructor is useful in straight-code situations, particularly to have the ZafString object to create, maintain and destroy its own ZafStringData object automatically. The *left* and *top* parameters specify the position where the left and top of the object will be placed on its parent, respectively. The *width* parameter specifies the width of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *text* is the string that initially appears in the new ZafString object, and *maxLength* is passed to the ZafStringData constructor, the maximum number of characters the user may type into the field (see the ZafStringData constructor for more information). If you pass -1 in for the *maxLength* parameter, the number of characters the user may type is not restricted.

```
ZafString(int left, int top, int width, ZafStringData
    *stringData);
```

This constructor is useful in straight-code situations where a ZafStringData object has already been created. This constructor may be used to maintain data pieces yourself, rather than have the ZafString class create and maintain the data pieces automatically. For example, to maintain a database of ZafStringData objects and tie them into ZafString objects, maintain your own ZafStringData objects and create ZafString objects using your ZafStringData objects by passing them into the *stringData* parameter of this constructor. For more information on using ZafStringData objects, see ZafStringData. The *left*, *top* and *width* parameters are the same as the previous constructor.

ZafString(const ZafString &copy);

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafString object and copies the object's information. If the data objects are StaticData() then the new ZafString object points to the original data objects, otherwise a copy is made for the new ZafString object. This allows a programmer to use static data for more than one ZafString object.

ZafString(const ZafIChar *name, ZafObjectPersistence
&persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafString creation techniques follow:

```
// Create a sample window with string objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Create strings and pass in the text directly.
window1->Add(new ZafString(0, 1, 25, "String1", 25));
window1->Add(new ZafString(0, 2, 25, "String2", 25));
...
// Create a sample window with string objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
// Create string data objects.
ZafStringData *stringData1 = new ZafStringData("String1", 25);
ZafStringData *stringData2 = new ZafStringData("String2", 25);
// Create strings that use the data previously created.
window2->Add(new ZafString(0, 1, 25, stringData1));
window2->Add(new ZafString(0, 2, 25, stringData2));
```

Destructor virtual ~**ZafString**(void);

The destructor is used to free the memory associated with a ZafString object, including all the data object pieces (such as StringData()) that are Destroyable(). It chains to the ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafString object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoClear

```
bool AutoClear(void) const;
virtual bool SetAutoClear(bool autoClear);
```

If AutoClear() is true, the string becomes entirely highlighted when the object gains focus, so that whatever the user types replaces the current text. The default value of this attribute is true, but the user may call SetAutoClear() to change it.

CursorOffset

```
int CursorOffset(void) const;
virtual ZafError SetCursorOffset(int position);
```

CursorOffset() returns the character offset of the cursor (the insertion point) in the ZafString object. This offset is zero-based, so the first character offset in the ZafString is 0. The user may call SetCursorOffset() to reposition the cursor to *position* in the ZafString. For example:

```
// Move the cursor to the beginning of the string.
object->SetCursorOffset(0);
```

Decrement

```
virtual ZafError Decrement(ZafData *data, bool wrapData =
    false);
```

Decrement() does nothing by default in the ZafString class, but is overloaded by other classes such as ZafDate and ZafInteger to decrement values. The corresponding data object is decremented via the -= operator by the amount specified in *data*. *wrapData* specifies whether or not to allow wrapping at the range minimum. If *wrapData* is true and the new value would be less than the allowable range minimum, the new value will be the range maximum; otherwise the new value will be the range minimum. The visual object is updated accordingly. If *data* is not of the correct class, nothing happens. For example, *data* for a ZafDate object must be a ZafDateData object.

DefaultValidate-Function

```
ZafEventType DefaultValidateFunction(const
    ZafEventStruct &event, ZafEventType ccode);
```

DefaultValidateFunction() is automatically called when a ZafString gets L_SELECT or N_NON_CURRENT events. The programmer should never call DefaultValidateFunction() directly. DefaultValidateFunction() calls Validate(), which does nothing by default in the ZafString class, but is overloaded by other classes that require validation, such as ZafDate and ZafInteger. *event* is the event that triggered the call to DefaultValidateFunction(), and *ccode* is the event type that triggered the call.

The return value for DefaultValidateFunction() is an error code indicating the result of the field validation. The return value is ZAF_ERROR_NONE if validation succeeded, and another value of the enumeration ZafError appropriate to the derived class otherwise. For example, ZAF_ERROR_OUT_OF_RANGE may be returned by a ZafDate object if a date out of the required range was entered.

Event

`virtual ZafEventType` **`Event`**`(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafString object, whether by processing the events itself, or by passing them to ZafWindowObject::Event() for base class processing. See ZafWindowObject for more information.

In addition to those handled by its base classes, ZafString handles the following events:

Event	**Description**
S_COPY	causes the object to copy its selected data to the clipboard
S_CUT	causes the object to cut its selected data to the clipboard
S_PASTE	causes the object to paste the clipboard’s data to its current cursor position, replacing any selected data
S_COPY_DATA	causes the object to copy event.windowObject's StringData() if event.windowObject is a ZafString object
S_SET_DATA	causes the object to create a new StringData() object, then copy into it event.windowObject's StringData() if event.windowObject is non-null and is a ZafString object

HzJustify

```
ZafHzJustify HzJustify(void) const;
virtual ZafHzJustify SetHzJustify(ZafHzJustify
    hzJustify);
```

HzJustify() controls the string’s horizontal justification, and is ZAF_HZ_LEFT by default. The user may call SetHzJustify() to change it to ZAF_HZ_RIGHT or ZAF_HZ_CENTER.

Increment

```
virtual ZafError Increment(ZafData *data, bool wrapData =
   false);
```

Increment() does nothing by default in the ZafString class, but is overloaded by other classes such as ZafDate and ZafInteger to increment values. The corresponding data object is incremented via the += operator by the amount specified in *data*. *wrapData* specifies whether or not to allow wrapping at the range maximum. If *wrapData* is true and the new value would be greater than the allowable range maximum, the new value will be the range minimum; otherwise the new value will be the range maximum. The visual object is updated accordingly. If *data* is not of the correct class, nothing happens. For example, *data* for a ZafDate object must be a ZafDateData object.

InputFormatData
SetInputFormat

```
ZafStringData *InputFormatData(void) const;
ZafError SetInputFormat(const ZafIChar *format);
virtual ZafError SetInputFormatData(ZafStringData
   *format);
```

The InputFormatData() portion of ZafStringData is used in use input validation for classes derived from ZafString, such as ZafDate and ZafFormattedString. InputFormatData() returns a pointer to the actual ZafStringData object that stores the input format data. InputFormatText() returns the string portion of the input format data.

The programmer may set the InputFormatData() with SetInputFormat() or SetInputFormatData(). SetInputFormat() is useful for passing in a simple string to be used in either modifying an existing input format data object, or automatically creating a new input format data object using the string you pass in. SetInputFormatData() is useful when you want ZafString to use an existing input format data object. SetInputFormatData() will delete the previous InputFormatData() object if it is Destroyable() and no other object uses it.

InputFormatData() returns the string data object used for the input formatting and InputFormatText() returns the text contained in the string data object. SetInputFormat() and SetInputFormatData() generally return ZAF_ERROR_NONE. For more information on format string arguments and what they mean, see ZafStringData. Sample usage follows:

```
// Get the input format two different ways.
const ZafStringData *inputFormat = object->InputFormatData();
const ZafIChar *inputText = object->InputFormatText();
...
// Set the input format two different ways.
ZafDate *date1 = new ZafDate(0, 0, 15);
ZafDate *date2 = new ZafDate(0, 1, 15);
date1->SetInputFormat("%m/%d/%y");
ZafStringData *inputFormatData = new ZafStringData("%m/%d/%y");
date2->SetInputFormatData(inputFormatData);
```

Invalid

```
bool Invalid(void) const;
virtual bool SetInvalid(bool invalid);
```

Invalid() is used in classes derived from ZafString that require validation, such as ZafBignum and ZafTime. If Invalid() is true, the user is forced to enter a valid value into the field. The default value of this attribute is false, but the user may call SetInvalid() to change it.

As an example, if a ZafInteger has a range of 1..100 and initially has the value 0, SetInvalid(true) would be called so that the user must enter a value in the range 1..100. Invalid() may be used in any scenario where a field is restricted by validation, whether the validation be automatically handled by ZAF or by another validation method that the programmer has implemented. After the user has entered a valid value into the field, Invalid() will be reset to false automatically by ZAF.

For example:

```
// Create the object with invalid data and force the user to
// enter something valid.
ZafInteger *int1 = new ZafInteger(0, 0, 15, 0);
int1->SetInvalid(true);
int1->SetRange("1..100");
```

LowerCase

```
bool LowerCase(void) const;
virtual bool SetLowerCase(bool lowerCase);
```

If LowerCase() is true, any upper-case characters typed into the ZafString field will be converted to lower-case. Any characters the programmer directly places into the ZafString's StringData() will be displayed as lower-case, but not converted. LowerCase() is false by default, but the user may call SetLowerCase() to change it. The programmer should never set both LowerCase() and UpperCase() on the same object at the same time, as the result is undefined.

OutputFormatData
OutputFormatText
SetOutputFormat

```
ZafStringData *OutputFormatData(void) const;
const ZafIChar *OutputFormatText(void) const;
ZafError SetOutputFormat(const ZafIChar *format);
virtual ZafError SetOutputFormatData(ZafStringData
    *format);
```

The OutputFormatData() piece of ZafString is used to display the user's input in a uniform format, for classes derived from ZafString—such as ZafDate and ZafFormattedString. OutputFormatData() returns a pointer to the actual ZafStringData object that stores the output format data. OutputFormatText() returns the string portion of the output format data.

The programmer may set the output format data with SetOutputFormat() or SetOutputFormatData(). SetOutputFormat() is useful for passing in a simple string to be used in either modifying an existing output format data object, or automatically creating an output format data object using the string you pass in. SetOutputFormatData() is useful when you want ZafString to use an existing output format data object. SetOutputFormatData() will delete the previous OutputFormatData() object if it is Destroyable() and no other object uses it.

Derived classes such as ZafDate and ZafTime may concatenate several format strings separated with '\n' characters in OutputFormatText(). For example, a sample OutputFormatText() for ZafDate may be:

```
"%m/%d/%y\n%d/%m/%y\n%m-%d-%y\n%d-%m-%y".
```

For more information on format string arguments and what they mean, see ZafStringData. Set SetInputFormat() for sample code.

Format Argument	Substitution
%c	ZafIChar character
%s	ZafIChar array (string)

Password

```
bool Password(void) const;
virtual bool SetPassword(bool password);
```

If Password() is true, all characters typed into the ZafString field will be hidden by appearing as asterisk or bullet characters. Internally, however, the data will accurately represent what was typed in. Password() is false by default, but the user may call SetPassword() to change it. Note: if drag-and-drop is enabled on a Password() ZafString, the user may drop away from it and reveal the actual contents.

RangeData
RangeText
SetRange

```
ZafStringData *RangeData(void) const;
const ZafIChar *RangeText(void) const;
ZafError SetRange(const ZafIChar *range);
virtual ZafError SetRangeData(ZafStringData *range);
```

The RangeData() portion of ZafString is used to validate that the user's input matches a specified range of values that are valid for the object, for classes derived from ZafString such as ZafDate and ZafFormattedString. RangeData() returns a pointer to the actual ZafStringData object that stores the range data. RangeText() returns the string portion of the range data.

The programmer may set the range data with SetRange() or SetRangeData(). SetRange() is useful for passing in a simple string to be used in either modifying an existing range data object, or automatically creating a range data object using the string you pass in. SetRangeData() is useful when you want ZafString to use an existing range data object. SetRangeData() will delete the previous RangeData() object if it is Destroyable() and no other object uses it.

Sample usage follows:

```
// Get the range two different ways.
const ZafStringData *rangeFormat = object->RangeData();
const ZafIChar *rangeText = object->RangeText();
...
// Set the range two different ways.
ZafInteger *myInt = new ZafInteger(10);
ZafReal *myReal = new ZafReal(10.0);
myInt->SetRange("1..100");
ZafStringData *realRange = new ZafStringData("1.0..100.0");
myReal->SetRangeData(realRange);
```

SetSelected

`virtual bool` **`SetSelected`**`(bool selected);`

This overloaded function adds to the functionality of ZafWindowObject::SetSelected() by performing platform-specific display operations such as displaying the contents of the string in a "selected" state.

StringData

`ZafStringData *`**`StringData`**`(void) const;`
`virtual ZafError` **`SetStringData`**`(ZafStringData *string);`

The StringData() object is where the actual data is stored for the ZafString object. The StringData() piece may be shared among several ZafString objects, or it may belong to a single ZafString object. If shared among several ZafString objects, all the associated ZafString objects will be updated when the StringData() piece changes. SetStringData() may be used to associate a StringData() object with a ZafString object. For more information on data sharing in ZAF, see ZafDataManager. SetStringData() will delete the previous StringData() object if it is Destroyable() and no other object uses it.

The return value for StringData() is a pointer to the StringData() object associated with the ZafString object. The return value for SetStringData() is normally ZAF_ERROR_NONE. The following code shows the proper use of these functions:

```
// Get the data.
const ZafStringData *data = string->StringData();
...
// Add the string data.
ZafStringData *newData = new ZafStringData("String", 25);
string->SetStringData(newData);
```

Text

```
virtual const ZafIChar *Text(void);
virtual ZafError SetText(const ZafIChar *text);
```

The textual data of a ZafString (contained in the StringData() object) may be returned or set with Text() and SetText(). These functions provide simple accessibility to the StringData() of a ZafString, and may be used if the programmer does not wish to interact with the data portion of the object.

The return value for Text() is a pointer to the textual information in the data object of a ZafString. The return value for SetText() is normally ZAF_ERROR_NONE. The following code shows the proper use of these functions:

```
// Get the text.
const ZafIChar *text = string->Text();
...
// Set the new text.
string->SetText("New Text");
```

Unanswered

```
bool Unanswered(void) const;
virtual bool SetUnanswered(bool unanswered);
```

If Unanswered() is true, the ZafString field will be initially blank. As soon as text is entered into the ZafString object—either by calling SetText() or by the end user entering data—the Unanswered() attribute is set to false. Unanswered() is false by default, but the user may call SetUnanswered() to make changes. Calling SetUnanswered(true) will clear the contents of the string object and its StringData().

UpperCase

```
bool UpperCase(void) const;
virtual bool SetUpperCase(bool upperCase);
```

If UpperCase() is true, any lower-case characters typed into the ZafString field will be converted to upper-case. Any characters the programmer directly places into the ZafString's StringData() will be displayed as upper-case, but not converted. UpperCase() is false by default, but the user may call SetUpperCase() make changes. The programmer should never set both LowerCase() and UpperCase() on the same object at the same time, as the result is undefined.

Validate

```
virtual ZafError Validate(bool processError = true);
```

Validate() does nothing by default in the ZafString class, but is overloaded by other classes such as ZafDate and ZafInteger that require validation. Validate() is called by DefaultValidateFunction(), but may be called in user functions for custom validation (see ZafWindowObject::UserFunction()). If *processError* is true and an error occurs, Validate() causes ZafErrorSystem to report the error; otherwise Validate() simply returns the appropriate error code.

The return value for Validate() is an error code indicating the result of the field validation. The return value is ZAF_ERROR_NONE if validation succeeded, and another value of the enumeration ZafError appropriate to the derived class otherwise. For example, ZAF_ERROR_OUT_OF_RANGE may be returned by a ZafDate object if a date out of the required range was entered.

VariableName

```
bool VariableName(void) const;
virtual bool SetVariableName(bool variableName);
```

If VariableName() is true, all space characters typed into the ZafString field will be converted to underscore ('_') characters. Any space characters the programmer directly places into the ZafString's StringData() will be converted to underscores. VariableName() is false by default, but the user may call SetVariableName() to change it.

ViewOnly

```
bool ViewOnly(void) const;
virtual bool SetViewOnly(bool viewOnly);
```

A ViewOnly() ZafString object may not be edited, but may be the current object of a window, may be copied into the clipboard, and arrow keys may be used to navigate it. ViewOnly() is false by default, but the user may call SetViewOnly() to change it.

ZafStringData

Append	Remove	operator +
Char	Replace	operator +=
Clear	StaticData	operator <
DynamicText	SetOSText	operator <=
DynamicOSText	SetOSWText	operator =
DynamicOSWText	Text	operator ==
Compare	ZafIChar	operator >
Insert	operator -	operator >=
Length	operator -=	operator []
MaxLength	operator !=	

Inheritance

```
ZafStringData : ZafFormatData : ZafData :
   ZafNotification, ZafElement
```

Declaration

```
#include <z_str.hpp>
```

Description

ZafStringData objects can be used to store and conveniently manipulate character-based data, including Unicode (double-byte) characters.

ZafStringData combines string encapsulation with data and object notification from ZafData. It is most often used in conjunction with user interface objects such as ZafString, ZafFormattedString, ZafText and ZafButton but may be used as a stand-alone object if desired.

All ZafData objects may make use of printf-style formatting and parsing arguments during string operations. Refer to user interface object reference for descriptions of the format arguments available for each data type. (For example, see ZafString for format arguments available when displaying a ZafStringData.)

Numerous overloaded operators are available to facilitate manipulation of ZafStringData objects.

Constructors

ZafStringData constructors initialize the member variables associated with a new ZafStringData object and allocate space to hold the string data.

The default values set by ZafStringData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafStringData

`MaxLength()`	`-1 (varies by constructor)`
`StaticData()`	`false (varies by constructor)`

Member Initializations

`Text()`	`"" (varies by constructor)`

ZafElement

`ClassID()`	`ID_ZAF_STRING_DATA`
`ClassName()`	`"ZafStringData"`

`**ZafStringData**(bool staticData = false);`

This constructor allocates a ZafStringData and initializes its contents to null. If *staticData* is true its internal string array is not deleted when the ZafStringData is destroyed.

```
ZafStringData(const ZafIChar *value, int maxLength = -1,
   bool staticData = false);
ZafStringData(const char *value, int maxLength = -1, bool
   staticData = false);
```

These constructors allocate a ZafStringData instance and initialize its contents to *value*. The data is automatically truncated at *maxLength* unless *maxLength* is -1 which allows the ZafStringData to dynamically allocate the minimum space necessary to store *value*. Refer to the destructor and StaticData() for more information about *staticData*.

Note: The third constructor is available for use with Unicode since ZafIChar defaults to be a char in ISO mode.

```
ZafStringData(const ZafStringData &copy);
```

This constructor is the copy constructor, which allocates a new ZafStringData instance and copies all member data from *copy*.

```
ZafStringData(const ZafIChar *name, ZafDataPersistence
   &persist);
```

This constructor is the persistent constructor. It allocates a new ZafStringData instance and reads most member data from directory *name* in the persistent data file referred to by *persist*. The StringID() of the new data is *name*.

```
// Sample ZafStringData creation techniques
ZafScrollData string1("Hello World!");
ZafStringData copyString = string1;
ZafStringData emptyString;
```

Destructor

```
virtual ~ZafStringData(void);
```

The destructor is used to free the memory associated with a ZafStringData object. If StaticData() is true the string array associated with the ZafStringData object is not freed.

Members

Append

```
virtual ZafStringData &Append(const ZafIChar *text);
```

This function concatenates text onto the end of the string. If the length of the old string plus the length of the string that is being appended is greater than MaxLength() then the string is truncated.

```
// Create the string-data.
ZafStringData hello("Hello world", 20);
printf("String: %s\n", hello.Text());
...
// Append to the object’s contents.
hello.Append("!!!");
printf("String: %s\n", hello.Text());
==========
String: Hello world
String: Hello world!!!
```

Char

```
ZafIChar Char(int offset) const;
virtual ZafError SetChar(int offset, ZafIChar value, bool
   ignoreNotification = true);
```

Char() returns the character at the zero-based index *offset*.

SetChar() replaces one character at position *offset* with *value*. If *ignoreNotification* is true then the ZafStringData object will not notify the items in its notification list about changes made during this operation.

Clear

```
virtual Void Clear(void);
```

Clear() sets the Text() portion of the specified object to the empty string ("").

DynamicText
DynamicOSText
DynamicOSWText

```
ZafIChar *DynamicText(void) const;
char *DynamicOSText(void) const;
wchar_t *DynamicOSWText(void) const;
```

These functions duplicate the string contained in ZafStringData and return a pointer to the duplicate. They are useful in situations when the programmer requires a pointer to a string that may be safely deleted (by another function, for example). DynamicOS*Text() functions return the result in different formats.

Note: DynamicOSWText() is only available in Unicode mode. It converts the data to a wide character array in the native OS codeset.

Compare

```
virtual int Compare(const ZafIChar *text, bool
    caselessCompare = false) const;
```

Compare() provides a safe method for performing string comparisons on ZafStringData objects. If *caselessCompare* is true, the strings are compared without regard for case. The following code shows the proper use of, and results from performing a Compare() operation.

```
// Create the string-data.
ZafStringData hello("Hello World");

if (!hello.Compare("hello world")
  printf("#1: The strings are equal.\n");

if (!hello.Compare("hello world", true)
  printf("#2: The strings are equal.\n");

==========
#2: The strings are equal.
```

Insert

```
virtual ZafStringData &Insert(int offset, const ZafIChar
    *text, int length = -1);
```

Insert() will insert the string *text* into a ZafStringData object at the zero-based index *offset*. *length* specifies the maximum length of the resulting ZafStringData. The following code shows the use of the Insert() operation.

```
// Create the string-data.
ZafStringData hello("Hello world");
printf("String: %s\n", hello.Text());
...
// Insert a string into the object’s contents.
hello.Insert(6, "to the ");
printf("String: %s\n", hello.Text());
==========
String: Hello world
String: Hello to the world
```

Length

```
int Length(void) const;
```

Length() returns the number of characters in the ZafStringData regardless of MaxLength().

MaxLength

```
int MaxLength(void) const;
virtual int SetMaxLength(int maxLength);
```

MaxLength() returns the maximum length of the string that may be stored in this ZafStringData. If the maximum length is dynamic (allowing ZAF to reallocate the buffer as the string length changes) MaxLength() returns -1.

SetMaxLength() sets the internal maximum length allowed by the ZafStringData object. If *maxLength* is greater than the allocated buffer and the object does not have static data then the object will allocate a larger buffer and copy the data. If *maxLength* is -1 the ZafStringData will dynamically allocate the minimum buffer necessary to hold its data.

Remove

```
virtual ZafString &Remove(int offset, int size);
virtual ZafString &Remove(const ZafIChar *text);
```

These functions remove text from the ZafStringData object. The first method removes *size* characters beginning with the character at zero-based *offset*. The second form removes the first occurrence of *text*. The following code shows the use of the Remove() methods.

```
// Create the string-data.
ZafStringData hello("Hello to the world");
printf("String: %s\n", hello.Text());
...
// Remove text from the object’s contents.
hello.Remove("the ");
printf("String: %s\n", hello.Text());
...
// Remove text from the object’s contents.
hello.Remove(6, 3);
printf("String: %s\n", hello.Text());

==========
String: Hello to the world
String: Hello to world
String: Hello the world
```

Replace

```
virtual ZafStringData &Replace(int offset, int size,
    const ZafIChar *text, int length = -1);
```

This function combines the functionality of Remove() and Insert() to replace text in a ZafStringData object. See Remove() and Insert() for description of parameters. The following code demonstrates the proper use of the Replace() function.

```
// Create the string-data.
ZafStringData hello("Hello world");
printf("String: %s\n", hello.Text());
...
// Insert a string into the object’s contents.
hello.Replace(6, 5, "Universe");
printf("String: %s\n", hello.Text());

==========
String: Hello world
String: Hello Universe
```

StaticData

```
bool StaticData(void) const;
virtual bool SetStaticData(bool staticData);
```

If StaticData() is true, the string array associated with a ZafStringData object will not be deleted when the ZafStringData is destroyed or reallocated. If Set-StaticData(false) while StaticData()==true, the object will make a copy of the data it was pointing to.

SetOSText
SetOSWText

```
virtual ZafError SetOSText(const char *text);
ZafError SetOSWText(const wchar_t *text);
```

SetOSText() converts *text* to the internal representation used by the native OS. These functions are used internally by ZAF and will generally not be called by the programmer.

SetOSWText() is only available in Unicode mode.

Text

```
const ZafIChar *Text(void) const;
virtual ZafError SetText(const ZafIChar *text);
virtual ZafError SetText(const ZafIChar *text, int
    maxLength);
virtual ZafError SetText(const ZafStringData &string);
virtual ZafError SetText(const ZafIChar *buffer, const
    ZafIChar *format);
```

Text() returns the internal pointer to the string array maintained by ZafStringData. The contents of this array should not be directly manipulated.

SetText() functions set the text of the ZafStringData object. For example:

```
// Create the string-data.
ZafStringData hello("", 20);
printf("String: %s\n", hello.Text());
...
// Append to the object’s contents.
hello.SetText("Hello world";
printf("String: %s\n", hello.Text());
==========
String:
String: Hello world
```

ZafIChar

`operator const` **`ZafIChar *`**`() const { return value; }`

ZafIChar() provides a useful alternative to Text(). Refer to Text() for more information. For example:

```
// Create a string data.
ZafStringData string ("mystring");
// The following test uses the overloaded operator
if (string)
  DoSomething();
```

operator -

```
ZafStringData operator-(const ZafStringData &string1,
    const ZafStringData &string2);
ZafStringData operator-(const ZafStringData &string,
    const ZafIChar *value);
ZafStringData operator-(const ZafIChar *value, const
    ZafStringData &string);
```

These operators create and return a new ZafStringData object that is the equivalent of the first string with the second string removed. For more information see Remove().

operator -=

```
ZafStringData &operator-=(const ZafStringData &value);
ZafStringData &operator-=(const ZafIChar *value);
```

These operators provide shortcuts to using the Remove methods. For more information see Remove().

operator !=

```
bool operator!=(const ZafStringData &string1, const
    ZafStringData &string2);
```

```
bool operator!=(const ZafStringData &string, const
    ZafIChar *value);
bool operator!=(const ZafIChar *value, const
    ZafStringData &string);
```

These operators use the Compare method of ZafStringData to determine if the two strings are different. For more information see Compare().

operator +

```
ZafStringData operator+(const ZafStringData &string1,
    const ZafStringData &string2);
ZafStringData operator+(const ZafStringData &string,
    const ZafIChar *value);
ZafStringData operator+(const ZafStringData &string,
    const ZafIChar value);
ZafStringData operator+(const ZafIChar *value, const
    ZafStringData &string);
ZafStringData operator+(const ZafIChar value, const
    ZafStringData &string);
```

These operators create and return a new ZafStringData object that is the equivalent of the first string (or character) with the second string (or character) appended to it. For more information see Append().

operator +=

```
ZafStringData &operator+=(const ZafStringData &value);
ZafStringData &operator+=(const ZafIChar value);
ZafStringData &operator+=(const ZafIChar *value);
```

These operators provide shortcuts to using the Append() methods. For more information see Append(). The second of the three operators provides support for adding a single ZafIChar to the end of the string data.

operator <

```
bool operator<(const ZafStringData &string1, const
    ZafStringData &string2);
bool operator<(const ZafStringData &string, const
    ZafIChar *value);
bool operator<(const ZafIChar *value, const ZafStringData
    &string);
```

These operators use the Compare method of ZafStringData to determine if the first string is alphabetically before the second string. For more information see Compare().

operator <=

```
bool operator<=(const ZafStringData &string1, const
   ZafStringData &string2);
bool operator<=(const ZafStringData &string, const
   ZafIChar *value);
bool operator<=(const ZafIChar *value, const
   ZafStringData &string);
```

These operators use the Compare method of ZafStringData to determine if the first string is alphabetically before the second string, or if the strings are equivalent. For more information see Compare().

operator =

```
ZafStringData &operator=(const ZafStringData &value);
ZafStringData &operator=(const ZafIChar *value);
```

These operators provide shortcuts to using the SetText() methods. For more information see SetText().

Note that these operators are different than other assignment operators in that they return const values.

operator ==

```
bool operator==(const ZafStringData &string1, const
   ZafStringData &string2);
bool operator==(const ZafStringData &string, const
   ZafIChar *value);
bool operator==(const ZafIChar *value, const
   ZafStringData &string);
```

These operators use the Compare method of ZafStringData to determine if the two strings are equivalent. For more information see Compare().

operator >

```
bool operator>(const ZafStringData &string1, const
   ZafStringData &string2);
bool operator>(const ZafStringData &string, const
   ZafIChar *value);
bool operator>(const ZafIChar *value, const ZafStringData
   &string);
```

These operators use the Compare method of ZafStringData to determine if the first string is alphabetically after the second string. For more information see Compare().

operator >=

```
bool operator>=(const ZafStringData &string1, const
   ZafStringData &string2);
```

```
bool operator>=(const ZafStringData &string, const
    ZafIChar *value);
bool operator>=(const ZafIChar *value, const
    ZafStringData &string);
```

These operators use the Compare method of ZafStringData to determine if the first string is alphabetically after the second string, or if the strings are equivalent. For more information see Compare().

operator []

```
ZafIChar operator[](int offset) const;
ZafIChar &operator[](int offset);
```

These operators provide a method of accessing individual characters in the string contained in the string data object. *offset* is the zero-based index of the character to access. The following code shows a use of the operators.

```
// Create the string-data.
ZafStringData hello("Hello world.", 20);
printf("String: %s\n", hello.Text());
...
// Append to the object’s contents.
hello[11] =  ‘!’;
printf("String: %s\n", hello.Text());
==========
String: Hello world.
String: Hello world!
```

ZafSystemButton

Add	Get	Subtract
Count	Index	SystemButtonType
Current	Last	operator +
Destroy	menu	operator -
First	Sort	

Inheritance

`ZafSystemButton : ZafButton : ZafWindowObject : ZafElement`

Declaration

`#include <z_sys.hpp>`

Description

The ZafSystemButton object may only be added to a ZafWindow. The ZafSystemButton is the system button decoration on a ZafWindow, and is generally drawn by the environment. The ZafSystemButton object is used to close the parent window and on environments that support it, to present a system menu with other functions available such as move and size.

Constructors

All ZafSystemButton constructors initialize the member variables associated with an instantiated ZafSystemButton object. The default values set by the ZafSystemButton and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafSystemButton. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafSystemButton

`menu`	`ZafPopUpMenu(0, 0)`
`menu.parent`	`this`
`menu.Temporary()`	`true`
`menu.Destroyable()`	`false`
`menu.NumberID()`	`ZAF_NUMID_SYSTEM_BUTTON_MENU`
`menu.StringID()`	`"ZAF_NUMID_SYSTEM_BUTTON_MENU"`
`SystemButtonType()`	`ZAF_NATIVE_SYSTEM_BUTTON`

ZafButton

`AllowDefault()`	`false`†
`AllowToggling()`	`false`†
`AutoRepeatSelection()`	`false`†
`AutoSize()`	`true`†

Member Initializations

`ButtonType()`	`ZAF_3D_BUTTON`†
`Depth()`	`1`†
`HotKeyChar()`	`0`†
`HotKeyIndex()`	`-1`†
`HzJustify()`	`ZAF_HZ_CENTER`†
`SelectOnDoubleClick()`	`false`†
`SelectOnDownClick()`	`false`†
`SendMessageText()`	`null`†
`SendMessageWhenSelected()`	`false`†
`Value()`	`0`†
`VtJustify()`	`ZAF_VT_CENTER`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`CopyDraggable()`	`false`†
`Disabled()`	`false`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`QuickTip()`	`null`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`Selected()`	`false`†
`SupportObject()`	`true`†
`SystemObject()`	`false`
`UserFunction()`	`null`†

ZafElement

`ClassID()`	`ID_ZAF_SYSTEM_BUTTON`
`ClassName()`	`"ZafSystemButton"`
`NumberID()`	`ZAF_NUMID_SYSTEM`
`StringID()`	`"ZAF_NUMID_SYSTEM"`

```
ZafSystemButton(ZafSystemButtonType systemButtonType =
   ZAF_NATIVE_SYSTEM_BUTTON);
```

This constructor is useful in straight-code situations to create a ZafSystemButton object. *systemButtonType* specifies the type of system button to be created. See SystemButtonType() for more information.

```
ZafSystemButton(const ZafSystemButton &copy);
```

The copy constructor creates a new ZafSystemButton object and initializes its data from *copy*.

```
ZafSystemButton(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a system button follows:

```
// Create a sample window with a native system button.
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
ZafSystemButton *sys = new ZafSystemButton;
window->Add(sys);
```

Destructor

```
virtual ~ZafSystemButton(void);
```

The destructor is used to free the memory associated with a ZafSystemButton object. It chains to the ZafButton, ZafWindowObject, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafSystemButton object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Add

```
virtual ZafWindowObject *Add(ZafWindowObject *object,
   ZafWindowObject *position =
   ZAF_NULLP(ZafWindowObject));
```

operator +

```
ZafSystemButton &operator+(ZafWindowObject *object);
```

This function and operator are used to create system menu items on environments that support them by adding ZafPopUpItem objects to the ZafSystemButton. The functionality is provided by the ZafPopUpMenu class through the menu member. *object* is a pointer to the ZafPopUpItem object to be added to the ZafSystemButton object's system menu. *position* specifies which ZafPopUpItem object already in the menu that object should appear before. If *position* is null, *object* is added to the end of the menu. See ZafWindow::Add() for more information.

Count

```
int Count(void);
```

Count() returns the number of ZafPopUpItem objects in the system menu, or 0 if there is no system menu. See ZafList::Count() for more information.

Current

```
ZafWindowObject *Current(void) const;
```

Current() returns the current ZafPopUpItem object in the system menu, if there is one. The Current() item does not necessarily have focus. Some native environment implementations of menus do not allow the menu to ever have focus. See ZafList::Current() for more information.

Destroy

```
virtual void Destroy(void);
```

Destroy() causes all the ZafPopUpItem objects in the system menu to be destroyed, if there is one. This is useful if a system menu is to be recreated from scratch. See ZafList::Destroy() for more information.

First

```
ZafWindowObject *First(void) const;
```

The First() function returns the first ZafPopUpItem object in the system menu, if any. See ZafList::First() for more information.

Get

```
ZafWindowObject *Get(int index);
```

Get() returns the ZafPopUpItem object at position *index* in the system menu, if there is one. index is zero-based, meaning the first ZafPopUpItem object in the system menu is at position 0. See ZafList::Get() for more information.

Index

```
int Index(ZafWindowObject const *element);
```

If there is a system menu, the Index() function returns the zero-based index of the ZafPopUpItem object element in the system menu. If there is no system menu or element is not found in the system menu, Index() returns -1. See ZafList::Index() for more information.

Last

```
ZafWindowObject *Last(void) const;
```

Last() returns the last ZafPopUpItem object in the system menu, if any. See ZafList::Last() for more information.

menu

```
ZafPopUpMenu menu;
```

The menu member, used internally by the ZAF libraries to maintain the ZafPopUpItem objects added to the ZafSystemButton object (forming the system menu), should normally not be accessed by the programmer. See ZafPopUpMenu for more information.

Sort

```
virtual void Sort(void);
```

Sort() causes the ZafPopUpItem objects in the system menu (if there is one) to be sorted according to the function returned by CompareFunction(). See ZafList::CompareFunction() for more information. Since some environments maintain the system menu, Sort() may have no effect.

Subtract

operator -

```
virtual ZafWindowObject *Subtract(ZafWindowObject
   *object);
ZafSystemButton &operator-(ZafWindowObject *object);
```

This function and operator are used for subtracting (or removing) ZafPopUpItem objects from the ZafSystemButton object's system menu. The functionality is provided by the ZafPopUpMenu class through the menu member. *object* is a pointer to the ZafPopUpItem object to be subtracted. See ZafWindow::Subtract() for more information.

SystemButtonType

```
ZafSystemButtonType SystemButtonType(void) const;
virtual ZafSystemButtonType
   SetSystemButtonType(ZafSystemButtonType
   systemButtonType);
```

SystemButtonType() specifies the type of system button a ZafSystemButton object is. The default value of this attribute is

ZAF_NATIVE_SYSTEM_BUTTON, but the user may call SetSystemButtonType() to change it. Here are the possible system button types:

IconType()	**Description**
`ZAF_EMPTY_SYSTEM_BUTTON`	Creates a system button object with no menu items in it so that the system menu may be custom-built (or remain empty)
`ZAF_NATIVE_SYSTEM_BUTTON`	Creates a native system button object with the default menu if supported on the environment (may look different from environment to environment)

ZafTable

BottomOffset	HeaderWidth	SeekRandomRecord
CurrentOffset	InsertRecord	SetColumnText
DeleteRecord	MaxOffset	SetCoordinateType
Flush	ReadRecord	SetReadFunction
FocusOffset	Record	SetWriteFunction
Grid	Repopulate	Tell
HeaderBackgroundColor	RowHeight	TopOffset
HeaderHeight	SeekNextRecord	VirtualRecord
HeaderTextColor	SeekPreviousRecord	WriteRecord

Inheritance `ZafTable : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_table.hpp>`

Description ZafTable is designed to display and modify data in a tabular format. It is optimized for interaction with a database, but can be used to interact with data in a variety of formats. It is not, however, intended to be used as a spreadsheet.

Data in a ZafTable is displayed in a familiar row/column format. Each row in a table represents one record, while each column represents a field within each record. If desired, ZafTableHeader objects are automatically provided to display row and column labels.

The columns (or fields) of a table are defined by adding objects to the table. For example, if a ZafString object is added to the table, each record in the table will contain a ZafString object. If the ZafString is the first object in the table, then the first column of the table will consist of ZafString objects, each ZafString object being the first field of a record.

Each row of a table is identical, each being one record, except for the data displayed in the fields. The number of rows is determined by MaxOffset() which is modified by using SetMaxOffset(), InsertRecord(), and DeleteRecord().

ZafTable defines two functions that must be overridden by a superclass: ReadRecord() and WriteRecord(). ReadRecord() is used to obtain data and make it available to the fields of a ZafTableRecord object. WriteRecord() is used to take data from the fields of a ZafTableRecord object and update the external data source. (See ReadRecord() and WriteRecord() for more information.)

In addition to ReadRecord() and WriteRecord(), a class derived from ZafTable can optionally overload three other functions to optimize performance: SeekNextRecord(), SeekPreviousRecord(), and SeekRandomRecord(). Whenever possible, ZafTable reads and writes records in sequential order using SeekNextRecord() or SeekPreviousRecord(). Database implementations that are optimized by sequential access should overload these functions. (See SeekNextRecord(), SeekPreviousRecord(), and SeekRandomRecord() for more information.)

This class is not available in the Personal or Registered versions of ZAF, but is included with the Professional version.

Constructors

All ZafTable constructors initialize the member variables associated with an instantiated ZafTable object. The default values set by the ZafTable and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTable. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafTable

`CurrentOffset()`	`-1`
`Grid()`	`true`
`HeaderHeight()`	`user-supplied parameter`
`HeaderWidth()`	`user-supplied parameter`
`MaxOffset()`	`-1`
`readFunction`	`ZafTable::ReadRecord`
`RowHeight()`	`user-supplied parameter`
`VirtualRecord()`	`null`
`writeFunction`	`ZafTable::WriteRecord`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Movable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_MULTIPLE_SELECTION`
`Sizeable()`	`false`†
`Temporary()`	`false`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`true`

Member Initializations

`OSDraw()`	`false`

ZafElement

`ClassID()`	`ID_ZAF_TABLE`
`ClassName()`	`"ZafTable"`

```
ZafTable(int left, int top, int width, int height, int
   headerWidth, int headerHeight, int rowHeight = 1);
```

This constructor is useful in straight-code situations. ZafTableHeader objects are automatically provided for displaying labels for the rows and columns of a table. *left*, *top*, *width* and *height* specify the position and size of the table on its parent. *headerWidth* and *headerHeight* specify the size of the row header and column header respectively. Zero values for headerWidth and/or header-Height cause the corresponding headers not to be displayed. *rowHeight* specifies the height of each row of the table. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

```
ZafTable(const ZafTable &copy);
```

The copy constructor creates a new ZafTable object and initializes its data from *copy*.

```
ZafTable(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a database-linked table follows:

```
// Declare a generic database.
extern SimpleDatabase *database;

// Derive a user table class.
class SampleTable : public ZafTable
{
public:
  SampleTable(void);
  virtual ZafError ReadRecord(ZafTableRecord &record,
    ZafWindowObject *row);
  virtual ZafError WriteRecord(ZafTableRecord &record,
    ZafWindowObject *row);
};

SampleTable::SampleTable(void) :
  ZafTable(5, 10, 400, 100, 25, 15, 15)
{
  // Use pixel coordinate type for the table, headers,
  // and records. SetCoordinateType() on the table affects
  // them all.
  SetCoordinateType(ZAF_PIXEL);

  // Add a vertical scroll bar.
  Add(new ZafScrollBar(0, 0, 0, 0));

  // Add a string column for "Name".
  Add(new ZafString(0, 0, 20, ZAF_NULLP(ZafIChar), 32), "Name");

  // Add a formatted string column for "SSN".
  Add(new ZafFormattedString(20, 0, 20, ZAF_NULLP(ZafIChar), new
    ZafStringData("NNNLNNLNNNN"), new ZafStringData("...-..-
    ....")), "SSN");

  // Add a string column for "Grade".
  Add(new ZafString(40, 0, 10, ZAF_NULLP(ZafIChar), 32),
    "Grade");

  // Set the number of records. This must be in the constructor.
  SetMaxOffset(database->Records() - 1);
}

// ReadRecord() must be overloaded in the derived class.
ZafError SampleTable::ReadRecord(ZafTableRecord &record,
    ZafWindowObject *row)
{
  // Read the fields in the record.
  ZafIChar name[32], ssn[16], grade[8];
  database->SeekRandomRecord(CurrentOffset(), name, ssn, grade);
  record(0)->SetText(name);
  record(1)->SetText(ssn);
  record(2)->SetText(grade);

  // Set the row header.
  ZafIChar rowText[16];
  sprintf(rowText, "%d", currentOffset + 1);
  row->SetText(rowText);
  return (ZAF_ERROR_NONE);
```

```
}

// WriteRecord() must be overloaded in the derived class.
ZafError SampleTable::WriteRecord(ZafTableRecord &record,
    ZafWindowObject *)
{
  // Write the fields in the record.
  database->ModifyRecord(currentOffset, record(0)->Text(),
    record(1)->Text(), record(2)->Text());
  return (ZAF_ERROR_NONE);
}

int ZafApplication::Main(void)
{
  // Ensure main() is linked properly.
  LinkMain();

  // Initialize the database.
  database = new SimpleDatabase;

  // Create the table and add it to a window.
  ZafWindow *window = new ZafWindow(0, 0, 60, 15);
  window->AddGenericObjects(new ZafStringData("Table Window"));
  window->Add(new SampleTable);
  zafWindowManager->Add(window);

  // Get the user input and return success.
  Control();
  return (0);
}
```

Destructor

`virtual ~`**`ZafTable`**`(void);`

The destructor is used to free the memory associated with a ZafTable object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafTable object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

BottomOffset

```
ZafOffset BottomOffset(void) const;
virtual ZafOffset SetBottomOffset(ZafOffset
   currentOffset);
```

BottomOffset() specifies the zero-based index of the record currently at the bottom of the table's viewable area. SetBottomOffset() may be called to change it. SetBottomOffset() causes ReadRecord() to get any necessary data, but does not change which record has focus. See TopOffset().

SetColumnText

```
ZafError SetColumnText(int columnNumber, const ZafIChar
   *text);
```

SetColumnText() sets the text on a column header. *columnNumber* is the zero-based index of the column number, and *text* is the text copied into the column header.

SetCoordinateType

```
virtual ZafCoordinateType
   SetCoordinateType(ZafCoordinateType coordinateType);
```

This overloaded function sets the coordinate type for the table headers and VirtualRecord(), as well as for the ZafTable object itself. See ZafWindowObject::SetCoordinateType() and the code snippet for the constructors for more information.

CurrentOffset
Tell

```
ZafOffset CurrentOffset(void) const;
virtual ZafOffset Tell(void);
virtual ZafOffset SetCurrentOffset(ZafOffset
   currentOffset);
```

CurrentOffset() and Tell() return the zero-based offset of the record that was most recently read into the table. CurrentOffset() and Tell() are used internally by the ZAF libraries to optimize database seeks, and may be modified by the derived ZafTable class by overriding SeekNextRecord(), SeekPreviousRecord(), and SeekRandomRecord as described in this chapter.

DeleteRecord

```
virtual ZafError DeleteRecord(ZafOffset deleteOffset);
```

DeleteRecord() causes the ZafTableRecord object at zero-based offset *deleteOffset* to be deleted from the ZafTable. The corresponding database record, if any, is not deleted. DeleteRecord() generally returns ZAF_ERROR_NONE.

Flush

```
ZafError Flush(ZafOffset offset = -1);
```

Flush() causes the table record at zero-based index *offset* to be written to the database using WriteRecord(). If *offset* specifies a record that is not in the viewable area of the database, nothing happens. If *offset* is -1, all records in the viewable area of the table are written to the database. If the operation was successful, ZAF_ERROR_NONE is returned; otherwise ZAF_ERROR_INVALID is returned.

FocusOffset

```
ZafOffset FocusOffset(void) const;
virtual ZafOffset SetFocusOffset(ZafOffset focusOffset);
```

FocusOffset() specifies the zero-based index of the record in the table that currently has focus. SetFocusOffset() may be called to set the focus to the record with zero-based index *focusOffset*. If the record gaining focus is not in the viewable area of the table, it is scrolled into view. The table is not scrolled if the the *focusOffset* record is in view.

Grid

```
bool Grid(void) const;
virtual bool SetGrid(bool grid);
```

If Grid() is true, grid lines are drawn between each field in the record, and between each record. This attribute defaults to true, but the programmer may change it by calling SetGrid().

HeaderBackground-Color

```
ZafLogicalColor HeaderBackgroundColor(ZafLogicalColor
   *color = ZAF_NULLP(ZafLogicalColor), ZafLogicalColor
   *mono = ZAF_NULLP(ZafLogicalColor));
virtual ZafLogicalColor
   SetHeaderBackgroundColor(ZafLogicalColor color,
   ZafLogicalColor mono = ZAF_MONO_NULL);
```

HeaderBackgroundColor() is the background color used for the ZafTableHeader objects in the ZafTable. SetHeaderBackgroundColor() may be called to change the background color used by all the ZafTableHeader objects attached to the ZafTable. See ZafWindowObject::BackgroundColor() for more information.

HeaderHeight

```
int HeaderHeight(void) const;
virtual int SetHeaderHeight(int headerHeight);
```

HeaderHeight() specifies the height of the column ZafTableHeader object in the same coordinate system as Region(). A zero value indicates the absence of a column ZafTableHeader object. SetHeaderHeight() should only be called from the constructor for the derived ZafTable class.

HeaderTextColor

```
ZafLogicalColor HeaderTextColor(ZafLogicalColor *color =
   ZAF_NULLP(ZafLogicalColor), ZafLogicalColor *mono =
   ZAF_NULLP(ZafLogicalColor));
virtual ZafLogicalColor
   SetHeaderTextColor(ZafLogicalColor color,
   ZafLogicalColor mono = ZAF_MONO_NULL);
```

HeaderTextColor() is the text color used for the ZafTableHeader objects in the ZafTable. SetHeaderTextColor() may be called to change the text color used by all the ZafTableHeader objects attached to the ZafTable. See ZafWindowObject::TextColor() for more information.

HeaderWidth

```
int HeaderWidth(void) const;
virtual int SetHeaderWidth(int headerWidth);
```

HeaderWidth() specifies the width of the row ZafTableHeader object in the same coordinate system as Region(). A zero value indicates the absence of a row ZafTableHeader object. SetHeaderWidth() should only be called from the constructor for the derived ZafTable class.

InsertRecord

```
virtual ZafError InsertRecord(ZafOffset insertOffset);
```

InsertRecord() inserts the database record at offset *insertOffset* into the ZafTable at offset *insertOffset*. The corresponding database record, if any, is not modified. InsertRecord() generally returns ZAF_ERROR_NONE.

MaxOffset

```
ZafOffset MaxOffset(void) const;
virtual ZafOffset SetMaxOffset(ZafOffset maxOffset);
```

MaxOffset() specifies one less than the number of records in the ZafTable. MaxOffset() is zero- based, so a value of 0 means that there is one record in the ZafTable, and the default value of -1 means that there are no records in the ZafTable. MaxOffset() must be set in the constructor for the derived ZafTable class using SetMaxOffset(). It is automatically updated appropriately by DeleteRecord() and InsertRecord().

SetReadFunction

```
MemberTableFunction SetReadFunction(MemberTableFunction
   readFunction);
```

Any function may be used to override ReadRecord() by passing that function into SetReadFunction(). SetReadFunction() returns *readFunction*. See ReadRecord() for more information. The definition for MemberTableFunction is as follows:

```
typedef ZafError
   (ZafTable::*MemberTableFunction)(ZafTableRecord &record,
   ZafWindowObject *row);
```

ReadRecord

```
ZafError ReadRecord(ZafTableRecord &record,
   ZafWindowObject *row);
```

ReadRecord() must be overridden by the derived ZafTable class to read the data from a record in the database. The data must be loaded into the ZafTableRecord *record* (see ZafTableRecord for more information). *row* specifies the row header, and the programmer must call SetText() for row to set the *row* header text. ReadRecord() returns ZAF_ERROR_INVALID if an error occurred, otherwise ZAF_ERROR_NONE is returned. Any function may be used to override ReadRecord() by passing that function into SetReadFunction().

Record

```
ZafTableRecord *Record(ZafOffset offset);
```

Record() returns a pointer to the table record at zero-based index *offset* if it is in the viewable area of the table. If the specified record is not in the viewable area of the table, or if it doesn't exist, null is returned.

Repopulate

```
ZafError Repopulate(ZafOffset offset = -1);
```

Repopulate() causes the table record at zero-based index *offset* to be read from the database using ReadRecord(). If *offset* specifies a record that is not in the viewable area of the database, nothing happens. If *offset* is -1, all records in the viewable area of the table are read from the database. If the operation was successful, ZAF_ERROR_NONE is returned; otherwise ZAF_ERROR_INVALID is returned.

RowHeight

```
int RowHeight(void) const;
virtual int SetRowHeight(int rowHeight, ZafCoordinateType
   coordinateType = ZAF_CELL);
```

RowHeight() specifies the height of each ZafTableRecord object in the same coordinate system as Region(). To modify the height of the ZafTableRecord objects, SetRowHeight() may be called before the table is added to the window manager. *rowHeight* specifies the new row height, and *coordinateType* specifies the coordinate system that rowHeight is specified in.

SeekNextRecord

```
virtual ZafError SeekNextRecord(void);
```

SeekNextRecord() causes CurrentOffset() to specify the next record in the ZafTable. If CurrentOffset() already specifies the last record, ZAF_ERROR_INVALID is returned; otherwise, ZAF_ERROR_NONE is returned. SeekNextRecord() may be overridden by the derived ZafTable class to provide additional functionality.

SeekPrevious-Record

```
virtual ZafError SeekPreviousRecord(void);
```

SeekPreviousRecord() causes CurrentOffset() to specify the previous record in the ZafTable. If CurrentOffset() already specifies the first record, ZAF_ERROR_INVALID is returned; otherwise, ZAF_ERROR_NONE is returned. SeekPreviousRecord() may be overridden by the derived ZafTable class to provide additional functionality.

SeekRandom-Record

```
virtual ZafError SeekRandomRecord(ZafOffset offset,
   ZafSeek location);
```

SeekRandomRecord() modifies CurrentOffset() according to *offset* and *location*. The possible values of location and how they interpret *offset* follow:

ZafSeek	Description
ZAF_SEEK_START	Interprets *offset* as the offset from the beginning of the ZafTable
ZAF_SEEK_CURRENT	Interprets *offset* as the offset from CurrentOffset()
ZAF_SEEK_END	Interprets *offset* as the offset from the end of the ZafTable

If the resulting offset is invalid, ZAF_ERROR_INVALID is returned; otherwise, ZAF_ERROR_NONE is returned. SeekRandomRecord() may be overridden by the derived ZafTable class to provide additional functionality.

TopOffset

```
ZafOffset TopOffset(void) const;
virtual ZafOffset SetTopOffset(ZafOffset topOffset);
```

TopOffset() specifies the zero-based index of the record currently at the top of the table's viewable area. SetTopOffset() may be called to change it. SetTopOffset() does not change which record has focus.

VirtualRecord

```
ZafTableRecord *VirtualRecord(void) const;
virtual ZafTableRecord *SetVirtualRecord(ZafTableRecord
   *virtualRecord);
```

VirtualRecord() is the one ZafTableRecord that actually exists for a ZafTable. It is used as a template record for all records in the ZafTable. VirtualRecord() is created automatically by the constructor, but SetVirtualRecord() may be called to change it. Normally, the programmer should not need to call SetVirtualRecord(), but VirtualRecord() may be necessary to modify the virtual record template.

SetWriteFunction

```
MemberTableFunction SetWriteFunction(MemberTableFunction
    writeFunction);
```

Any function may be used to override WriteRecord() by passing that function into SetWriteFunction(). SetWriteFunction() returns *writeFunction*. See WriteRecord() for more information. The definition for MemberTableFunction is as follows:

```
typedef ZafError
    (ZafTable::*MemberTableFunction)(ZafTableRecord &record,
    ZafWindowObject *row);
```

WriteRecord

```
ZafError WriteRecord(ZafTableRecord &record,
    ZafWindowObject *row);
```

WriteRecord() must be overridden by the derived ZafTable class to write the data in *record* to the corresponding record in the database. *row* specifies the row header, and the programmer may call Text() for *row* to get the row header text. WriteRecord() returns ZAF_ERROR_INVALID if an error occurred, otherwise ZAF_ERROR_NONE is returned. Any function may be used to override WriteRecord() by passing that function into SetWriteFunction().

ZafTableHeader

HeaderType	Table	VirtualField

Inheritance `ZafTableHeader : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_table.hpp>`

Description ZafTableHeader provides support for displaying header rows and columns in a ZafTable object. ZafTableHeader is designed as a support class only, so the programmer should normally not need to create a ZafTableHeader object. ZafTableHeader objects are automatically added to a ZafTable object in the ZafTable constructor.

This class is not available in the Personal or Registered versions of ZAF, but is included with the Professional version.

Constructors All ZafTableHeader constructors initialize the member variables associated with an instantiated ZafTableHeader object. The default values set by the ZafTableHeader and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTableHeader. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafTableHeader

`HeaderType()`	`user-supplied parameter`
`VirtualField()`	`null`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Movable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_MULTIPLE_SELECTION`†
`Sizeable()`	`false`†
`Temporary()`	`false`†

Member Initializations

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`true`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`Noncurrent()`	`true`†
`OSDraw()`	`false`
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`SupportObject()`	`true`†
`UserFunction()`	`null`†

ZafElement

`ClassID()`	`ID_ZAF_TABLE_HEADER`
`ClassName()`	`"ZafTableHeader"`
`NumberID()`	`ZAF_NUMID_COLUMN_HEADER, ZAF_NUMID_CORNER_HEADER, or ZAF_NUMID_ROW_HEADER`
`StringID()`	`"ZAF_COLUMN_HEADER", "ZAF_CORNER_HEADER", or "ZAF_ROW_HEADER"`

```
ZafTableHeader(int width, int height, ZafTableHeaderType
   headerType = ZAF_ROW_HEADER);
```

This constructor is useful in straight-code situations. *width* and *height* specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *headerType* specifies the header type (see HeaderType() for more information).

```
ZafTableHeader(const ZafTableHeader &copy);
```

The copy constructor creates a new ZafTableHeader object and initializes its data from *copy*.

```
ZafTableHeader(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

A simple example of how to create table headers follows:

```
// To ensure proper sizing, always add the corner header first.
table->Add(new ZafTableHeader(5, 1, ZAF_CORNER_HEADER));

//Add the "top" column header.
table->Add(new ZafTableHeader(0, 1, ZAF_COLUMN_HEADER));

//Create the "side" row header.
ZafTableHeader *rowHeader = new ZafTableHeader(5, 0,
   ZAF_ROW_HEADER);
ZafString *string = new ZafString(0, 0, 5, "", -1);
string->SetHzJustify(ZAF_HZ_RIGHT);
rowHeader->SetVirtualField(string);
table->Add(rowHeader);
```

Destructor

```
virtual ~ZafTableHeader(void);
```

The destructor is used to free the memory associated with a ZafTableHeader object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafTableHeader object, since it is automatically destroyed when its parent table is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

HeaderType

```
ZafTableHeaderType HeaderType(void) const;
virtual ZafTableHeaderType
   SetHeaderType(ZafTableHeaderType headerType);
```

HeaderType() specifies what type of header this ZafTableHeader is. SetHeaderType() may be called to change the value of this attribute before the header is added to the ZafTable. The possible values for HeaderType() follow:

HeaderType()	Description
ZAF_COLUMN_HEADER	Specifies a column header to be positioned at the top edge of the ZafTable
ZAF_CORNER_HEADER	Specifies a corner header to be positioned in the space between the column and row headers in the top left corner of the ZafTable

HeaderType()	Description
ZAF_ROW_HEADER	Specifies a row header to be positioned at the left edge of the ZafTable

Table

```
ZafTable *Table(void) const;
```

Table() returns a pointer to the ZafTable object that the ZafTableHeader is attached to. Table() returns null if the header has not been added to a table.

VirtualField

```
ZafWindowObject *VirtualField(void) const;
virtual ZafWindowObject *SetVirtualField(ZafWindowObject
    *virtualField);
```

VirtualField() is the one ZafWindowObject that actually exists for a row ZafTableHeader. It is used as a template field for all fields in the row ZafTableHeader. VirtualField() must be set before the row header is added to the ZafTable by calling SetVirtualField(). Column and corner headers display the text of their respective children, and do not use VirtualField().

ZafTableRecord

ActivateObject	Offset
DeactivateObject	Table

Inheritance

`ZafTableRecord : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_table.hpp>`

Description

ZafTableRecord provides support for displaying records in a ZafTable object. ZafTableRecord is designed as a support class only, so the programmer should normally not need to create a ZafTableRecord object. A virtual ZafTableRecord object is automatically added to a ZafTable object in the ZafTable constructor. See ZafTable for more information.

This class is not available in the Personal or Registered versions of ZAF, but is included with the Professional version.

Constructors

All ZafTableRecord constructors initialize the member variables associated with an instantiated ZafTableRecord object. The default values set by the ZafTableRecord and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTableRecord. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafTableRecord

`Offset()`	`-1`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Movable()`	`false`†
`NormalHotKeys()`	`false`†
`SelectionType()`	`ZAF_MULTIPLE_SELECTION`
`Sizeable()`	`false`†
`Temporary()`	`false`†

Member Initializations

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`Disabled()`	`false`†
`Noncurrent()`	`false`†
`ParentDrawFocus()`	`true`†
`RegionType()`	`ZAF_INSIDE_REGION`†
`SupportObject()`	`false`†

ZafElement

`ClassID()`	`ID_ZAF_TABLE_RECORD`
`ClassName()`	`"ZafTableRecord"`

```
ZafTableRecord(int width, int height);
```

This constructor is useful in straight-code situations. *width* and *height* specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

```
ZafTableRecord(const ZafTableRecord &copy);
```

The copy constructor creates a new ZafTableRecord object and initializes its data from *copy*.

```
ZafTableRecord(const ZafIChar *name,
   ZafObjectPersistence &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

See ZafTable for an example of how to utilize ZafTableRecord objects.

Destructor

`virtual ~ZafTableRecord(void);`

The destructor is used to free the memory associated with a ZafTableRecord object. It chains to the ZafWindow, ZafWindowObject, ZafList, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafTableRecord object, since it is automatically destroyed when its parent table is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

ActivateObject

`virtual bool ActivateObject(ZafWindowObject *object);`

ActivateObject() causes *object* (which is a child of the table record) to be activated. In other words, the object becomes editable. ActivateObject() returns true if successful, and false otherwise. Normally, the programmer should not call ActivateObject(), as it is used internally by ZAF.

DeactivateObject

`virtual bool DeactivateObject(ZafWindowObject *object);`

DeactivateObject() causes *object* (which is a child of the table record) to be deactivated. In other words, if the object is editable, it becomes non-editable. DectivateObject() returns false if successful, and true otherwise. Normally, the programmer should not call DeactivateObject(), as it is used internally by ZAF.

Offset

```
ZafOffset Offset(void) const;
virtual ZafOffset SetOffset(ZafOffset offset);
```

Offset() is the zero-based record offset for the ZafTableRecord in the ZafTable. Offset() is maintained by the ZafTable object, so the programmer should normally not call SetOffset(), but Offset() is useful when a record's offset in the parent table is needed.

Table

`ZafTable *Table(void) const;`

Table() returns a pointer to the ZafTable object that the ZafTableRecord is attached to. Table() returns null if the header has not been added to a table.

ZafText

AutoClear	HzJustify	Unanswered
CursorOffset	Invalid	ViewOnly
CursorPosition	StringData	WordWrap
Event	Text	

Inheritance

`ZafText : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

`#include <z_text.hpp>`

Description

The ZafText object is a multi-line text object that allows user input through the keyboard. Other user interaction is also supported such as copy/cut/paste. A ZafText object may have scroll bars associated with it.

Constructors

All ZafText constructors initialize the member variables associated with an instantiated ZafText object. The default values set by the ZafText and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafText. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafText

AutoClear()	false
HzJustify()	ZAF_HZ_LEFT
Invalid()	false
StringData()	null
Unanswered()	false
ViewOnly()	false
WordWrap()	true

ZafWindow

Destroyable()	false†
Locked()	false†
Maximized()	false†
Minimized()	false†
Modal()	false†
Moveable()	false†
NormalHotKeys()	false†
SelectionType()	ZAF_SINGLE_SELECTION†
Sizeable()	false†

Member Initializations

`Temporary()`	`false`†
ZafWindowObject	
`Bordered()`	`true`
ZafElement	
`ClassID()`	`ID_ZAF_TEXT`
`ClassName()`	`"ZafText"`

```
ZafText(int left, int top, int width, int height, const
   ZafIChar *text, int maxLength);
```

This constructor is useful in straight-code situations, particularly if you wish the ZafText object to create, maintain and destroy its own ZafStringData object automatically. *left* and *top* specify the position where the left and top of the object will be placed on its parent. *width* and *height* specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *text* is the text you wish to initially appear in the new ZafText object, and *maxLength* is passed to the ZafStringData constructor, the maximum number of characters the user may type into the field (see the ZafStringData constructor for more information). If you pass -1 in for the *maxLength* parameter, the number of characters the user may type is not restricted.

```
ZafText(int left, int top, int width, int height,
   ZafStringData *stringData = ZAF_NULLP(ZafStringData));
```

This constructor is useful in straight-code situations where you have already created a ZafStringData object. This constructor could be used to maintain data pieces yourself, rather than having the ZafText class create and maintain the data pieces automatically. For example, to maintain a database of ZafStringData objects and tie them into ZafText objects, maintain your own ZafStringData objects and create ZafText objects using your ZafStringData objects by passing them into the *stringData* parameter of this constructor. For more information on using ZafStringData objects, see ZafStringData. The *left*, *top*, *width* and *height* parameters are the same as the previous constructor.

```
ZafText(const ZafText &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafText object and copies the object's information. If the data objects are StaticData() then the new ZafText object simply points to the original data objects, otherwise a copy is made of them for the new ZafText object. This allows a programmer to use static data for more than one ZafText object.

```
ZafText(const ZafIChar *name, ZafObjectPersistence
   &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafText creation techniques follow:

```
// Create a sample window with text objects.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);
// Create text objects and pass in the text directly.
window1->Add(new ZafText(0, 1, 20, 3, "Text1", 200));
window1->Add(new ZafText(25, 1, 20, 3, "Text2", 200));
...
// Create a sample window with text objects.
ZafWindow *window2 = new ZafWindow(10, 10, 50, 10);
// Create string data objects.
ZafStringData *stringData1 = new ZafStringData("Text1", 200);
ZafStringData *stringData2 = new ZafStringData("Text2", 200);
// Create text objects that use the data previously created.
window2->Add(new ZafText(0, 1, 20, 3, stringData1));
window2->Add(new ZafText(25, 1, 20, 3, stringData2));
```

Destructor

```
virtual ~ZafText(void);
```

The destructor is used to free the memory associated with a ZafText object, including all the data object pieces that are Destroyable(). It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafText object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoClear

```
bool AutoClear(void) const;
virtual bool SetAutoClear(bool autoClear);
```

If AutoClear() is true, the text becomes entirely highlighted when the object gains focus so whatever the user types replaces the current text. The default value of this attribute is true, but the user may call SetAutoClear() to change it.

CursorOffset

```
int CursorOffset(void) const;
virtual ZafError SetCursorOffset(int position);
```

CursorOffset() returns the character offset of the cursor (the insertion point) in the ZafText object. This offset is zero-based, so the first character offset in the ZafText is 0. The user may call SetCursorOffset() to reposition the cursor to *position* in the ZafText. For example:

```
// Move the cursor to the beginning of the text.
object->SetCursorOffset(0);
```

CursorPosition

```
ZafPositionStruct CursorPosition(void) const;
virtual ZafError SetCursorPosition(ZafPositionStruct
   position);
```

CursorPosition() returns the character position of the cursor (the insertion point) in the ZafText object. This position is zero-based, so the first character position in the ZafText is (0, 0). The user may call SetCursorPosition() to reposition the cursor to *position* in the ZafText. For example:

```
// Move the cursor down one line in the text.
ZafPositionStruct cursorPos = object->CursorPosition();
cursorPos.line++;
object->SetCursorOffset(cursorPos);
```

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events that get sent to the ZafText object, whether by processing the events itself, or by passing them to a base class for processing. See ZafWindowObject for more information.

In addition to those handled by its base classes, ZafText handles the following events:

Event	Description
S_COPY	causes the object to copy its selected data to the clip-board
S_COPY_DATA	causes the object to copy event.windowObject's String-Data() if event.windowObject is a ZafText object

Event	Description
S_CUT	causes the object to cut its selected data to the clipboard
S_PASTE	causes the object to paste the clipboard's data to its current cursor position, replacing any selected data
S_SET_DATA	causes the object to create a new StringData() object, then copy into it event.windowObject's StringData() if event.windowObject is non-null and is a ZafText object

HzJustify

```
ZafHzJustify HzJustify(void) const;
virtual ZafHzJustify SetHzJustify(ZafHzJustify
    hzJustify);
```

HzJustify() controls the text's horizontal justification, and is ZAF_HZ_LEFT by default. The user may call SetHzJustify() to change it to ZAF_HZ_RIGHT or ZAF_HZ_CENTER.

Invalid

```
bool Invalid(void) const;
virtual bool SetInvalid(bool invalid);
```

This attribute provides a user hook that may be used during validation on a ZafText object. During validation, the programmer may set Invalid() to true to indicate that the end user has entered invalid data. Because it is a user hook, Invalid() is an advanced function that does not have any default behavior in ZafText. The default value of this attribute is false, but the user may call SetInvalid() to change it.

StringData

```
ZafStringData *StringData(void) const;
virtual ZafError SetStringData(ZafStringData *string);
```

StringData() is where the actual data is stored for the ZafText object. The StringData() piece may belong to a single ZafText object, or may be shared among several ZafText objects, in which case all the associated ZafText objects will be updated when the StringData() piece changes. SetStringData() may be used to associate a StringData() object with a ZafText object. For more information on data sharing in ZAF, see ZafDataManager. SetStringData() will delete the previous StringData() object if it is Destroyable() and no other object uses it.

The return value for StringData() is a pointer to the StringData() object associated with the ZafText object. The return value for SetStringData() is normally ZAF_ERROR_NONE. The following code shows the proper use of these functions:

```
// Get the data.
const ZafStringData *data = text->StringData();
...
// Add the string data.
ZafStringData *newData = new ZafStringData("Text", 25);
text->SetStringData(newData);
```

Text

`virtual const ZafIChar *`**`Text`**`(void);`
`virtual ZafError `**`SetText`**`(const ZafIChar *text);`

The textual data of a ZafText (contained in the StringData() object) may be returned or set with Text() and SetText(). These functions provide simple accessibility to the StringData() of a ZafText, and may be used if the programmer does not wish to interact with the data portion of the object.

The return value for Text() is a pointer to the textual information in the data object of a ZafText. The return value for SetText() is normally ZAF_ERROR_NONE. The following code shows the proper use of these functions:

```
// Get the text.
const ZafIChar *text = textObject->Text();
...
// Set the new text.
textObject->SetText("New Text");
```

Unanswered

`bool `**`Unanswered`**`(void) const;`
`virtual bool `**`SetUnanswered`**`(bool unanswered);`

If Unanswered() is true, the ZafText field will be initially blank. When text is entered into the ZafText object, either by calling SetText(), or by the end user entering data, the Unanswered() attribute is set to false. Unanswered() is false by default, but the user may call SetUnanswered() to make changes. Calling SetUnanswered(true) will clear the contents of the text object and its StringData().

ViewOnly

`bool `**`ViewOnly`**`(void) const;`
`virtual bool `**`SetViewOnly`**`(bool viewOnly);`

A ViewOnly() ZafText object may not be edited, but it may be the current object of a window, may be copied into the clipboard, and the arrow keys may be used to navigate it. ViewOnly() is false by default, but the user may call SetViewOnly() to change it.

WordWrap

```
bool WordWrap(void) const;
virtual bool SetWordWrap(bool wrappedData);
```

A WordWrap() ZafText object automatically wraps its data at the end of each line. If WordWrap() is false, the end user must type a carriage return to go to the next line. WordWrap() is true by default, but the user may call SetWordWrap() to change it.

ZafTime

Event	TimeData

Inheritance `ZafTime : ZafString : ZafWindowObject : ZafElement`

Declaration `#include <z_time1.hpp>`

Description ZafTime is a single-line time object that allows user input through the keyboard. ZafTime is fully internationalized to display and input using any format.

All ZafTime objects refer to data contained in a ZafTimeData object (refer to this class for additional essential information).

Formats ZafString and derived classes parse input and display output based on default or programmer-defined input and output formats. Programmers may use the SetInputFormat() and SetOutputFormat() families of functions to change the default format. The functions are documented in the ZafString reference.

Each class derived from ZafFormatData handles a different set of formatting arguments, in addition to those supported by its base classes. ZafTimeData (and therefore ZafTime) handles the following "time" subset of the arguments supported by ZafUTimeData (the parent class to ZafTimeData):

Format Argument	Substitution
%%	'%' character
%h	Same as %H
%H	Hour (24-hour clock) as a decimal number [00, 23]
%i	Same as %I; can be one or two digits
%I	Hour (12-hour clock) as a decimal number [01, 12]
%J	Seconds in tenths (.1)
%k	Seconds in hundredths (.01)
%K	Seconds in thousandths (.001)
%p	Locale equivalent of either a.m. or p.m.
%r	Time in a.m. or p.m. notation; in the POSIX locale this is equivalent to: %I:%M:%S %p
%R	Time in 24-hour notation (%H:%M)
%s	Same as %S; can be one or two digits
%S	Seconds as a decimal number [00, 59]

Format Argument	Substitution
%T	Time (%H:%M:%S)
%X	Locale-specific time representation
%Z	Timezone name or abbreviation

Constructors

All ZafTime constructors initialize the member variables associated with an instantiated ZafTime object. The default values set by the ZafTime and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTime. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafTime	
`TimeData()`	`null`
ZafString	
`LowerCase()`	`false`†
`Password()`	`false`†
`StringData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_TIME`
`ClassName()`	`"ZafTime"`

```
ZafTime(int left, int top, int width, int hour, int
    minute, int second, int milliSecond = 0);
```

This constructor is useful in straight-code situations, particularly if the ZafTime object is to create, maintain and destroy its own ZafTimeData object automatically. *left*, *top*, and *width* are the position and size of the object on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *hour*, *minute*, *second*, and *milliSecond* specify the time values that initially appear in the new ZafTime object.

ZafTime(int left, int top, int width, ZafTimeData *timeData = ZAF_NULLP(ZafTimeData));

This constructor is useful in straight-code situations where a ZafTimeData object has already been created. This constructor could be used when manually maintaining a ZafTimeData object, rather than having the ZafTime class create and maintain the data object automatically. For more information on using ZafTimeData objects, see ZafTimeData. See the previous constructor for a description of *left*, *top*, and *width* parameters.

ZafTime(const ZafTime &copy);

The copy constructor calls the overloaded Duplicate() to create a new ZafTime object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafTime object simply points to the original data, otherwise StaticData() copies are made.

ZafTime(const ZafIChar *name, ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafTime creation techniques follow:

```
// Create a sample window with time objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);

// Create time objects and pass in the values directly.
window1->Add(new ZafTime(0, 1, 25, 8, 0, 0));
window1->Add(new ZafTime(0, 2, 25, 17, 59, 59));
...
// Create a sample window with time objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);

// Create time data objects.
ZafTimeData *timeData1 = new ZafTimeData(8, 0, 0);
ZafTimeData *timeData2 = new ZafTimeData(17, 59, 59);

// Create times that use the data previously created.
window2->Add(new ZafTime(0, 1, 25, timeData1));
window2->Add(new ZafTime(0, 2, 25, timeData2));
```

Destructor virtual ~**ZafTime**(void);

The destructor is used to free the memory associated with a ZafTime object, including all the data objects that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafTime object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Event

`virtual ZafEventType **Event**(const ZafEventStruct &event);`

This overloaded function receives all events that get sent to the ZafTime object and either handles them or passes them to ZafString, its immediate base class. See ZafWindowObject for more information.

ZafTime specifically handles the following events:

Event	Description
N_RESET_I18N	causes the object to redisplay its data according to the new internationalization values
S_COPY_DATA	causes the object to copy event.windowObject's Time-Data() if event.windowObject is a ZafTime object
S_SET_DATA	causes the object to create a new TimeData() object, then copy into it event.windowObject's TimeData() if event.windowObject is non-null and is a ZafTime object

TimeData

```
ZafTimeData *TimeData(void) const;
virtual ZafError SetTimeData(ZafTimeData *timeData);
```

*TimeData() contains the actual information used by ZafTime. The TimeData() object may be used by one or more ZafTime objects, or other objects. If shared, all associated ZafTime objects will be notified when the TimeData() changes. For more information on data sharing in ZAF, see ZafDataManager. SetTimeData() will delete the previous TimeData() object if it is Destroyable() and no other object uses it.

TimeData() returns a pointer to the TimeData() object associated with the ZafTime object. The return value for SetTimeData() is normally ZAF_ERROR_NONE. See the code snippet for an example using ZafTimeData objects with ZafTime.

ZafTimeData

Clear FormattedText SetTime

Inheritance

`ZafTimeData : ZafUTimeData : ZafFormatData : ZafData : ZafElement, ZafNotification`

Declaration

```
#include <z_time.hpp>
```

Description

ZafTimeData combines time encapsulation with data notification and object notification from ZafData. It is most often used in conjunction with the ZafTime user interface object but may be used as a stand-alone object if desired. Refer to the ZafUTimeData documentation for a discussion of member methods, inherited by ZafTimeData, used to retrieve and set time-specific information (e.g., hour, minute, second, etc.).

All ZafData objects may make use of printf-style formatting and parsing arguments during string operations. In addition, all ZafUTimeData objects may make use of strftime- and strptime-style formatting and parsing arguments during string operations. Refer to standard library documentation for detailed information on printf, strftime, and strptime functions as well as their corresponding conversion characters.

Constructors

ZafTimeData constructors initialize the member variables associated with a new ZafTimeData object and allocate space to hold the time data. The default values set by ZafTimeData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafUTimeData	
`Hour()`	`(varies by constructor)`
`MilliSecond()`	`(varies by constructor)`
`Minute()`	`(varies by constructor)`
`Second()`	`(varies by constructor)`
`Value()`	`(varies by constructor)`
`ZoneOffset()`	`(varies by constructor)`
ZafElement	
`ClassID()`	`ID_ZAF_time_DATA`
`ClassName()`	`"ZafTimeData"`

ZafTimeData(void);

The basic constructor allocates a ZafTimeData instance and initializes its value to the current system time.

ZafTimeData(int hour, int minute, int second, int milliSecond);

This constructor allocates a ZafTimeData instance and initializes its contents to the time corresponding to *hour*, *minute*, *second* and *milliSecond*.

ZafTimeData(const ZafIChar *string, const ZafIChar *format = ZAF_NULLP(ZafIChar));

This constructor allocates a ZafTimeData instance and initializes its contents to the time equivalent of *string*. The conversion uses the strptime-style specifier *format* to interpret the string. If *format* is null ZafTimeData uses its locale-specific default format.

ZafTimeData(const ZafTimeData &copy);
ZafTimeData(const ZafUTimeData &copy);

These constructors are the copy constructors. They each allocate a new ZafTimeData instance and copy all member data from copy.

ZafTimeData(const ZafIChar *name, ZafDataPersistence &persist);

This constructor is the persistent constructor. It allocates a new ZafTimeData instance and reads most member data from the *name* directory of the persistent data file referred to by *persist*. The StringID() of the new data is *name*.

```
// Sample ZafTimeData creation techniques
ZafTimeData time1(13, 34, 20, 0);
ZafTimeData copyTime = time1;
ZafTimeData time2("16 15 30", "%H %M %S");
ZafTimeData systemTime;
```

Destructor

virtual ~**ZafTimeData**(void);

The destructor is used to free the memory associated with an instantiated ZafTimeData object. Unless StaticData() is true a ZafTimeData object is usually destroyed automatically when all ZafTime objects that refer to it are destroyed.

Members

Clear

`virtual void` **`Clear`**`(void);`

Clear() sets the value of a ZafTimeData object to the current system time.

FormattedText

```
virtual int FormattedText(ZafIChar *buffer, int
   maxLength, const ZafIChar *format = 0) const;
```

FormattedText() fills *buffer* with a string representation of the ZafTimeData using the strftime-style specifier *format* to build the string. A locale-specific default format is used if *format* is not included. Buffer contents will be truncated if they exceed *maxLength* characters. FormattedText() returns the integer value it receives from its call to strftime().

```
// Show various results of FormattedText().
ZafIChar buffer[256];

ZafTimeData time(18, 25, 30);
time.FormattedText(buffer, 256, "%I:%M:%S %p");
printf("time - %s\n", buffer);

time.FormattedText(buffer, 256, "%H:%M");
printf("time - %s\n", buffer);

==========
time - 06:25:30 p.m.
time - 18:25
```

SetTime

```
virtual ZafError SetTime(int hour, int minute, int second,
   int milliSecond);
virtual ZafError SetTime(const ZafIChar *buffer, const
   ZafIChar *format);
virtual ZafError SetTime(const ZafTimeData &time);
```

SetTime() functions set the value of the ZafTimeData object from numeric input, another time, or an interpreted string. Refer to FormattedText() for more information on time/string conversions.

ZafTimer

Add	NotifyMessage	operator +
Event	Poll	operator -
Interval	QueueEvents	
NotifyCount	Subtract	

Inheritance `ZafTimer : ZafDevice : ZafElement`

Declaration `#include <z_timer.hpp>`

Description The ZafTimer device notifies a list of objects when a specified interval of time has passed. Notification is made by sending a ZafEvent to each object in the notification list. This message is N_TIMER by default, but may be specified by the programmer.

Since ZafTimer is not interrupt-driven, it is not guaranteed that the objects will receive a notification message within the exact interval specified. Although native OS timers may queue timer events with relative accuracy, these events do not interrupt applications and are therefore subject to limitations of event polling. For maximum accuracy, ZafTimer uses native timers where available.

Constructors All ZafTimer constructors initialize the member variables associated with an instantiated ZafTimer object. Default values set by the ZafTimer follow, as well as base class values when overridden by ZafTimer.

Member Initializations

ZafTimer	
`Interval()`	`0`
`NotifyMessage()`	`N_TIMER`
`QueueEvents()`	`false`
ZafDevice	
`DeviceType()`	`E_TIMER`
ZafElement	
`ClassID()`	`ID_ZAF_TIMER`
`ClassName()`	`"ZafTimer"`
`NumberID()`	`ID_ZAF_TIMER`
`StringID()`	`"ZafTimer"`

```
ZafTimer(ZafDeviceState state = D_ON, unsigned long
   interval);
```

This constructor is used to instantiate a ZafTimer object to be added to the ZafEventManager. *state* specifies the initial state of the device, and *interval* specifies the time interval in milliseconds, that expires before a message is sent to the list of notification objects (see ZafDevice for valid states).

```
ZafTimer(const ZafTimer &copy);
```

The copy constructor accepts another ZafTimer object and copies the object's information. The list of notification objects is not copied, since two timers should not send notifications to the same objects. An example of how to create a ZafTimer object follows:

```
// Create a timer.
ZafTimer *timer = new ZafTimer(D_ON, 1000);
// Add the field to be notified.
timer->Add(myObject);
// Add the timer to the event manager, which also activates the
   timer.
zafEventManager->Add(timer);
```

Destructor

```
virtual ~ZafTimer(void);
```

The destructor is used to free the memory associated with a ZafTimer object. It chains to the ZafDevice and ZafElement destructors.

The programmer may delete a ZafTimer object when it is no longer needed; otherwise it is automatically destroyed when the event manager is destroyed. For more information on device object deletion, see ZafEventManager::~ZafEventManager().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Add

```
ZafWindowObject *Add(ZafWindowObject *object,
   ZafEventType newNotifyMessage, ZafWindowObject
   *position = ZAF_NULLP(ZafWindowObject));
```

```
ZafWindowObject *Add(ZafWindowObject *object,
   ZafWindowObject *position =
   ZAF_NULLP(ZafWindowObject));
```

operator +

```
ZafTimer &operator+(ZafWindowObject *object);
```

These functions and operator add object to the timer's notification list. When the time interval expires, the timer sends either *newNotifyMessage* (unique to the object) or the default notify message to each objects on the notification list.

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function handles all events sent to the ZafTimer object. The following events are handled:

ZafEventType	**Description**
`D_DEINITIALIZE`	causes the timer to deinitialize its notification mechanism
`D_INITIALIZE`	causes the timer to initialize its notification mechanism
`D_OFF`	causes the timer to stop sending notification messages
`D_ON`	causes the timer to begin sending notification messages
`D_STATE`	causes the timer to return its device state
`S_ADD_OBJECT`	causes event.windowObject to be added to the notification list
`S_SUBTRACT_OBJECT`	causes event.windowObject to be removed from the notification list

Interval

```
unsigned long Interval(void) const;
virtual unsigned long SetInterval(unsigned long
   interval);
```

Interval() returns the notification time interval in milliseconds. SetInterval may be used to change the timer delay after a ZafTimer has been created

NotifyCount

```
int NotifyCount(void) const;
```

NotifyCount() returns the number of objects in the timer's notification list. This function is useful if the programmer wishes to delete a ZafTimer when it is no longer used by any objects.

NotifyMessage

```
ZafEventType NotifyMessage(void) const;
ZafEventType SetNotifyMessage(ZafEventType
    notifyMessage);
```

When Interval() expires, the timer sends an event of type NotifyMessage() to all the objects on the notification list that don't have their own specific event type assigned via Add(). NotifyMessage() defaults to N_TIMER, but the programmer may pass a different event type into the constructor or SetNotifyMessage().

Poll

```
virtual void Poll(void);
```

In some environments, the Poll() function checks the timer device to see if the Interval() has expired, if the ZafTimer's state is not D_OFF. In other environments where timer events are handled automatically by the native environment, Poll() may simply block timer events from coming through ZAF's event manager queue if the ZafTimer's state is D_OFF.

QueueEvents

```
bool QueueEvents(void) const;
virtual bool SetQueueEvents(bool queueEvents);
```

QueueEvents() causes the timer to put an event of type NotifyMessage() on ZAF's event manager queue after all objects in the notification list have been notified directly

Using this option, a ZafTimer may "notify" the Zaf system generally rather than directly calling the event function for individual objects. QueueEvents() defaults to false, but may be changed with SetQueueEvents().

Subtract
operator -

```
ZafWindowObject *Subtract(ZafWindowObject *object);
ZafTimer &operator-(ZafWindowObject *object);
```

This function and operator subtract *object* from the timer's notification list, so that the *object* is no longer sent notification messages.

ZafTitle

Inheritance `ZafTitle : ZafButton : ZafWindowObject : ZafElement`

Declaration `#include <z_title.hpp>`

Description

ZafTitle is the title bar decoration on a ZafWindow, and is generally drawn by the environment. A ZafTitle object may only be added to a ZafWindow, and allows a user to move the parent window with a ZafMouse device.

ZafTitle can be automatically added to a window along with other window "decorations" by using ZafWindow::AddGenericObjects().

Constructors

All ZafTitle constructors initialize the member variables associated with an instantiated ZafTitle object. The default values set by the ZafTitle and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTitle. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafButton

`AllowDefault()`	`false`†
`AllowToggling()`	`false`†
`AutoRepeatSelection()`	`false`†
`AutoSize()`	`true`†
`BitmapData()`	`null`†
`ButtonType()`	`ZAF_FLAT_BUTTON`†
`Depressed()`	`false`†
`Depth()`	`0`†
`HotKeyChar()`	`0`†
`HotKeyIndex()`	`-1`†
`HzJustify()`	`ZAF_HZ_CENTER`†
`SelectOnDoubleClick()`	`true`†
`SelectOnDownClick()`	`true`†
`SendMessageText()`	`null`†
`SendMessageWhenSelected()`	`true`†
`Value()`	`Used internally by ZAF`†
`VtJustify()`	`ZAF_VT_CENTER`†

ZafWindowObject

`AcceptDrop()`	`false`†
`Bordered()`	`false`†

Member Initializations

`CopyDraggable()`	`false`†
`Disabled()`	`false`†
`Focus()`	`false`†
`HelpContext()`	`null`†
`HelpObjectTip()`	`null`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`Noncurrent()`	`true`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`QuickTip()`	`null`†
`RegionType()`	`ZAF_AVAILABLE_REGION`†
`Selected()`	`false`†
`SupportObject()`	`true`†
`SystemObject()`	`false`
`UserFunction()`	`null`†

ZafElement

`ClassID()`	`ID_ZAF_TITLE`
`ClassName()`	`"ZafTitle"`
`NumberID()`	`ZAF_NUMID_TITLE`
`StringID()`	`"ZAF_NUMID_TITLE"`

ZafTitle(const ZafIChar *text);

This constructor is useful in straight-code situations, particularly if you wish the ZafTitle object to create, maintain and destroy its own ZafStringData object automatically. Simply pass the text to appear in the title bar into the *text* parameter.

ZafTitle(ZafStringData *textData);

This constructor is also useful in straight-code situations, particularly if you have already created a ZafStringData object to be associated with the title bar. This constructor could be used to maintain string data pieces manually, rather than having the ZafTitle class create and maintain the string data pieces automatically. For more information see ZafStringData. *textData* specifies the string data object to be associated with the title bar.

ZafTitle(const ZafTitle &copy);

The copy constructor creates a new ZafTitle object and initializes its data from copy.

ZafTitle(const ZafIChar *name, ZafObjectPersistence
&persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a title bar follows:

```
// Create a sample window.
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
ZafTitle *title = new ZafTitle("Test Window");
window->Add(title);
```

Destructor

virtual ~**ZafTitle**(void);

The destructor is used to free the memory associated with a ZafTitle object. It chains to the ZafButton, ZafWindowObject, and ZafElement destructors. Generally, the programmer will not directly destroy a ZafTitle object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

ZafToolBar

DockType	WrapChildren

Inheritance

```
ZafToolBar : ZafWindow : (ZafWindowObject : ZafElement),
   ZafList
```

Declaration

```
#include <z_tbar.hpp>
```

Description

The ZafToolBar object may be placed along any of the four edges of a window, and generally contains groups of buttons. However, the ZafToolBar object may contain any of ZAF's input objects. ZafToolBar is Noncurrent() by default, meaning that it does not receive focus, but it allows the option of receiving focus if desired.

Constructors

All ZafToolBar constructors initialize the member variables associated with an instantiated ZafToolBar object. The default values set by the ZafToolBar and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafToolBar. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafToolBar	
DockType()	ZAF_DOCK_TOP
WrapChildren()	true
ZafWindow	
Destroyable()	false†
Locked()	false†
Maximized()	false†
Minimized()	false†
Modal()	false†
Moveable()	false†
NormalHotKeys()	false†
Sizeable()	false†
Temporary()	false†
ZafWindowObject	
AcceptDrop()	false†
Bordered()	true
Noncurrent()	true
RegionType()	ZAF_AVAILABLE_REGION†

Member Initializations

`SupportObject()`	`true`
ZafElement	
`ClassID()`	`ID_ZAF_TOOL_BAR`
`ClassName()`	`"ZafToolBar"`

ZafToolBar`(int left, int top, int width, int height);`

This constructor is useful in straight-code situations. *left* and *top* specify the left and top of the object, while *width* and *height* specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. Currently, *left* and *top* are ignored since the tool bar is automatically placed on the edge of its parent window's client region, but they may be used in the future. *width* and *height* are ignored if the tool bar is WrapChildren().

ZafToolBar`(const ZafToolBar &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafToolBar object and copies the object's information.

ZafToolBar(const ZafIChar *name, ZafObjectPersistence &persist);

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

An example of how to create a tool bar with buttons follows:

```
// Create a sample window with a tool bar and buttons.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);
// Create a wrapping tool bar.
ZafToolBar *toolBar = new ZafToolBar(0, 0, 80, 1);
// Add two groups of buttons separated by a spacer.
// They are automatically positioned by the tool bar.
toolBar->Add(new ZafButton(0, 0, 10, 1, "Button 1",
    ZAF_NULLP(ZafBitmapData)));
toolBar->Add(new ZafButton(0, 0, 10, 1, "Button 2",
    ZAF_NULLP(ZafBitmapData)));
ZafButton *spacer = new ZafButton(0, 0, 1, 1,
    ZAF_NULLP(ZafIChar), ZAF_NULLP(ZafBitmapData));
toolBar->Add(spacer);
```

```
toolBar->Add(new ZafButton(0, 0, 10, 1, "Button 3",
    ZAF_NULLP(ZafBitmapData)));
toolBar->Add(new ZafButton(0, 0, 10, 1, "Button 4",
    ZAF_NULLP(ZafBitmapData)));
// Add the tool bar to the window.
window1->Add(toolBar);
```

Destructor

```
virtual ~ZafToolBar(void);
```

The destructor is used to free the memory associated with a ZafToolBar object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafToolBar object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

DockType

```
ZafDockType DockType(void) const;
virtual ZafDockType SetDockType(ZafDockType dockType);
```

A ZafToolBar object may be “docked” on any of the four sides of its parent window, according to the DockType() attribute. The default value of this attribute is ZAF_DOCK_TOP, but the user may call SetDockType() to change it. The possible values of this attribute are:

- ZAF_DOCK_TOP
- ZAF_DOCK_BOTTOM
- ZAF_DOCK_LEFT
- ZAF_DOCK_RIGHT

WrapChildren

```
bool WrapChildren(void) const;
virtual bool SetWrapChildren(bool wrapChildren);
```

If WrapChildren() is true, the ZafToolBar object automatically positions its children based on the available space on the tool bar, and the tool bar adjusts its size on its parent window to accommodate the children. A WrapChildren() tool bar, therefore, ignores the width and height specified in the constructor. If WrapChildren() is false, the tool bar reflects the width and height specified in the constructor, and respects its children’s positioning. WrapChildren() is true by default, but the user may call SetWrapChildren() to change it.

ZafTreeItem

AutoSortData	Expanded	TreeList
DepthCurrent	NormalBitmap	ViewCurrent
DepthFirst	SelectedBitmap	ViewFirst
DepthLast	SetSelectionType	ViewLast
DepthNext	StringData	ViewLevel
DepthPrevious	Text	ViewNext
Expandable	ToggleExpanded	ViewPrevious

Inheritance

```
ZafTreeItem : ZafWindow : (ZafWindowObject : ZafElement),
   ZafList
```

Declaration

```
#include <z_tree.hpp>
```

Description

ZafTreeItems are contained in ZafTreeLists. Each ZafTreeItem may or may not contain other ZafTreeItems. Those that contain children may be expandable to expose or hide their children. Like ZafHzList and ZafVtList items, tree items may not be Noncurrent(). Since the ZafTreeList and ZafTreeItem classes were specially designed to work together, only other ZafTreeItem objects may be added to a ZafTreeItem object. See ZafTreeList for a more detailed description.

Constructors

All ZafTreeItem constructors allocate memory for an object instance and initialize member variables. The default values set by the ZafTreeItem and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTreeItem. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafTreeItem

`AutoSortData()`	`false`
`Expandable()`	`false`
`Expanded()`	`false`
`NormalBitmap()`	`null`
`SelectedBitmap()`	`null`
`StringData()`	`null`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†

Member Initializations

`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`false`†
`Sizeable()`	`false`†
`Temporary()`	`false`†
ZafWindowObject	
`AcceptDrop()`	`false`†
`Bordered()`	`false`†
`RegionType()`	`ZAF_INSIDE_REGION`†
`SystemObject()`	`false`
ZafElement	
`ClassID()`	`ID_ZAF_TREE_ITEM`
`ClassName()`	`"ZafTreeItem"`

```
ZafTreeItem(ZafBitmapData *normalBitmap, ZafBitmapData
    *selectedBitmap, ZafIChar *text);
```

This constructor is useful in straight-code situations, particularly if the ZafTreeItem object is to create, maintain, and destroy its own ZafStringData object automatically. *text* specifies the textual information displayed by the ZafTreeItem object. The *normalBitmap* and *selectedBitmap* parameters specify the bitmaps displayed by the ZafTreeItem object in its normal and selected states, respectively.

```
ZafTreeItem(ZafBitmapData *normalBitmap, ZafBitmapData
    *selectedBitmap, ZafStringData *stringData);
```

This constructor is also useful in straight-code situations, particularly when a ZafStringData object, *stringData*, has already been created to be associated with the ZafTreeItem object. For more information see ZafStringData.

```
ZafTreeItem(const ZafTreeItem &copy);
```

The copy constructor is used in conjunction with the overloaded Duplicate() function. It allocates a new ZafTreeItem object and initializes its data from *copy*. If the original ZafTreeItem's internal data objects are StaticData() then the new ZafTreeItem object points to the originals, otherwise copies are made.

```
ZafTreeItem(const ZafIChar *name, ZafObjectPersistence
    &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level. The following example demonstrates how to create ZafTreeItem objects:

```
// Create a sample window with a tree list.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);

// Create the tree list object.
extern ZafBitmapData *nBitmap, *sBitmap;
ZafTreeList *tree = new ZafTreeList(1, 1, 20, 5);

// Create the tree items and add them to the tree.
ZafTreeItem *item1 = new ZafTreeItem(normalBitmap,
    selectedBitmap, "Item 1");
item1->SetExpandable(true);
item1->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 1.1"));
item1->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 1.2"));
item1->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 1.3"));
tree->Add(item1);
ZafTreeItem *item2 = new ZafTreeItem(nBitmap, sBitmap, "Item
    2");
item2->SetExpandable(true);
item2->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 2.1"));
item2->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 2.2"));
item2->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 2.3"));
tree->Add(item2);

// Add a vertical scroll bar to the tree list.
tree->Add(new ZafScrollBar(0, 0, 0, 0));

// Add the list to the window.
window1->Add(tree);
```

Destructor

```
virtual ~ZafTreeItem(void);
```

The destructor is used to free the memory associated with a ZafTreeItem object, including all the data object pieces—such as StringData()—that are Destroyable(). It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafTreeItem object, since it is automatically destroyed when its parent ZafTreeList is destroyed.

For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AutoSortData

```
bool AutoSortData(void) const;
virtual bool SetAutoSortData(bool autoSortData);
```

AutoSortData() is provided at this level only for the purpose of checking the attribute, since this attribute applies for the entire hierarchy of the ZafTreeList object. SetAutoSortData() has no effect for ZafTreeItem. See ZafTreeList::AutoSortData() for more information.

DepthCurrent

```
ZafTreeItem *DepthCurrent(void);
```

DepthCurrent() returns the current leaf ZafTreeItem object in the current branch of the tree—beginning with this ZafTreeItem object and traversing down the current branch of the hierarchy. The current leaf item will not necessarily be viewable.

DepthFirst

```
ZafTreeItem *DepthFirst(void);
```

DepthFirst() returns the first ZafTreeItem object in the current sub-tree, which is always this ZafTreeItem object. This function may be used together with ZafTreeItem::DepthNext() to perform a depth traversal of the entire hierarchy of the sub-tree (beginning with this ZafTreeItem object). This traversal will find every ZafTreeItem in the sub-tree, whether in an expanded branch or not. This is a depth traversal, as opposed to a depth-first traversal. See ZafTreeList::DepthFirst() for more information. The following code shows how to do this traversal:

```
// Traverse every item of the entire sub-tree hierarchy.
for (ZafTreeItem *item = this; item; item = item->DepthNext())
  if (item == matchItem)
    break;
```

For the following sub-tree, the traversal would find the nodes in this order: A, A1, A2.

```
A
  |__A1
  |__A2
```

DepthLast

`ZafTreeItem *`**`DepthLast`**`(void);`

DepthLast() returns the last leaf ZafTreeItem object in the sub-tree, traversing down the last branch of the sub-tree hierarchy. The last leaf item will not necessarily be visible. This function may be used together with ZafTreeItem::DepthPrevious() to perform a reverse depth traversal of the entire hierarchy of the sub-tree. This traversal will find every ZafTreeItem in the sub-tree, whether in an expanded branch or not. This is a depth traversal, as opposed to a depth-first traversal. See DepthFirst() for example code.

DepthNext

`ZafTreeItem *`**`DepthNext`**`(void);`

DepthNext() returns the next item in a depth traversal of the sub-tree. See DepthFirst() for more information.

DepthPrevious

`ZafTreeItem *`**`DepthPrevious`**`(void);`

DepthPrevious() returns the previous item in a depth traversal of the sub-tree. See DepthFirst() and DepthLast() for more information.

Expandable

`bool `**`Expandable`**`(void) const;`
`virtual bool `**`SetExpandable`**`(bool expandable);`

An Expandable() ZafTreeItem object is considered a sub-tree of the parent ZafTreeList object and may have ZafTreeItem objects within itself. The end user will not be able to access sub-items unless the parent item is Expandable(). Expandable() is false by default.

Expanded

`bool `**`Expanded`**`(void) const;`
`virtual bool `**`SetExpanded`**`(bool expanded);`

ToggleExpanded

`virtual bool `**`ToggleExpanded`**`(void);`

The children of an Expanded() ZafTreeItem object are viewable. If Expanded() is false, the ZafTreeItem object is collapsed, and its children are not visible to the end user. This attribute is false by default, but the end user may modify it at any time, and SetExpanded() may be called to change it.

ToggleExpanded() will toggle the value of this attribute, collapsing an Expanded() ZafTreeItem object, and expanding a collapsed ZafTreeItem object.

NormalBitmap
SelectedBitmap

```
ZafBitmapData *NormalBitmap(void) const;
ZafBitmapData *SelectedBitmap(void) const;
virtual ZafError SetNormalBitmap(ZafBitmapData
   *normalBitmap);
virtual ZafError SetSelectedBitmap(ZafBitmapData
   *selectedBitmap);
```

The NormalBitmap() and SelectedBitmap() objects point to the actual bitmap data. NormalBitmap() is the bitmap displayed by the ZafTreeItem object in its normal (non-selected) state, and SelectedBitmap() is the bitmap displayed by the ZafTreeItem object in its selected state.

The NormalBitmap() and SelectedBitmap() objects may be shared among several ZafTreeItem objects (to save memory, for example), or they may belong to a single ZafTreeItem object. If shared among several ZafTreeItem objects, all the associated ZafTreeItem objects will be updated when the NormalBitmap() or SelectedBitmap() objects change. For more information on data sharing in ZAF, see ZafDataManager. SetNormalBitmap() will delete the previous NormalBitmap() object if it is Destroyable() and no other object uses it. SetSelectedBitmap() will delete the previous SelectedBitmap() object if it is Destroyable() and no other object uses it.

The return value for SetNormalBitmap() and SetSelectedBitmap() is normally ZAF_ERROR_NONE.

```
// Set the bitmaps on a tree item if not already present.
extern ZafBitmapData *normalBitmap, *selectedBitmap;
if (!item->NormalBitmap())
  item->SetNormalBitmap(normalBitmap);
if (!item->SelectedBitmap())
  item->SetSelectedBitmap(selectedBitmap);
```

SetSelectionType

```
virtual ZafSelectionType
   SetSelectionType(ZafSelectionType selectionType);
```

This overloaded function is provided so that the entire hierarchy of ZafTreeItem objects will reflect the SelectionType() of the ZafTreeList object. The programmer should normally not call this function at this level, but at the ZafTreeList level. See ZafTreeList::SelectionType() for complete information.

StringData

```
ZafStringData *StringData(void) const;
virtual ZafError SetStringData(ZafStringData
   *stringData);
```

ZafTreeItems contain ZafStringData objects where their text is stored. The StringData() object may be shared among several ZafTreeItem objects (to save memory, for example), or it may belong to a single ZafTreeItem object. If shared, all the associated ZafTreeItem objects will be updated when the StringData() object changes. For more information on data sharing in ZAF, see ZafDataManager. SetStringData() will delete the previous StringData() object if it is Destroyable() and no other object uses it.

The return value for SetStringData() is normally ZAF_ERROR_NONE.

Refer to Set*Bitmap() for more information.

Text

```
virtual const ZafIChar *Text(void);
virtual ZafError SetText(const ZafIChar *text);
```

The textual data of a ZafTreeItem object may be returned or set with Text() and SetText(). These functions provide simple accessibility to the StringData() of a ZafTreeItem object, and may be used if the programmer does not wish to interact with the data portion of the object.

ToggleExpanded

```
virtual bool ToggleExpanded(void);
```

See Expanded().

TreeList

```
ZafTreeList *TreeList(void) const;
```

TreeList() returns a pointer to this ZafTreeItem object's parent ZafTreeList object. It returns null if this ZafTreeItem is not yet attached (directly or indirectly) to a ZafTreeList object.

ViewCurrent

```
ZafTreeItem *ViewCurrent(void);
```

The ViewCurrent() item in the sub-tree is the current item for the entire hierarchy of the sub-tree, beginning with this ZafTreeItem object.

ViewFirst

```
ZafTreeItem *ViewFirst(void);
```

ViewFirst() returns a pointer to the first viewable item in the sub-tree, beginning with this ZafTreeItem object, which is always this ZafTreeItem object. In the context of ZafTreeItem, a viewable item may be seen by the end user by scrolling through the list without expanding any additional ZafTreeItem objects. The following code shows how to search through the viewable items in the sub-tree:

```
// Find a visible item in the sub-tree.
for (ZafTreeItem *item = ViewFirst(); item; item = item->
    ViewNext())
  if (item->NumberID() == matchID)
    break;
```

ViewLast

`ZafTreeItem *`**`ViewLast`**`(void);`

ViewLast() returns a pointer to the last viewable item in the sub-tree, beginning with this ZafTreeItem object. If this ZafTreeItem object is not Expanded(), or if there are not ZafTreeItem objects within this ZafTreeItem object, this ZafTreeItem object is returned. In the context of ZafTreeItem, a viewable item may be seen by the end user by scrolling through the list without expanding any additional ZafTreeItem objects. See ViewFirst() for example code.

ViewLevel

`int `**`ViewLevel`**`(void);`

ViewLevel() returns the zero-based level at which the ZafTreeItem object is found. ZafTreeItem objects that are direct children of the parent ZafTreeList object are considered to be at level 0, and their children are at level 1, etc. ViewLevel() is used internally by the ZAF libraries for properly indenting ZafTreeItem objects within the parent ZafTreeList object.

ViewNext

`ZafTreeItem *`**`ViewNext`**`(void);`

ViewNext() returns the next viewable item in the sub-tree, beginning with this ZafTreeItem object. See ViewFirst() for more information.

ViewPrevious

`ZafTreeItem *`**`ViewPrevious`**`(void);`

ViewPrevious() returns the previous viewable item in the sub-tree, beginning with this ZafTreeItem object. See ViewFirst() for more information.

ZafTreeList

AddDepthItem	DrawLines	ViewCurrent
AutoSortData	SelectionType	ViewFirst
DepthCurrent	SetBackgroundColor	ViewLast
DepthFirst	SetTextColor	
DepthLast	ViewCount	

Inheritance `ZafTreeList : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_tree.hpp>`

Description ZafTreeList is a scrollable hierarchical list object that intuitively presents a “tree” of list items. Each object contained in a ZafTreeList may or may not contain other objects. Objects that contain children may be expanded and collapsed to expose or hide contents. Since the ZafTreeList and ZafTreeItem classes were specially designed to work together, only ZafTreeItem objects may be added to a ZafTreeList. The ZafTreeList class utilizes the native OS tree list API if available, or is closely modeled after popular tree controls on each platform.

Constructors All ZafTreeList constructors allocate memory for an object instance and initialize member variables. The default values set by the ZafTreeList and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafTreeList. “†” Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafTreeList

`AutoSortData()`	`false`
`DrawLines()`	`true`

ZafWindow

`Destroyable()`	`false`†
`Locked()`	`false`†
`Maximized()`	`false`†
`Minimized()`	`false`†
`Modal()`	`false`†
`Moveable()`	`false`†
`NormalHotKeys()`	`false`†
`Sizeable()`	`false`†

Member Initializations

`Temporary()`	`false`†
ZafWindowObject	
`Bordered()`	`true`
ZafElement	
`ClassID()`	`ID_ZAF_TREE_LIST`
`ClassName()`	`"ZafTreeList"`

`ZafTreeList``(int left, int top, int width, int height);`

This constructor is useful in straight-code situations. *left* and *top* specify the position where the left and top of the object will be placed on its parent, while *width* and *height* specify the width and height of the object.

All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. See ZafWindowObject::SetCoordinateType() for more information.

`ZafTreeList``(const ZafTreeList &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It allocates a new ZafTreeList object and initializes its data from *copy*.

`ZafTreeList``(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafTreeList creation techniques:

```
// Create a sample window with a tree list
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);

// Create the tree list object
extern ZafBitmapData *nBitmap, *sBitmap;
ZafTreeList *tree = new ZafTreeList(1, 1, 20, 5);

// Create children and add to the tree list
```

```
ZafTreeItem *item1 = new ZafTreeItem(nBitmap, sBitmap, "Item
    1");
item1->SetExpandable(true);
item1->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 1.1"));
item1->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 1.2"));
item1->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 1.3"));
tree->Add(item1);
ZafTreeItem *item2 = new ZafTreeItem(nBitmap, sBitmap, "Item
    2");
item2->SetExpandable(true);
item2->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 2.1"));
item2->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 2.2"));
item2->Add(new ZafTreeItem(nBitmap, sBitmap, "Item 2.3"));
tree->Add(item2);

// Add a vertical scroll bar to the tree list.
tree->Add(new ZafScrollBar(0, 0, 0, 0));

// Add the list to the window.
window1->Add(tree);
```

Destructor

`virtual ~`**`ZafTreeList`**`(void);`

The destructor is used to free the memory associated with a ZafTreeList object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

All ZafTreeItem children of a ZafTreeList are automatically destroyed when the ZafTreeList is destroyed.

Generally, the programmer will not directly destroy a ZafTreeList since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

AddDepthItem

`ZafWindowObject *`**`AddDepthItem`**`(const ZafIChar *pathName,`
`    ZafWindowObject *object);`

AddDepthItem() adds the ZafTreeItem *object* to the ZafTreeList hierarchy, using *pathName* as the parent. *pathName* is specified by stringIDs separated by the tilde ('~') character, starting with the stringID of the ZafTreeList object as the root and ending with the ZafTreeItem that will contain the new object (if any). AddDepthItem() returns a pointer to the item added, if successful, otherwise it returns null.

```
// Add Item 1.4 to the tree. "TreeList" is the StringID()
// of the tree, and "Item1" is the StringID() of the tree
// item that will contain the newly added object.
ZafTreeItem *newItem = new ZafTreeItem(normalBitmap,
    selectedBitmap, "Item 1.4");
tree->AddDepthItem("TreeList~Item1", newItem);
```

AutoSortData

`bool` **`AutoSortData`**`(void) const;`
`virtual bool` **`SetAutoSortData`**`(bool autoSortData);`

If AutoSortData() is set to true, the tree list will automatically sort its children as they are added to the list. AutoSortData() affects the entire hierarchy of tree items, therefore each sub-tree will be independently sorted. AutoSortData() defaults to false.

The function returned by CompareFunction() is used to sort the children. By default, sorting is done in alphabetical order, but SetCompareFunction() may be called to provide a custom sorting function. See ZafList::CompareFunction() for more information about sorting list children.

DepthCurrent

`ZafTreeItem *`**`DepthCurrent`**`(void);`

DepthCurrent() returns the current leaf ZafTreeItem object in the current branch of the hierarchy. The current leaf item is the item in the tree list that has focus when the tree list has focus and all its ancestors (higher level or enclosing tree items) are expanded. The current leaf item will not necessarily be viewable, meaning that not all its ancestors may be expanded.

DepthFirst

`ZafTreeItem *`**`DepthFirst`**`(void);`

DepthFirst() returns the first top-level ZafTreeItem object in the tree. If there are no tree items, null is returned. This function may be used together with ZafTreeItem::DepthNext() to perform a depth traversal of the entire hierarchy of the tree list. This traversal will find every ZafTreeItem in the list, whether in an expanded branch or not. This is a depth traversal, as opposed to a depth-first traversal. The following code shows how to do this traversal:

```
// Traverse all the tree items in the entire hierarchy.
for (ZafTreeItem *item = treeList->DepthFirst(); item; item =
    item->DepthNext())
  if (item == matchItem)
```

```
   break;
```

For the following tree, the traversal would find the nodes in this order: A, A1, A2, B, B1, B2.

```
A
  |__A1
  |__A2
B
  |__B1
  |__B2
```

DepthLast

`ZafTreeItem *`**`DepthLast`**`(void);`

DepthLast() returns the last leaf ZafTreeItem object in the last branch of the hierarchy. If there are no tree items, null is returned. The last leaf item will not necessarily be viewable, since it may be in a non-expanded branch. This function may be used together with ZafTreeItem::DepthPrevious() to perform a reverse depth traversal of the entire hierarchy of the tree list. This traversal will find every ZafTreeItem in the list, whether in an expanded branch or not. This is a depth traversal, as opposed to a depth-first traversal. See DepthFirst() for sample code. See also ZafTreeItem::DepthNext().

DrawLines

`bool `**`DrawLines`**`(void) const;`
`virtual bool `**`SetDrawLines`**`(bool drawLines);`

If DrawLines() is true, the tree list will automatically display lines between the bitmaps of its children. These lines help to visually define the hierarchical nature of the list and may differ slightly between environments as appropriate. DrawLines() is set true by default.

SelectionType

`ZafSelectionType `**`SelectionType`**`(void) const;`
`virtual ZafSelectionType`
`   `**`SetSelectionType`**`(ZafSelectionType selectionType);`

ZafTreeLists may allow different types of selection behavior. SetSelectionType() allows this behavior to be changed from the single-selection default. Valid values are listed.

SelectionType()	**Description**
ZAF_SINGLE_SELECTION	Allows only one ZafTreeItem to be selected. If another item is selected any previously selected item is deselected.

SelectionType()	**Description**
ZAF_MULTIPLE_SELECTION	Allows multiple ZafTreeItems to be selected. “Selection actions,” including mouse clicks, cause the selection state of an item to be toggled. The state of other tree items is unchanged.
ZAF_EXTENDED_SELECTION	Allows multiple ZafTreeItems to be selected, and does this using native multiple- and extended-selection techniques. For example, a single click might act as single-select, shift-click might select a range of items, and ctrl-click might act as multiple-select.

SetBackground-Color

```
virtual ZafLogicalColor
   SetBackgroundColor(ZafLogicalColor color,
   ZafLogicalColor mono = ZAF_MONO_NULL);
```

SetBackgroundColor() specifies the background color of the ZafTreeList and the background color of all ZafTreeItems. The default color is obtained from ZafWindow.

SetTextColor

```
virtual ZafLogicalColor SetTextColor(ZafLogicalColor
   color, ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of tree list children, this overloaded function provides functionality for setting the text color for the entire tree list hierarchy.

ViewCount

```
int ViewCount(void);
```

ViewCount() returns the number of tree items that may be seen by scrolling through the list. These include top-level children of the tree list as well as viewable items in expanded branches. Internally, ZAF uses ViewCount() when calculating scroll bar values.

ViewCurrent

```
ZafTreeItem *ViewCurrent(void);
ZafTreeItem *SetViewCurrent(ZafTreeItem *item);
```

The ViewCurrent() item is the current viewable ZafTreeItem (none of its ancestor tree items is not expanded) in the current branch of the tree list. The ViewCurrent() item has focus when the tree list has focus. ZafTreeList objects call SetViewCurrent() internally, and the programmer should normally not call SetViewCurrent().

ViewFirst

```
ZafTreeItem *ViewFirst(void);
```

ViewFirst() returns a pointer to the first viewable item in the tree list, which is always the first top-level child of the tree list. If there are no items in the tree list, null is returned. In the context of ZafTreeList, the "viewable" items may be seen by scrolling through the list without expanding any additional ZafTreeItem objects. The following code shows how to search through the viewable items in the ZafTreeList object:

```
// Find an item in the tree.
for (ZafTreeItem *item = ViewFirst(); item; item = item->
    ViewNext())
  if (item->NumberID() == matchID)
    break;
```

ViewLast

```
ZafTreeItem *ViewLast(void);
```

ViewLast() returns a pointer to the last viewable item in the tree list. If there are no items in the tree list, null is returned. See ViewFirst() for more information. See also ZafTreeItem::ViewNext().

ZafUTime

Event	UTimeData

Inheritance `ZafUTime : ZafString : ZafWindowObject : ZafElement`

Declaration `#include <z_utime1.hpp>`

Description

ZafUTime is a single-line date and time object that allows user input through the keyboard. ZafUTime is fully internationalized to display and input using any format.

All ZafUTime objects refer to data contained in a ZafUTimeData object (refer to this class for additional essential information). ZafUTime includes "year 2000 compliance," meaning that through the underlying ZafUTimeData object, a ZafUTime object keeps track of the exact year, rather than just the last two digits.

Formats

ZafString and derived classes parse input and display output based on default or programmer-defined input and output formats. Programmers may use the SetInputFormat() and SetOutputFormat() families of functions to change the default format. The functions are documented in the ZafString reference.

Each class derived from ZafFormatData handles a different set of formatting arguments, in addition to those supported by its base classes. ZafUTimeData (and therefore ZafUTime) handles the following arguments:

Format Argument	Substitution
%%	'%' character
%a	Locale-specific abbreviated weekday name
%A	Locale-specific full weekday name
%b	Locale-specific abbreviated month name
%B	Locale-specific full month name
%c	Locale-specific date and time representation
%C	Century number (the year divided by 100 and truncated to an integer) as a decimal number [00-99]
%d	Day of month as a decimal number [01, 31]
%D	Same as %m/%d/%Y
%e	Day of the month as a decimal number [1, 31]; a single digit is preceded by a space

Format Argument	Substitution
%EC	Number of the base year (period) in the locale's alternative representation
%Ey	The offset from %EC (year only) in the locale's alternative representation
%EY	The full alternative year representation
%g	Month as an abbreviated month name
%G	Day as an abbreviated day name
%h	Same as %H
%H	Hour (24-hour clock) as a decimal number [00, 23]
%i	Same as %I; may be one or two digits
%I	Hour (12-hour clock) as a decimal number [01, 12]
%j	Day of the year as a decimal number [01, 366]
%J	Seconds in tenths (.1)
%k	Seconds in hundredths (.01)
%K	Seconds in thousandths (.001)
%m	Month as a decimal number [01, 12]
%M	Minute as a decimal number [00, 59]
%p	Locale equivalent of either a.m. or p.m.
%r	Time in a.m. or p.m. notation; in the POSIX locale this is equivalent to: %I:%M:%S %p
%R	Time in 24-hour notation (%H:%M)
%s	Same as %@; may be one or two digits
%S	Seconds as a decimal number [00, 59]
%T	Time (%H:%M:%S)
%u	Weekday as a decimal number [1, 7], with 1 representing Monday
%U	Week number of the year (Sunday as the first day of the week) as a decimal number [00, 53]
%v	Month number as a decimal [1, 12]
%V	Week number of the year (Monday as the first day of the week) as a decimal number [01, 53]; if the week containing 1 January has four or more days in the new year then it is considered week 1; otherwise, it is week 53 of the previous year, and the next week is week 1
%w	Replaced by the weekday as a decimal number [0, 6], with 0 representing Sunday

Format Argument	Substitution
%W	Week number of the year (Monday as the first day of the week) as a decimal number [00, 53]; all days in a new year preceding the first Sunday are considered to be in week 0
%x	Locale-specific date representation
%X	Locale-specific time representation
%y	Year without century as a decimal number [00, 99]
%Y	Year with century as a decimal number
%Z	Timezone name or abbreviation

Constructors

All ZafUTime constructors initialize the member variables associated with an instantiated ZafUTime object. The default values set by the ZafUTime and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafUTime. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafUTime	
`UTimeData()`	`null`
ZafString	
`LowerCase()`	`false`†
`Password()`	`false`†
`StringData()`	`null`†
`UpperCase()`	`false`†
`VariableName()`	`false`†
ZafElement	
`ClassID()`	`ID_ZAF_UTIME`
`ClassName()`	`"ZafUTime"`

```
ZafUTime(int left, int top, int width, int year, int
   month, int day, int hour, int minute, int second, int
   milliSecond = 0);
```

This constructor is useful in straight-code situations, particularly if the ZafUTime object is to create, maintain and destroy its own ZafUTimeData object automatically. *left*, *top*, and *width* specify the position and size of the object on its parent. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. *year*, *month*, *day*, *hour*, *minute*, *second*, and *milliSecond* specify the date and time values that initially appear in the new ZafUTime object.

```
ZafUTime(int left, int top, int width, ZafUTimeData
    *utimeData = ZAF_NULLP(ZafUTimeData));
```

This constructor is useful in straight-code situations where a ZafUTimeData object has already been created. This constructor could be used when manually maintaining a ZafUTimeData object, rather than having the ZafUTime class create and maintain the data object automatically. For more information on using ZafUTimeData objects, see ZafUTimeData. See the previous constructor for a description of *left*, *top*, and *width* parameters.

```
ZafUTime(const ZafUTime &copy);
```

The copy constructor calls the overloaded Duplicate() to create a new ZafUTime object and initialize its data from *copy*. If the original data objects are StaticData() then the new ZafUTime object simply points to the original data, otherwise StaticData() copies are made.

```
ZafUTime(const ZafIChar *name, ZafObjectPersistence
    &persist);
```

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafUTime creation techniques follow:

```
// Create a sample window with utime objects.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Create utime objects and pass in the values directly.
window1->Add(new ZafUTime(0, 1, 25, 1984, 1, 22, 8, 0, 0));
window1->Add(new ZafUTime(0, 2, 25, 1999, 12, 31, 23, 59, 59));
...
// Create a sample window with utime objects.
ZafWindow *window2 = new ZafWindow(10, 10, 40, 10);
// Create utime data objects.
ZafUTimeData *utimeData1 = new ZafUTimeData(1984, 1, 22, 8, 0,
    0);
ZafUTimeData *utimeData2 = new ZafUTimeData(1999, 12, 31, 23,
    59, 59);
// Create utimes that use the data previously created.
window2->Add(new ZafUTime(0, 1, 25, utimeData1));
window2->Add(new ZafUTime(0, 2, 25, utimeData2));
```

Destructor

```
virtual ~ZafUTime(void);
```

The destructor is used to free the memory associated with a ZafUTime object, including all data object pieces that are Destroyable(). It chains to the ZafString, ZafWindowObject, and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafUTime object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Event

```
virtual ZafEventType Event(const ZafEventStruct &event);
```

This overloaded function receives all events that get sent to the ZafUTime object and either handles them or passes them to ZafString, its immediate base class. See ZafWindowObject for more information.

ZafUTime specifically handles the following events:

Event	Description
N_RESET_I18N	Causes the object to redisplay its data according to the new internationalization values (as a result of calling ZafI18nData::ResetI18n())
S_COPY_DATA	Causes the object to copy into its existing UTimeData() object event.windowObject's UTimeData(), but only if event.windowObject is a ZafUTime object
S_SET_DATA	Causes the object to create for itself a new UTimeData() object, then copy into it event.windowObject's UTime-Data(), but only if event.windowObject is a ZafUTime object

UTimeData

```
ZafUTimeData *UTimeData(void) const;
virtual ZafError SetUTimeData(ZafUTimeData *utime);
```

*UTimeData() contains the actual information used by ZafUTime. The UTimeData() object may be used by one or more ZafUTime objects, or other objects. If shared, all associated ZafUTime objects will be notified when the UTimeData() changes. For more information on data sharing in ZAF, see ZafDataManager. SetUTimeData() will delete the previous UTimeData() object if it is Destroyable() and no other object uses it.

UTimeData() returns a pointer to the UTimeData() object associated with the ZafUTime object. The return value for SetUTimeData() is normally ZAF_ERROR_NONE. See the Constructors code snippet for an example using ZafUTimeData objects with ZafUTime.

ZafUTimeData

BasisYear	Minute	operator --
Clear	Month	operator =
Day	MonthName	operator +=
DayName	Second	operator -=
DayOfWeek	SetUTime	operator <
DaysInMonth	TimeName	operator <=
DaysInYear	Value	operator >
FormattedText	Year	operator >=
Hour	ZoneOffset	operator ==
LeapYear	operator +	operator !=
long	operator ++	
MilliSecond	operator -	

Inheritance

```
ZafUTimeData : ZafFormatData : ZafData : ZafElement,
   ZafNotification
```

Declaration

```
#include <z_utime.hpp>
```

Description

ZafUTimeData combines date and time encapsulation with data notification and object notification from ZafData. It is most often used in conjunction with the ZafUTime user interface object but may be used as a stand-alone object if desired. ZafUTimeData serves as the base class for the ZafDateData and ZafTimeData classes.

All ZafData objects may make use of printf-style formatting and parsing arguments during string operations. All ZafUTimeData objects may make use of strftime- and strptime-style formatting and parsing arguments during string operations. In addition to printf arguments normally used by string data types, ZafUTimeData adds additional custom arguments (conversion characters) to those normally available to the printf family of functions:

Format conversion char	Description
"U"	Formats the printf() argument as an utime.
Parse conversion char	
"U"	Parses a scanf() stream component as an utime and stores the value in the supplied utime argument.

Refer to standard library documentation for detailed information on printf, strftime, and strptime functions as well as their corresponding conversion characters.

Constructors

ZafUTimeData constructors initialize the member variables associated with a new ZafUTimeData object and allocate space to hold the date and time data.

The default values set by ZafUTimeData follow, if they are overridden from those set by base class constructors:

Member Initializations

ZafUTimeData	
`BasisYear()`	`ZAF_BASIS_YEAR (in z_utime.hpp)`
`Day()`	`(varies by constructor)`
`DayName()`	`(varies by constructor)`
`DayOfWeek()`	`(varies by constructor)`
`DaysInMonth()`	`(varies by constructor)`
`DaysInYear()`	`(varies by constructor)`
`Hour()`	`(varies by constructor)`
`LeapYear()`	`(varies by constructor)`
`MilliSecond()`	`(varies by constructor)`
`Minute()`	`(varies by constructor)`
`Month()`	`(varies by constructor)`
`MonthName()`	`(varies by constructor)`
`Second()`	`(varies by constructor)`
`TimeName()`	`(varies by constructor)`
`Value()`	`(varies by constructor)`
`Year()`	`(varies by constructor)`
`ZoneOffset()`	`(varies by constructor)`
ZafElement	
`ClassID()`	`ID_ZAF_UTIME_DATA`
`ClassName()`	`"ZafUTimeData"`

`ZafUTimeData``(void);`

The basic constructor allocates a ZafUTimeData instance and initializes its value to the current system date and time.

`ZafUTimeData``(ZafUInt32 seconds);`

This constructor allocates a ZafUTimeData instance and initializes its contents to *seconds*. The data is converted to an offset based on the number of seconds elapsed since the year 1970 and stored in an internal buffer.

ZafUTimeData`(int year, int month, int day, int hour, int minute, int second, int milliSecond);`

This constructor allocates a ZafUTimeData instance and initializes its contents to the date and time values corresponding to *year*, *month*, *day*, *hour*, *minute*, *second* and *milliSecond*. The *hour* value is assumed to be in 24-hour format (i.e., 22 means 10 p.m.).

ZafUTimeData`(const ZafIChar *string, const ZafIChar *format = ZAF_NULLP(ZafIChar));`

This constructor allocates a ZafUTimeData instance and initializes its contents to the date and time equivalent of *string*. The conversion uses the strptime-style specifier *format* to interpret the string. If *format* is null ZafUTimeData uses its locale-specific default format.

ZafUTimeData`(const ZafUTimeData &copy);`

This constructor is the copy constructor. It allocates a new ZafUTimeData instance and copies all member data from copy.

ZafUTimeData`(const ZafIChar *name, ZafDataPersistence &persist);`

This constructor is the persistent constructor. It allocates a new ZafUTimeData instance and reads most member data from the *name* directory of the persistent data file referred to by *persist*. The StringID() of the new data is name.

```
// Sample ZafUTimeData creation techniques.
ZafUTimeData uTime1(1997, 3, 20, 10, 25);
ZafUTimeData copyUTime = uTime1;
ZafUTimeData uTime2("1997 2 14 14 25", "%y %m %d %H %M");
ZafUTimeData systemUTime;
```

Destructor

`virtual ~`**ZafUTimeData**`(void);`

The destructor is used to free the memory associated with an instantiated ZafUTimeData object. Unless StaticData() is true a ZafUTimeData object is usually destroyed automatically when all ZafUTime objects that refer to it are destroyed.

Members

BasisYear

```
int BasisYear(void) const;
virtual ZafError SetBasisYear(int basisYear);
```

BasisYear() returns the basis year value of the ZafUTimeData object. By default, the basis year is set to ZAF_BASIS_YEAR, defined in z_utime.hpp. ZAF_BASIS_YEAR is set to 1950 in the shipping ZAF header file, but may be modified by the programmer before rebuilding the libraries for the new value to take effect. SetBasisYear() sets the basis year used by the ZafUTimeData object to interpret 2-digit year values.

Clear

```
virtual void Clear(void);
```

Clear() sets the value of the ZafUTimeData object to the current system date and time.

Day

```
int Day(void) const;
```

Day() returns the day-of-year value (1..366) for the ZafUTimeData object.

DayName

```
static ZafIChar ZAF_FARDATA *DayName(void);
```

DayName() returns the name string of the day of the week (e.g., Tuesday) for the ZafUTimeData object. This name string will be the language-specific string set up by the application's language initialization.

DayOfWeek

```
int DayOfWeek(void) const;
```

DayOfWeek() returns the numerical value of the day of the week (Sunday = 1, Monday = 2, ... Saturday = 7) for the ZafUTimeData object.

DaysInMonth

```
int DaysInMonth(int month = 0) const;
```

DaysInMonth() returns the number of days in the month corresponding to *month*. If *month* is missing, the number of days in the month represented by the ZafUTimeData object is returned.

DaysInYear

```
int DaysInYear(void) const;
```

DaysInYear() returns the number of days in the year represented by the ZafUTimeData object.

FormattedText

```
virtual int FormattedText(ZafIChar *buffer, int
   maxLength, const ZafIChar *format = 0) const;
```

FormattedText() fills *buffer* with a string representation of the ZafUTImeData using the strftime-style specifier *format* to build the string. A locale-specific default format is used if *format* is not included. Buffer contents will be truncated if they exceed *maxLength* characters. FormattedText() returns the integer value it receives from its call to strftime().

Hour

```
int Hour(void) const;
```

Hour() returns the hour value (0..23) of the ZafUTimeData object.

LeapYear

```
bool LeapYear(void) const;
```

LeapYear() returns true if the current year value of the ZafUTimeData object is a leap year. Otherwise, this function returns false.

long

```
operator long();
```

See Value().

MilliSecond

```
int MilliSecond(void) const;
```

MilliSecond() returns the time value, in milliseconds (0..999), of the ZafUTimeData object.

Minute

```
int Minute(void) const;
```

Minute() returns the time value, in minutes (0..59), of the ZafUTimeData object.

Month

```
int Month(void) const;
```

Month() returns the numerical month value (January = 1, February = 2, ... December = 12) of the ZafUTimeData object.

MonthName

```
static ZafIChar ZAF_FARDATA *MonthName(void);
```

MonthName() returns the name string for the month value of the ZafUTimeData object. This name string will be the language-specific string set up by the application's language initialization.

Second

```
int Second(void) const;
```

Second() returns the time value, in seconds (0..59), of the ZafUTimeData object.

TimeName

```
static ZafIChar ZAF_FARDATA *TimeName(void);
```

TimeName() returns the name string (e.g., a.m.) for the time value of a ZafUTimeData object. This name string will be the language-specific string set up by the application's language initialization.

SetUTime

```
virtual ZafError SetUTime(ZafUInt32 seconds);
virtual ZafError SetUTime(int year, int month, int day,
    int hour, int minute, int second, int milliSecond);
virtual ZafError SetUTime(const ZafIChar *buffer, const
    ZafIChar *format);
virtual ZafError SetUTime(const ZafUTimeData &number);
```

SetUTime() functions set the value of the ZafUTimeData object from numeric input, another utime, or an interpreted string. Refer to FormattedText() for more information on utime/string conversions.

Value
long

```
long Value(void) const;
operator long();
```

Value() returns the difference in time, measured in hundredths of seconds, between the ZafUTimeData object's value and the year 1900. The convenience operator long(), which returns Value(), is more commonly used.

Year

```
int Year(void) const;
```

Year() returns the year value of the ZafUTimeData object.

ZoneOffset

```
int ZoneOffset(void) const;
virtual ZafError SetZoneOffset(int zoneOffset);
```

ZoneOffset() returns the timezone offset used by the ZafUTimeData object to interpret time values. SetZoneOffset() sets the timezone offset used by the ZafUTimeData object to interpret time values.

operator -

```
ZafUTimeData operator-(const ZafUTimeData &utime);
ZafUTimeData operator-(long seconds);
```

These operators allow simple subtraction operations involving ZafUTimeData objects and longs.

operator --

```
ZafUTimeData operator--(void);
ZafUTimeData operator--(int);
```

These pre- and post-operators decrement the ZafUTimeData object's date and time values by 1.

operator +

```
ZafUTimeData operator+(const ZafUTimeData &utime2);
ZafUTimeData operator+(long seconds);
```

These operators allow simple addition operations involving ZafUTimeData objects and longs.

operator ++

```
ZafUTimeData operator++(void);
ZafUTimeData operator++(int);
```

These pre- and post-operators increment the ZafUTimeData object's date and time values by 1.

operator =

```
ZafUTimeData &operator=(const ZafUTimeData &utime);
ZafUTimeData &operator=(long seconds);
```

These operators assign the ZafUTimeData object's value to the input value which may be a long or another ZafUTimeData.

operator -=

```
ZafUTimeData &operator-=(const ZafUTimeData &utime);
ZafUTimeData &operator-=(long seconds);
```

These operators decrement the ZafUTimeData object's value by the input value.

operator +=

```
ZafUTimeData &operator+=(const ZafUTimeData &utime);
ZafUTimeData &operator+=(long seconds);
```

These operators increment the ZafUTimeData object's value by the input *value*.

operator <

`bool **operator<**(const ZafUTimeData &utime2);`

This operator returns true if *utime2* is earlier than this ZafUTimeData object.

operator <=

`bool **operator<=**(const ZafUTimeData &utime2);`

This operator returns true if *utime2* is earlier than or the same as this ZafUTimeData object.

operator >

`bool **operator>**(const ZafUTimeData &utime2);`

This operator returns true if *utime2* is later than this ZafUTimeData object.

operator >=

`bool **operator>=**(const ZafUTimeData &utime2);`

This operator returns true if *utime2* is later than or the same as this ZafUTimeData object.

operator ==

`bool **operator==**(const ZafUTimeData &utime2);`

This operator returns true if *utime2* is the same as this ZafUTimeData object.

operator !=

`bool **operator!=**(const ZafUTimeData &utime2);`

This operator returns true if *utime2* is not the same as this ZafUTimeData object.

ZafVtList

AutoSortData	SetBackgroundColor	SetTextColor
SelectionType	SetFont	

Inheritance

`ZafVtList : ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration

```
#include <z_vlist.hpp>
```

Description

The ZafVtList object is a single-column list object that arranges list items vertically. A ZafVtList object may have a vertical scroll bar associated with it. Like ZafHzList it supports single, multiple and extended selection methods, and list children may not be Noncurrent().

Constructors

All ZafVtList constructors initialize the member variables associated with an instantiated ZafVtList object. The default values set by the ZafVtList and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafVtList. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafVtList	
AutoSortData()	false
ZafWindow	
Destroyable()	false†
Locked()	false†
Maximized()	false†
Minimized()	false†
Modal()	false†
Moveable()	false†
NormalHotKeys()	false†
Sizeable()	false†
ZafWindowObject	
Bordered()	true
ZafElement	
ClassID()	ID_ZAF_VT_LIST
ClassName()	"ZafVtList"

ZafVtList`(int left, int top, int width, int height);`

This constructor is useful in straight-code situations. *left* and *top* specify the position where the left and top of the object will be placed on its parent. *width* and *height* specify the width and height of the object. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired.

ZafVtList`(const ZafVtList &copy);`

The copy constructor is used in conjunction with the overloaded Duplicate() function. It accepts another ZafVtList object and copies the object's information.

ZafVtList`(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. Refer to ZafWindow for more information, since most persistence is done at the ZafWindow level.

Sample ZafVtList creation techniques follow:

```
// Create a sample window with a vertical list of strings.
ZafWindow *window1 = new ZafWindow(0, 0, 50, 10);
// Create the vertical list object.
ZafVtList *vList1 = new ZafVtList(1, 1, 20, 5);
// Add a scroll bar and the strings to the vertical list.
vList1->Add(new ZafScrollBar(0, 0, 0, 0));
vList1->Add(new ZafString(0, 0, 20, "String 1", -1));
vList1->Add(new ZafString(0, 0, 20, "String 2", -1));
vList1->Add(new ZafString(0, 0, 20, "String 3", -1));
vList1->Add(new ZafString(0, 0, 20, "String 4", -1));
vList1->Add(new ZafString(0, 0, 20, "String 5", -1));
vList1->Add(new ZafString(0, 0, 20, "String 6", -1));
// Add the list to the window.
window1->Add(vList1);
...
// Create a sample window with a vertical list of buttons.
ZafWindow *window2 = new ZafWindow(10, 10, 50, 10);
// Create the vertical list object and its children.
ZafVtList *vList2 = new ZafVtList(1, 1, 20, 5);
// Allow the list children to draw bitmap information.
vList2->SetOSDraw(false);
extern ZafBitmapData *bitmap1, *bitmap2, *bitmap3, *bitmap4;
vList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap1));
```

```
vList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap2));
vList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap3));
vList2->Add(new ZafButton(0, 0, 20, 1, ZAF_NULLP(ZafIChar),
    bitmap4));
// Add the list to the window.
window2->Add(vList2);
```

Destructor

`virtual ~`**`ZafVtList`**`(void);`

The destructor is used to free the memory associated with a ZafVtList object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors.

Generally, the programmer will not directly destroy a ZafVtList object, since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion, see ZafWindow::~ZafWindow().

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. If the Set*() function does not successfully change the state as requested, however, it will instead return the current state.

AutoSortData

`bool `**`AutoSortData`**`(void) const;`
`virtual bool `**`SetAutoSortData`**`(bool autoSortData);`

If AutoSortData() is true, the list will automatically sort its children as they are added to the list. The function returned by CompareFunction() is used to sort the children. By default, sorting is done in alphabetical order, but SetCompareFunction() may be called to provide a custom sorting function. See ZafList::CompareFunction() for more information about sorting list children. The default value of this attribute is false, but the user may call SetAutoSortData() to change it.

SetBackground-Color

```
virtual ZafLogicalColor
    SetBackgroundColor(ZafLogicalColor color,
    ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of list children, the ZafVtList object sets the ParentPalette() attribute on each of its children (see ZafWindowObject::ParentPalette()). In conjunction with this attribute, this overloaded function provides functionality for setting the background color for all the children in the list.

SelectionType

```
ZafSelectionType SelectionType(void) const;
virtual ZafSelectionType
   SetSelectionType(ZafSelectionType selectionType);
```

ZafVtLists may allow different types of selection behavior. SetSelectionType() allows this behavior to be changed from the single-selection default. Valid values are listed.

SelectionType()	**Description**
`ZAF_SINGLE_SELECTION`	Allows only one item to be selected. If another item is selected any previously selected item is deselected.
`ZAF_MULTIPLE_SELECTION`	Allows multiple items to be selected. “Selection actions,” including mouse clicks, cause the selection state of an item to be toggled. The state of other list items is unchanged.
`ZAF_EXTENDED_SELECTION`	Allows multiple items to be selected, and does this using native multiple- and extended-selection techniques. For example, a single click might act as single-select, shift-click might select a range of items, and ctrl-click might act as multiple-select.

SetFont

```
virtual ZafLogicalFont SetFont(ZafLogicalFont font);
```

To provide consistency in the appearance of list children, the ZafVtList object sets the ParentPalette() attribute on each of its children (see ZafWindowObject::ParentPalette()). In conjunction with this attribute, this overloaded function provides functionality for setting the font for all the children in the list.

SetTextColor

```
virtual ZafLogicalColor SetTextColor(ZafLogicalColor
   color, ZafLogicalColor mono = ZAF_MONO_NULL);
```

To provide consistency in the appearance of list children, the ZafVtList object sets the ParentPalette() attribute on each of its children (see ZafWindowObject::ParentPalette()). In conjunction with this attribute, this overloaded function provides functionality for setting the text color for all the children in the list.

ZafWindow

Add	GeometryManager	Subtract
AddGenericObjects	HorizontalScrollBar	support
AutomaticUpdate	Locked	SupportCurrent
Border	MaximizeButton	SupportDestroy
BroadcastEvent	Maximized	SupportFirst
Changed	MinimizedButton	SupportLast
ClientRegion	Minimized	SystemButton
CompareAscending	MinimizeIcon	SystemButtonMenu
CompareDescending	Modal	Temporary
CornerScrollBar	Movable	Text
DefaultButton	NormalHotKeys	Title
Destroy	Owner	VerticalScrollBar
Destroyable	PullDownMenu	operator +
Event	SelectionType	operator -
FocusObject	Sizeable	operator ()

Inheritance `ZafWindow : (ZafWindowObject : ZafElement), ZafList`

Declaration `#include <z_win.hpp>`

Description ZafWindow defines the basic functionality necessary to display groups of objects on the screen. As with all other ZAF classes, the ZafWindow class utilizes the native window API if available, so the look-and-feel is exactly what the end user expects. In fact, ZAF ties into the native API so closely that system-wide modifications made by the end user are reflected in ZAF windows (such as color and font schemes), unless a user-defined palette has been specified. See ZafWindowObject::UserPaletteData() for more information.

Windows provided by the native environment generally have automatic support for decorations such as borders, title bars, system buttons, minimize buttons, and maximize buttons. These decorations may be added to a ZafWindow object with the following classes: ZafBorder, ZafTitle, ZafSystemButton, ZafMinimizeButton, and ZafMaximizeButton. However, a ZafWindow object with any of these decorations may not be a proper child window (in other words, a non-MDI child window). Only top-level windows added to the ZafWindowManager object may have decorations, with the exception of the ZafMDIWindow class. See ZafMDIWindow for more information.

ZafWindow is a convenient base class for other classes that maintain child objects. Therefore, many of the classes in ZAF such as ZafGroup, ZafTreeList, and ZafVtList derive from ZafWindow. ZAF also provides many variations of window classes based upon ZafWindow, such as ZafDialogWindow, ZafMDIWindow, and ZafScrolledWindow.

Refer to this section of this manual to answer questions regarding the general operation of window classes.

Constructors

All ZafWindow constructors initialize the member variables associated with an instantiated ZafWindow object. The default values set by the ZafWindow and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafWindow. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindow

`DefaultButton()`	`null`
`Destroyable()`	`true`
`Locked()`	`false`
`Maximized()`	`false`
`Minimized()`	`false`
`Modal()`	`false`
`Moveable()`	`true`
`NormalHotKeys()`	`false`
`Owner()`	`null (available in MSWindows only)`
`SelectionType()`	`ZAF_SINGLE_SELECTION`
`Sizeable()`	`true`
`Temporary()`	`false`

ZafWindowObject

`CopyDraggable()`	`false`†
`LinkDraggable()`	`false`†
`MoveDraggable()`	`false`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`Region()`	`ZAF_CELL, left, top, left + width - 1, top + height - 1`
`Selected()`	`false`†

ZafElement

`ClassID()`	`ID_ZAF_WINDOW`
`ClassName()`	`"ZafWindow"`

ZafWindow`(int left, int top, int width, int height);`

The first constructor is useful in straight-code situations. The four parameters *left*, *top*, *width*, and *height* define the absolute size and position of the window. All values are specified in cell coordinates by default, but may be specified using another coordinate system if desired. A root window (one added to the ZafWindowManager object) positions itself on the screen such that the *left* and *top* parameters specify the left and top coordinates of its client region, respectively. A child window's position is relative to the top-left corner of its parent's client region.

ZafWindow`(const ZafWindowObject &copy);`

This is the copy constructor which accepts another ZafWindow, *copy*, and copies the object's information. This constructor is used in conjunction with the overloaded Duplicate() function.

ZafWindow`(const ZafIChar *name, ZafObjectPersistence &persist);`

The final constructor is used for persistence. *name* specifies the name of the window to be read from a persistent file. *persist* contains persistent information such as a pointer to the file-system and object constructors—both necessary for object creation. The following examples demonstrate how to create a window in code and how to use persistence in general window creation:

```
// Create a sample window.
ZafWindow *window1 = new ZafWindow(0, 0, 40, 10);
// Add the decorations to the window.
window1->Add(new ZafBorder);
window1->Add(new ZafMaximizeButton);
window1->Add(new ZafMinimizeButton);
window1->Add(new ZafSystemButton);
window1->Add(new ZafTitle("Sample Window");
// Add a button to the window.
window1->Add(new ZafButton(2, 4, 15, 1, "Button",
    ZAF_NULLP(ZafBitmapData)));
// Put the window on the screen.
windowManager->Add(window1);

// Open the data file.
ZafStorage *storage = new ZafStorage("myfile.dat");
// Create the persistence object.
ZafObjectPersistence persist(storage,
    zafDefaultDataConstructor, zafDefaultObjectConstructor);
```

```
// Load the persistent window "MyWindow".
windowManager->Add(new ZafWindow("MyWindow", persist));
```

Destructor

`virtual ~`**`ZafWindow`**`(void);`

The destructor is used to free the memory associated with a ZafWindow object, including all the attached child objects and all the data object pieces that are Destroyable(). It chains to the ZafWindowObject, ZafElement, and ZafList destructors.

Since this destructor chains to the ZafList destructor, all the attached child objects are also subtracted from the window and destroyed. This is convenient for the programmer, since child objects need not be individually destroyed. See Subtract() for more information.

Generally, the programmer will not directly destroy a ZafWindow object, since it is automatically destroyed when it is removed from the window manager, or when the parent window is destroyed. The following code provides an example:

```
// Create a sample window.
ZafWindow *window1 = new ZafWindow(2, 2, 40, 10);
// Add the decorations to the window.
window1->Add(new ZafBorder);
window1->Add(new ZafMaximizeButton);
window1->Add(new ZafMinimizeButton);
window1->Add(new ZafSystemButton);
window1->Add(new ZafTitle("Sample Window");
// Add a button to the window.
window1->Add(new ZafButton(2, 4, 15, 1, "Button",
   ZAF_NULLP(ZafBitmapData)));
...
// Destroy the window and all its children.
delete window1;
```

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Add

```
virtual ZafWindowObject *Add(ZafWindowObject *object,
   ZafWindowObject *position =
   ZAF_NULLP(ZafWindowObject));
```

operator +

```
ZafWindow &operator+(ZafWindowObject *object);
```

This function and operator overload base ZafList::Add() functionality to handle advanced addition operations typical of derived ZafWindow classes. For instance, ZafVtList has widely different implementations on the Microsoft Windows and Motif platforms. On Windows, the objects are represented internally by the OS and the only interface is accomplished through LB_* messages. On Motif, there is no widget representation at all! Thus the exact handling, insertion and updating of an object is performed uniquely by each overloaded Add() function.

For objects added to ZafWindow, these three operations are performed:

- they are added to the list of support or non-support children (either the support member or the base ZafList part of the class, respectively)
- their parent pointer is set to point to the ZafWindow object
- they are updated on the screen if the parent window is already visible to the user

This overloaded function and operator return a typesafe ZafWindowObject pointer, which is generally the object that was passed to the Add() function, but can be null if the object either currently resides within another window or is an invalid type of Add() operation. An invalid add operation would be adding a ZafTable object to a ZafPullDownMenu.

The following code demonstrates correct use of this function and operator:

```
// Add support children to a window.
ZafWindow *window1 = new ZafWindow(2, 2, 50, 10);
window1->Add(new ZafBorder);
window1->Add(new ZafMaximizeButton);
window1->Add(new ZafMinimizeButton);
window1->Add(new ZafSystemButton);
window1->Add(new ZafTitle("String Window"));

// Do the same thing with the + operator.
ZafWindow *window2 = new ZafWindow(3, 3, 50, 10);
*window2
  + new ZafBorder
  + new ZafMaximizeButton
  + new ZafMinimizeButton
  + new ZafSystemButton
  + new ZafTitle("String Window");
```

AddGenericObjects

```
ZafWindow *AddGenericObjects(ZafStringData *title,
    ZafWindowObject *minObject =
    ZAF_NULLP(ZafWindowObject));
```

AddGenericObjects() may be called on a ZafWindow to add all the common decorations to it. The decorations included on a window created with AddGenericObjects() are ZafBorder, ZafTitle, ZafMaximizeButton, ZafMinimizeButton, ZafSystemButton, and optionally a minimize icon (ZafIcon). *title* specifies the text to be placed in the title bar. *minObject*, if non-null, specifies the ZafIcon object to be used when the window is minimized. A pointer to the window is returned. The following code shows the proper use of this function:

```
// Create a window with all the normal decorations on it.
ZafWindow *window = new ZafWindow(2, 2, 40, 10);
window->AddGenericObjects(new ZafStringData("Test Window"));
// Add the window to the window manager.
windowManager->Add(window);
```

AutomaticUpdate

`virtual bool` **`AutomaticUpdate`**`(void) const;`
`virtual bool` **`SetAutomaticUpdate`**`(bool automaticUpdate);`

This function inherits all the functionality of the base ZafWindowObject::SetAutomaticUpdate() function and adds functionality that optimizes the addition and subtraction of child objects. Frequently, when either adding or subtracting numerous child objects, it is desirable to have only a single visible update to the screen. For example, a ZafVtList that contains the names of all files in the current directory, when moving up a directory should present the new files in one clean refresh. This is done by calling SetAutomaticUpdate(false), making the list changes, then resetting the automatic update to true. The following code shows how this can be done:

```
// Refresh the list with new files.
void MyFileList::RedoList(void)
{
  // Destroy the old elements in the list.
  SetAutomaticUpdate(false);
  Destroy();

  // Add new list elements
  for (FileElement *element = fileSystem->FindFirst("*");
    element;
    element = fileSystem->FindNext());
    Add(new ZafString(0, 0, 20, element->Text(), -1);

  // Update the list's presentation.
  SetAutomaticUpdate(true);
}
```

Border

`ZafBorder *`**`Border`**`(void);`

This function returns a pointer to a ZafBorder child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafBorder object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafBorder object
- it has been added by the AddGenericObjects() function
- the window was constructed using the persistent constructor and a ZafBorder object was loaded as a child object

Otherwise, this function returns a null pointer.

BroadcastEvent

```
virtual void BroadcastEvent(const ZafEventStruct &event,
    int levels = 0);
```

This is a convenience function that dispatches an event to all the window's normal and support children. Typically, this function is used to propagate a particular event to all of the children associated with a derived window. For instance, the following code shows how an event can be passed to a ZafWindow object's children:

```
ZafEventType MyWindow::Event(const ZafEventStruct &event)
{
  ZafEventType ccode = event.type;
  if (ccode == MY_EVENT)
    BroadcastEvent(event);
  ccode = ZafWindowObject::Event(event);
  return (ccode);
}
```

levels specifies the number of hierarchical levels of children BroadcastEvent() traverses. If *levels* is 0, BroadcastEvent() does not traverse children other than the window's immediate children. If *levels* is -1, BroadcastEvent() traverses all levels of children in a window's hierarchy.

The return values from the children's Event() functions are ignored. Thus, to assess the current state of a given operation, rather than calling BroadcastEvent(), dispatch the events directly to the objects. The following example shows how this may be accomplished:

```
ZafEventType MyWindow::Broadcast(const ZAF_EVENT_STRUCT &event)
{
  // Broadcast the event to all normal children.
  ZafEventType ccode = event.type;
  for (ZafWindowObject *object = First(); object; object =
    object->Next())
  {
    ccode = object->Event(event);
    if (ccode != event.type)
      break; // an error occurred.
  }
  return (ccode);
}
```

Changed

```
virtual bool Changed(void) const;
virtual bool SetChanged(bool changed);
```

These functions inherit all the features of ZafWindowObject::Changed() and ZafWindowObject::SetChanged(), but also add a search mechanism on the window's children. In particular, the Changed() function traverses all it's normal children to determine if any has the "Changed() == true" setting. If any child's setting is true, the function returns true.

SetChanged() overrides the base functionality by not only resetting the window's changed status, but also by clearing the children's Changed() values if the argument passed is false. This in effect is a "Change All" command, but only acts as such if the argument passed is false. If the argument is true, the window resets its internal value, but does not propagate that change to all of its children. The following example demonstrates correct use of these functions:

```
// Check for a changed window.
if (window->Changed())
{
  WriteInfoToDisk(window);
  window->SetChanged(false); // clears all the children.
}
```

ClientRegion

```
ZafRegionStruct ClientRegion(void) const;
```

The client region of a window is the area inside all the decorations and support objects. For example, after a border, a title bar, a tool bar, and a status bar are added to a window, the remaining region in the window is referred to as the window's ClientRegion(). Any normal child added to the window, such as a string field, is placed relative to the top-left of the window's ClientRegion(). In other words, the ClientRegion() of the window is made smaller by each support object added to the window.

Note that ClientRegion() returns the region defined by the native environment as the window's client region, and thus may only be used portably for determining the size of the window's client region. This is an advanced function used internally by the ZAF libraries, and should normally not be called by the programmer. Child objects are automatically placed relative to the client region when added to the window, so the programmer should never be concerned with the position of the ClientRegion().

CompareAscending

Compare-Descending

```
static int CompareAscending(ZafWindowObject *object1,
   ZafWindowObject *object2);
static int CompareDescending(ZafWindowObject *object1,
   ZafWindowObject *object2);
```

These two functions provide sort methods for derived ZafWindow classes such as ZafVtList and ZafHzList to allow the insertion of list items in ascending or descending collation sequences. The functions are bound directly to ZafList::CompareFunction() whenever the SetAutoSort(true) function is called for these derived classes. In general, these functions should not be used with ZafWindow, but they are available for classes derived from ZafWindow that require sorting functionality. The following sample code shows how to set the list pointer to these functions:

```
void MyWindow::DoTheSort(bool sortAscending)
{
  // Reset the sort function.
  if (sortAscending)
    SetCompareFunction((ZafCompareFunction)CompareAscending);
  else
    SetCompareFunction((ZafCompareFunction)CompareDescending);
  // Sort the children.
  Sort();
}
```

CornerScrollBar

```
ZafScrollBar *CornerScrollBar(void);
```

This function returns a pointer to a corner ZafScrollBar child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A corner ZafScrollBar object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated `corner ZafScrollBar` object
- the window was constructed using the persistent constructor and a corner ZafScrollBar object was loaded as a child object

Otherwise, this function returns a null pointer.

DefaultButton

```
ZafButton *DefaultButton(void) const;
ZafButton *SetDefaultButton(ZafButton *object);
```

A default button is the button that will be selected when the user types <Enter> or <Return>. The default value of this attribute is null, but the user may call SetDefaultButton() to set a default button for a window. SetDefaultButton() tells the parent window which button is to function as the default button, but does not set the ZafButton::AllowDefault() attribute on the button, which causes the button to be visually indicated as the default button. DefaultButton() affects which button functions as the default button on the window, and the ZafButton::AllowDefault() attribute affects the visual aspect of a button. Refer to ZafButton::AllowDefault() for more information.

The following code provides a brief example:

```
// Create the OK button as the default button.
ZafButton *button1 = new ZafButton(1, 4, 12, 1, "OK",
    ZAF_NULLP(ZafBitmapData));
button1->SetAllowDefault(true);
window->Add(button1);
window->SetDefaultButton(button1);
```

Destroy

```
virtual void Destroy(void);
```

This function inherits features of the base ZafList::Destroy() function and adds functionality to redisplay the window, if visible on the screen, and to delete OS specific references to the children if they exist. This is a destructive call that not only removes children from the window's list, but also deletes them.

Note, this function does not remove any of the window's support children. This must be done with a call to SupportDestroy().

Destroyable

```
bool Destroyable(void) const;
virtual bool SetDestroyable(bool destroyable);
```

If Destroyable() is true, the window is considered non-static and is maintained by ZAF. In other words, when the window is closed (either by the end user, or by the programmer), it is destroyed with the delete operator, causing its destructor to be called. On the other hand, if Destroyable() is false, ZAF will not destroy the window, and the programmer assumes responsibility for it. The default value of this attribute is true, but it may be changed by calling SetDestroyable().

Event

`virtual ZafEventType **Event**(const ZafEventStruct &event);`

This overloaded function handles all events that are sent to the ZafWindow object, either by processing the events itself, or by passing the event down for base class processing. Refer to ZafWindowObject::Event() for complete details. In addition to events handled by its base classes, the following are handled by ZafWindow:

Event type	Description
`S_ADD_OBJECT`	Causes event.windowObject to be added as a child
`S_MAXIMIZE`	Causes the window to be maximized
`S_MINIMIZE`	Causes the window to be minimized
`S_RESTORE`	Causes a maximized or minimized window to be restored
`S_SUBTRACT_OBJECT`	Causes event.windowObject to be subtracted as a child
`N_CLOSE`	Notifies that the window is about to be closed
`L_NEXT`	Causes the next child to receive focus
`L_PREVIOUS`	Causes the previous child to receive focus

FocusObject

`virtual ZafWindowObject ***FocusObject**(void);`

FocusObject() returns the leaf object that has focus, the object that receives keyboard events. If there is no object with focus, such as when all the objects on a window are either Disabled() or Noncurrent(), FocusObject() returns null.

GeometryManager

`ZafGeometryManager ***GeometryManager**(void);`

This function returns a pointer to a ZafGeometryManager child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafGeometryManager object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafGeometryManager object
- the window was constructed using the persistent constructor and a ZafGeometryManager object was loaded as a child object

Otherwise, this function returns a null pointer.

HorizontalScrollBar

```
ZafScrollBar *HorizontalScrollBar(void);
```

This function returns a pointer to a horizontal ZafScrollBar child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A horizontal ZafScrollBar object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated horizontal ZafScrollBar object
- the window was constructed using the persistent constructor and a horizontal ZafScrollBar object was loaded as a child object

Otherwise, this function returns a null pointer.

Locked

```
bool Locked(void) const;
virtual bool SetLocked(bool locked);
```

If Locked() is true, the window may not be closed, but is to remain on the screen. A Locked() window's system button will reflect the fact that the end user may not close the window by disabling the appropriate menu item, if it exists. However, in some environments the window may be closed down unexpectedly by the environment. If Locked() is false, the window may be closed normally. The default value of this attribute is false, but it may be changed by calling SetLocked().

MaximizeButton

```
ZafMaximizeButton *MaximizeButton(void);
```

This function returns a pointer to a ZafMaximizeButton child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafMaximizeButton object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafMaximizeButton object
- it has been added by the AddGenericObjects() function
- the window was constructed using the persistent constructor and a ZafMaximizeButton object was loaded as a child object

Otherwise, this function returns a null pointer.

Maximized

```
bool Maximized(void) const;
virtual bool SetMaximized(bool maximized);
```

If Maximized() is true, the window is presented on the screen as maximimized, otherwise the window's position and size are specified by Region(). The default value of this attribute is false, but it may be changed at any time by calling SetMaximized().

To make the window appear maximized when it first shows up on the screen, call SetMaximized(true) before adding the window to the window manager. Later calling SetMaximized(false) restores the window to its normal position and size. Both Maximized() and Minimized() should never be set to true at the same time, as the result is undefined.

MinimizedButton

```
ZafMinimizeButton *MinimizeButton(void);
```

This function returns a pointer to a ZafMinimizeButton child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafMinimizeButton object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafMinimizeButton object
- it has been added by the AddGenericObjects() function
- the window was constructed using the persistent constructor and a ZafMinimizeButton object was loaded as a child object

Otherwise, this function returns a null pointer.

Minimized

```
bool Minimized(void) const;
virtual bool SetMinimized(bool minimized);
```

If Minimized() is true, the window is presented on the screen as minimimized, represented on the screen only by a minimize icon (or something similar), otherwise the window's position and size specified by Region(). The default value of this attribute is false, but it may be changed at any time by calling SetMinimized().

To make the window appear minimized when it first shows up on the screen, call SetMinimized(true) before adding the window to the window manager.

Later calling SetMinimized(false) restores the window to its normal position and size. Both Maximized() and Minimized() should never be set to true at the same time, as the result is undefined.

MinimizeIcon

```
ZafIcon *MinimizeIcon(void);
```

This function returns a pointer to a minimize ZafIcon child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A minimize ZafIcon object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated minimize ZafIcon object
- it has been added by the AddGenericObjects() function, and a minimize ZafIcon object was specified
- the window was constructed using the persistent constructor and a minimize ZafIcon object was loaded as a child object

Otherwise, this function returns a null pointer.

Modal

```
bool Modal(void) const;
virtual bool SetModal(bool modal);
```

Modal() is most commonly used with ZafDialogWindow objects, since users are generally only accustomed to modal dialogs. But in special circumstances, a normal ZafWindow may be set to be Modal().

If Modal() is true, the window will stay in front of all other windows while it is open. Otherwise, the window may be sent to the background by the end user. Commonly, Modal() dialogs are used when information must be specified by the end user before the program may continue. This attribute defaults to false, but it may be changed before the window appears on screen by calling SetModal().

Movable

```
bool Moveable(void) const;
virtual bool SetMoveable(bool moveable);
```

If Moveable() is true, the window may be moved around on the screen by the end user. A non-Moveable() window's system button will reflect the fact that the end user may not move the window by disabling the appropriate menu item, if it exists. The default value of this attribute is true, but it may be changed by calling SetMoveable().

NormalHotKeys

```
bool NormalHotKeys(void) const;
virtual bool SetNormalHotKeys(bool normalHotKeys);
```

If NormalHotKeys() is true, keystrokes are interpretted as hot keys without an accompanying modifier key (such as <Alt> or <Command>). For example, a NormalHotKeys() calculator window that has child buttons with hot keys may recognize a ’1’ keystroke without a modifier key to activate the ’1’ button. The default value of this attribute is false, but it may be changed by calling SetNormalHotKeys().

Owner

```
ZafWindow *Owner(void) const;
virtual ZafWindow *SetOwner(ZafWindow *owner);
```

This attribute is available in Microsoft Windows only. If Owner() is non-null, Owner() is a pointer to the owner of this window. A window with an Owner() always appears on top of its Owner(), and “follows” its Owner(). For example, when the Owner() is minimized, restored, or killed, this window is also minimized, restored, or killed, respectively. And a window with an Owner() does not appear in the Microsoft Windows task list. The default value of this attribute is null, but it may be changed by calling SetOwner().

PullDownMenu

```
ZafPullDownMenu *PullDownMenu(void);
```

This function returns a pointer to a ZafPullDownMenu child object, if the instantiated object exists in the window’s list of support children (refer to the support section of this chapter for more information about support children). A ZafPullDownMenu object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafPullDownMenu object
- the window was constructed using the persistent constructor and a ZafPullDownMenu object was loaded as a child object

Otherwise, this function returns a null pointer.

SelectionType

```
ZafSelectionType SelectionType(void) const;
virtual ZafSelectionType
   SetSelectionType(ZafSelectionType selectionType);
```

These functions set the selection parameters for a window's children as they operate in the context of their parent. There are three types of selection operations permitted with windows:

Selection type	Description
ZAF_SINGLE_SELECTION	Allows just one child object to be selected at a time
ZAF_MULTIPLE_SELECTION	Allows zero or more child objects to be selected at a time
ZAF_EXTENDED_SELECTION	Allows zero or more child objects to be selected at a time, with extended environment-specific selection rules

The following code shows the proper use of these functions:

```
// Get the attribute
if (window->SelectionType() == ZAF_SINGLE_SELECTION)
  break;

// Set the attribute for a new vertical list.
ZafVtList *vtList = new ZafVtList(0, 0, 50, 10);
vtList->SetSelectionType(ZAF_MULTIPLE_SELECTION);
```

Sizeable

`bool` **`Sizeable`**`(void) const;`
`virtual bool` **`SetSizeable`**`(bool sizeable);`

If Sizeable() is true, the window may be sized by the end user. A non-Sizeable() window's system button will reflect the fact that the end user may not size the window by disabling the appropriate menu item, if it exists. The default value of this attribute is true, but it may be changed by calling SetSizeable().

Subtract

operator -

`virtual ZafWindowObject *`**`Subtract`**`(ZafWindowObject *object);`
`ZafWindow &`**`operator-`**`(ZafWindowObject *object);`

This function and operator overload base ZafList::Subtract() functionality to handle advanced subtraction operations typical of derived ZafWindow classes. For example, ZafVtList has widely different implementations on the Microsoft Windows and Motif platforms. On Windows, the objects are represented internally by the OS and the only interface is accomplished through LB_* messages. On Motif, there is no widget representation at all! Thus the exact handling, deletion and updating of an object is performed uniquely by each overloaded Subtract() function.

For objects subtracted from ZafWindow, these three operations are performed:

- they are subtracted from the list of support or non-support children (either the support member or the base ZafList part of the class, respectively)
- their parent pointer is cleared
- they are removed from the screen if the parent window is already visible to the user

This overloaded function and operator return a typesafe ZafWindowObject pointer. This is generally the object that was passed to the Subtract() function, but can be null if the object isn't a child of the window.

The following code demonstrates correct use of this function and operator:

```
// Subtract children from a window.
window1->Subtract(string1);
window1->Subtract(string2);
window1->Subtract(button1);
window1->Subtract(button2);

// Do the same thing with the - operator.
*window2
  - string1
  - string2
  - button1
  - button2;
```

support
SupportCurrent
SupportDestroy
SupportFirst
SupportLast

```
ZafList support;
ZafWindowObject *SupportCurrent(void) const;
void SupportDestroy(void);
ZafWindowObject *SupportFirst(void) const;
ZafWindowObject *SupportLast(void) const;
```

The support list of a ZafWindow object maintains a list of support children whose purposes are simply to support the ZafWindow object. Some support objects commonly used on a ZafWindow object are ZafBorder, ZafTitle, and ZafScrollBar. Typical decorations of a ZafWindow object reside in its support list. Operations on support objects are redirected to the parent ZafWindow object. For example, dragging a ZafTitle object has the effect of moving the parent window.

Just as Current(), Destroy(), First(), and Last() operate on the normal children of a window, SupportCurrent(), SupportDestroy(), SupportFirst(), and SupportLast() operate on the support children of a window. SupportCurrent()

returns the current support child, SupportDestroy() destroys all the children in the support list, SupportFirst() returns the first child in the support list, and SupportLast() returns the last child in the support list. The following example demonstrates correct use of some these functions:

```
// Search for the title bar in the support list.
for (ZafWindowObject *object = SupportFirst(); object; object =
    object->Next())
  if (object->IsA(ID_ZAF_TITLE))
    break;
...
// Destroy the support list.
SupportDestroy();
```

SystemButton

`ZafSystemButton *`**`SystemButton`**`(void);`

This function returns a pointer to a ZafSystemButton child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafSystemButton object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafSystemButton object
- it has been added by the AddGenericObjects() function
- the window was constructed using the persistent constructor and a ZafSystemButton object was loaded as a child object

Otherwise, this function returns a null pointer.

SystemButtonMenu

`ZafPopUpMenu *`**`SystemButtonMenu`**`(void);`

This function returns a pointer to a ZafSystemButton child object's menu member, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafSystemButton object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafSystemButton object
- it has been added by the AddGenericObjects() function

- the window was constructed using the persistent constructor and a ZafSystemButton object was loaded as a child object

Otherwise, this function returns a null pointer.

Temporary

```
bool Temporary(void) const;
virtual bool SetTemporary(bool temporary);
```

A Temporary() window will be removed from the screen under any of the following circumstances:

- An S_CLOSE_TEMPORARY is received by the window manager
- The end user clicks the mouse on another window
- The <Escape> key is pressed, if the window is a pop-up menu
- A menu item is selected, if the window is a pop-up menu

An example of a temporary window is a pop-up menu, which closes when the end user makes a selection. If Temporary() is false, the window behaves as a normal window. The default value of this attribute is false, but it may be changed by calling SetTemporary().

Text

```
virtual const ZafIChar *Text(void);
virtual ZafError SetText(const ZafIChar *text);
```

These functions overload the base ZafWindowObject::Text() and ZafWindowObject::SetText() functions by returning or changing the window's title bar, if there is one. If the ZafWindow object contains a child ZafTitle object, the *text* parameter of SetText() is passed to this child object, reflecting changes to the title bar portion of the window, and Text() returns the textual information from the title bar. If no ZafTitle object exists, these functions return null.

Title

```
ZafTitle *Title(void);
```

This function returns a pointer to a ZafTitle child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A ZafTitle object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated ZafTitle object
- it has been added by the AddGenericObjects() function

- the window was constructed using the persistent constructor and a ZafTitle object was loaded as a child object

Otherwise, this function returns a null pointer.

VerticalScrollBar

`ZafScrollBar *`**`VerticalScrollBar`**`(void);`

This function returns a pointer to a vertical ZafScrollBar child object, if the instantiated object exists in the window's list of support children (refer to the support section of this chapter for more information about support children). A vertical ZafScrollBar object will exist only if one of the following conditions have been met:

- it has previously been added with the ZafWindow::Add() function
- it has been added by sending an S_ADD_OBJECT message with event.windowObject pointing to an instantiated vertical ZafScrollBar object
- the window was constructed using the persistent constructor and a vertical ZafScrollBar object was loaded as a child object

Otherwise, this function returns a null pointer.

operator +

`ZafWindow &`**`operator+`**`(ZafWindowObject *object);`

See Add().

operator -

`ZafWindow &`**`operator-`**`(ZafWindowObject *object);`

See Subtract().

operator ()

`ZafWindowObject *`**`operator`**`()(int index);`

This operator returns the child object corresponding to the zero-based *index* specified.

ZafWindowManager

Center	Event	helpObject
dragObject	ExitFunction	mouseObject

Inheritance ZafWindowManager : ZafWindow : (ZafWindowObject : ZafElement), ZafList

Declaration `#include <z_win.hpp>`

Description ZafWindowManager is the top-level class used to manage all the windows on the screen. To cause the window manager to manage a window, simply add the window to the window manager's list with the Add() function. The window will then appear on the screen (unless the window's Visible() attribute is false). The window manager allows no interaction with the user, but transparently manages the windows on the screen.

Constructor The ZafWindowManager constructor initializes the member variables associated with an instantiated ZafWindowManager object. The default values set by the ZafWindowManager and its base class constructors follow, if they differ from those set by the base class constructor, or if a blocking function is implemented in ZafWindowManager. "†" Indicates a blocking function that prevents changes to the attribute in this class.

Member Initializations

ZafWindowManager

exitFunction	null
dragObject	null
helpObject	null
mouseObject	null

ZafWindow

NormalHotKeys()	false†
SelectionType()	ZAF_SINGLE_SELECTION†
Temporary()	false†

ZafWindowObject

AcceptDrop()	false†
AutomaticUpdate()	true†
Bordered()	false†

Member Initializations

`OSDraw()`	`true`†
`ParentDrawBorder()`	`false`†
`ParentDrawFocus()`	`false`†
`ParentPalette()`	`false`†
`Region()`	`ZAF_PIXEL, 0, 0, display->columns - 1, display->lines - 1`
`RegionType()`	`ZAF_AVAILABLE_REGION`†
ZafElement	
`ClassID()`	`ID_ZAF_WINDOW_MANAGER`
`ClassName()`	`"ZafWindowManager"`

```
ZafWindowManager(ZafExitFunction exitFunction =
    ZAF_NULLF(ZafExitFunction));
```

This constructor should normally not be called by the programmer, since it is called by the ZafApplication constructor. *exitFunction* specifies the function to be called when the application is about to close down (see ExitFunction() for more information). Static members of ZafWindowObject, including display, eventManager and windowManager, are initialized in this constructor. The mouse cursor is also initialized to DM_VIEW in this constructor (the default pointer).

Destructor

```
virtual ~ZafWindowManager(void);
```

This destructor is used to free the memory associated with a ZafWindowManager object. It chains to the ZafWindow, ZafList, ZafWindowObject and ZafElement destructors, first removing all windows from the screen and then deleting them, if they are Destroyable().

Generally, the programmer will not directly destroy a ZafWindowManager object, since it is automatically destroyed when the ZafApplication object is destroyed.

Members

Unless otherwise noted, member functions that set or get class attributes will return the final or current value of the attribute. Under normal circumstances, this will be the value passed into the Set*() function. However, if the Set*() function does not successfully change the state as requested, it will instead return the current state.

Center

`void **Center**(ZafWindowObject *object);`

The Center() function centers the window passed into the *object* parameter on the screen. This function may be used before adding the window to the window manager, as well as after it has appeared on the screen. Consider the following example:

```
// Create a window centered on the screen.
ZafWindow *window = new ZafWindow(5, 5, 50, 10);
window->AddGenericObjects(new ZafStringData("Main Window"));
windowManager->Center(window);
// Add the window to the screen.
windowManager->Add(window);
```

dragObject

`ZafWindowObject ***dragObject**;`

The dragObject member is used during drag and drop and points to the object being dragged. This advanced member is used internally by ZAF, and should not be modified by the programmer.

Event

`virtual ZafEventType **Event**(const ZafEventStruct &event);`

This overloaded function handles all events sent to the ZafWindowManager object, whether by processing the events itself, or by passing them to a base class for processing. See ZafWindowObject for more information.

In addition to events handled by its base classes, ZafWindowManager handles the following events:

Event	**Description**
`A_CHANGE_LANG_LOC`	causes the application to change its language and locale bases specified in event.text (the object handling the event deletes event.text)
`A_CLOSE_WINDOW`	causes the application to close the window whose stringID matches event.text (if the window is Destroyable() it is deleted, and the object handling the event deletes event.text)
`A_MINIMIZE_WINDOWS`	causes the window manager to minimize all the windows on the display
`A_OPEN_WINDOW`	causes the application to open the persistent window whose storage pathname is in event.text (the object handling the event deletes event.text)

Event	Description
`A_RESTORE_WINDOWS`	causes the window manager to restore all the minimized windows on the display
`S_CLOSE`	causes all the temporary windows on the display and the top-most window to be closed (and deleted if it is Destroyable()) if event.windowObject is non-null; otherwise event.windowObject is closed
`S_CLOSE_TEMPORARY`	causes all the temporary windows on the display to be closed
`S_EXIT`	causes the application to exit (if there is an ExitFunction(), it is called first)
`S_NEXT_WINDOW`	causes the next window to become the top-most

ExitFunction

```
ZafExitFunction ExitFunction(void) const;
ZafExitFunction SetExitFunction(ZafExitFunction
    exitFunction);
```

If ExitFunction() is not null, it is called before the application may close down. The application may be requested to close down programmatically, by the end user, or by the native environment. Note that there are some cases that the native environment will close an application without giving it a chance to call its exit function.

Programmatically, an S_EXIT message may be posted on the event manager's queue. The end-user may request the application to close down by attempting to close the main window. (The main window is specified by setting the window manager's screenID to be the same as the window's screenID.) Either of these two methods will cause the ExitFunction() to be called.

If the ExitFunction() returns zero, the application is allowed to close down, otherwise the message is ignored. The default value of this attribute is null, but the user may call SetExitFunction() to change it. An example of specifying an exit function follows:

```
// Create the main window.
ZafWindow *window = new ZafWindow(5, 5, 50, 10);
window->AddGenericObjects(new ZafStringData("Main Window"));
// Add the window to the screen.  This gives it a screenID.
windowManager->Add(window);
// Specify the window as the main window.
windowManager->screenID = window->screenID;
// Set up the exit function.
```

```
extern ZafExitFunction MyExitFunction;
windowManager->SetExitFunction(MyExitFunction);
```

helpObject

`ZafWindowObject *`**`helpObject`**`;`

The helpObject member is used by ZafHelpTips and points to the object used to display help messages. This advanced member is used internally by ZAF, and should not be modified by the programmer.

mouseObject

`ZafWindowObject *`**`mouseObject`**`;`

The mouseObject member is used by ZafHelpTips and points to the object under the mouse. This advanced member is used internally by ZAF, and should not be modified by the programmer.

ZafWindowObject

AcceptDrop	Duplicate	ParentPalette
AutomaticUpdate	EndDraw	Previous
BackgroundColor	Error	QuickTip
BeginDraw	Event	Read
Bordered	eventManager	Redisplay
Changed	Focus	RedisplayData
ClassID	FocusObject	Region
ClassName	Font	RegionType
ConvertCoordinates	GetObject	RepeatDelay
ConvertRegion	HelpContext	RootObject
ConvertToDrawRegion	HelpObjectTip	screenID
ConvertToObjectPosition	InitialDelay	ScrollEvent
ConvertToScreenPosition	IsA	Selected
ConvertToOSPosition	LinkDraggable	ToggleSelected
ConvertToZafPosition	LogicalEvent	Text
ConvertToOSRegion	LogicalPalette	TextColor
ConvertToZafRegion	memberUserFunction	userFlags
ConvertToZafEvent	MemberUserFunction	userFunction
CoordinateType	MoveDraggable	UserFunction
CopyDraggable	MoveEvent	UserInformation
DefaultUserFunction	Next	userObject
Disabled	Noncurrent	userPaletteData
display	NotifyFocus	UserPaletteData
DragDropEvent	NotifySelection	userStatus
Draggable	OSDraw	Visible
Draw	OSScreenID	windowManager
DrawBackground	PaletteState	Write
DrawBorder	Parent	zafRegion
DrawFocus	ParentDrawBorder	
DrawShadow	ParentDrawFocus	

Inheritance

`ZafWindowObject : ZafElement`

Declaration

`#include <z_win.hpp>`

Description

ZafWindowObject defines the basic functionality necessary to display objects on the screen. All ZAF displayable objects including windows, strings, buttons, prompts, borders, etc., derive from this class.

ZAF displayable classes share certain characteristics. For example, all displayable objects occupy a certain region on the screen. Many objects display text in a variety of font types and sizes. Some objects display borders and other visual characteristic in a multitude of foreground and background colors. Frequently, displayable objects handle events such as gaining or losing focus.

Finally, displayable objects sometimes allow drag and drop functionality to other displayable objects.

ZafWindowObject is important as a base class because it defines the basic functionality that provides the underlying definition of a graphical user interface system. Although this class cannot be instantiated directly, other classes can be derived from ZafWindowObject.

Since this is the core class for all user interface objects, the descriptions in this chapter are more comprehensive and descriptive. In each case, examples apply to ZafWindowObject, but also may apply to the creation and use of all user interface objects. Refer to this and the ZafWindow section of this manual when questions arise regarding the general operation of user interface objects.

Constructors

All ZafWindowObject constructors initialize the member variables associated with an instantiated ZafWindowObject object. Default values set by the Zaf-WindowObject and its base class constructors are listed below.

Member Initializations

ZafWindowObject	
`AcceptDrop()`	`false`
`AutomaticUpdate()`	`true`
`Bordered()`	`false`
`Changed`	`false`
`CoordinateType()`	`ZAF_CELL`
`CopyDraggable`	`false`
`Disabled()`	`false`
`EditMode()`	`false`
`Error()`	`ZAF_ERROR_NONE`
`Focus()`	`false`
`HelpContext()`	`NO_HELP_CONTEXT`
`HelpObjectTip()`	`null`
`LinkDraggable()`	`false`
`MoveDraggable()`	`false`
`memberUserFunction`	`ZafWindowObject::DefaultUserFunction`
`Noncurrent()`	`false`
`OSDraw()`	`true`
`parent`	`null`
`ParentDrawBorder()`	`false`
`ParentDrawFocus`	`false`
`ParentPalette()`	`false`
`QuickTip()`	`null`

Member Initializations

Region()	ZAF_CELL, left, top, left + width - 1, top + height - 1
RegionType()	ZAF_INSIDE_REGION
screenID()	null
Selected()	false
SupportObject()	false
SystemObject()	true
userObject	null
userFlags	0
userStatus	0
userText	null
UserFunction()	null
UserPaletteData()	null
Visible()	true
ZafElement	
ClassID()	ID_ZAF_WINDOW_OBJECT
ClassName()	"ZafWindowObject"

Since the constructors for ZafWindowObject are protected, you cannot instantiate a ZafWindowObject directly—it must be initialized through a derived class such as ZafButton, ZafWindow, or ZafText. The arguments and types of constructors for this class represent the basic construction techniques available to all derived window objects.

ZafWindowObject`(int left, int top, int width, int height);`

The first constructor is useful in straight-code situations. *left*, *top*, *width*, and *height* define the absolute size and position of the window object (relative to the top-left corner of its parent's "client" region). By default, these values are given in cell coordinates, but minicell, pixel, point, or twip coordinates can be used if you set the CoordinateType() attribute immediately after the constructor as follows:

```
ZafWindowObject *object = new ZafWindow(50, 30, 200, 95);
object->SetCoordinateType(ZAF_PIXEL);
```

The following examples demonstrate how derived objects call the base Zaf-WindowObject constructor:

```
ZafButton::ZafButton(int left, int top, int width, int height,
    const ZafIChar *text, ZafBitmapData *zBitmapData,
    ZafButtonType tButtonType) : ZafWindowObject(left, top,
    width, height)
  ...

ZafWindow::ZafWindow(int left, int top, int width, int height) :
  ZafWindowObject(left, top, width, height)
  ...

ZafString::ZafString(int left, int top, int width, const
    ZafIChar *text,
  int maxLength) :
  ZafWindowObject(left, top, width, 1)
  ...

// Show actual object creation using the constructors shown
    above.
ZafButton *button = new ZafButton(0, 0, 10, "button",
    ZAF_NULLP(ZafBitmapData));
ZafWindow *window = new ZafWindow(0, 0, 50, 10);
ZafString *string = new ZafString(2, 2, 20, "message1", 100);
```

ZafWindowObject(const ZafWindowObject &copy);

The copy constructor calls the overload Duplicate() to create a new ZafWindowObject and initialize its data from *copy*. Note that the copy constructor “copies” all field information including attributes, sizes, and text information, so variables such as QuickHelpText(), UserPaletteData() and derived object’s data components that do not have the “StaticData() == true,” will depth copy their information, not just repoint the internal variables to the original object’s values.

The following examples show how derived objects use the base ZafWindowObject copy constructor to duplicate base class information Also included is a code sample that shows how to duplicate another window object.

```
ZafButton::ZafButton(const ZafButton &copy) :
  ZafWindowObject(copy)
  ...

ZafWindow::ZafWindow(const ZafWindow &copy) :
  ZafWindowObject(copy)
  ...

ZafString::ZafString(const ZafString &copy) :
  ZafWindowObject(copy)
  ...

// Example 1: Create, then copy a string object.
ZafString *string1 = new ZafString(2, 2, 20, "message1", 100);
string1->SetBordered(false);
string1->SetTextColor(ZAF_CLR_BLUE);
string1->SetAutoClear(true);

ZafString *string2 = new ZafString(*string1); // A lot easier
    than the code above.
string2->SetText("message2");
```

ZafWindowObject(const ZafIChar *name,
    ZafObjectPersistence &persist);

The final constructor is used for persistence. *name* specifies the name of the window or window object to be read from a persistent file. *persist* contains persistent information such as a pointer to the file-system and object constructors, both necessary for object creation.

Below are several code snippets that show how derived objects use the base ZafWindowObject persistent constructor to read base class information Also included is a code sample that shows how to use persistence in general window creation.

```
ZafButton::ZafButton(const ZafIChar *name, ZafObjectPersistence
    &persist) :
  ZafWindowObject(name, persist.PushLevel(className, classID,
    ZAF_PERSIST_DIRECTORY))
  ...

ZafWindow::ZafWindow(const ZafIChar *name, ZafObjectPersistence
    &persist) :
  ZafWindowObject(name, persist.PushLevel(className, classID,
    ZAF_PERSIST_ROOT_DIRECTORY)),
  ...

ZafString::ZafString(const ZafIChar *name, ZafObjectPersistence
    &persist) :
  ZafWindowObject(name, persist.PushLevel(className, classID,
    ZAF_PERSIST_DIRECTORY)),
  ...

// Load a persistent window.
ZafStorage *storage = new ZafStorage("myfile.dat");
```

```
ZafObjectPersistence persist(storage,
   zafDefaultDataConstructor, zafDefaultObjectConstructor);
windowManager->Add(new ZafWindow("MyWindow", persist));
```

Destructor

`virtual ~`**`ZafWindowObject`**`(void);`

This destructor is used to free the memory associated with a ZafWindowObject object. The ZafWindowObject portion of the destructor deletes the object's QuickTip(), HelpObjectTip(), and UserPalette() members if memory has been allocated. It then chains to the ZafElement destructor.

Generally, the programmer will not directly destroy a ZafWindowObject object since it is automatically destroyed when its parent window is destroyed. For more information on child object deletion see ZafWindow::~ZafWindow().

Below is an example of object deletion that chains the destruction sequence to the ZafWindowObject class.

```
// Create a simple window.
ZafWindow *window = new ZafWindow(0, 0, 40, 10);
window->Add(new ZafBorder);
window->Add(new ZafMaximizeButton);
window->Add(new ZafMinimizeButton);
window->Add(new ZafSystemButton(ZAF_NATIVE_SYSTEM_BUTTON));
window->Add(new ZafTitle(new ZafStringData("Text Window")));
...
ZafWindowObject *object = new ZafText(2, 1, 35, 6, "text",
   1000);
window->Add(object);
...
// This call selectively deletes a child object.
window->Subtract(object);
delete object;
...
// This call deletes the whole window with all its children.
delete window;
```

Members

AcceptDrop

`bool `**`AcceptDrop`**`(void) const;`
`bool `**`SetAcceptDrop`**`(bool acceptDrop);`

These functions are part of a suite of drag/drop functions and attributes that allow the user to move, copy, or link application specific data from one object to another. Although different in actual presentation, all environments provide visual queues to the user when they permit drag and drop operations from one object to another. For example, the Windows environment shows a copy or move folder when a draggable object is picked-up in a dragging operation, then interactively shows either the continued copy/move image when positioned over a dropable object, or a cancel image if the mouse is positioned over an object that does not allow drop operations.

Calling SetAcceptDrop(true) tells ZAF that in your application the specified object allows dropping operations. When this is done, ZAF first communicates with the native environment, then with your application, by sending drop messages to your object's virtual Event() function.

ZafWindowObject provides simple handling of the copy and move drag/drop operations, but does not have any special handling for link drag/drop. Simple copying or moving of the object's Text() information for objects derived from ZafWindowObject is accomplished as follows:

```
// Perform the specified drop operation.
object = windowManager->dragObject;
const ZafIChar *text = object->Text();
if (ccode == S_DROP_COPY)
  SetText(text);
else if (ccode == S_DROP_MOVE)
  {
    SetText(text);
    object->SetText(ZafLanguageData::blankString);
  }
```

Most ZAF objects add additional native drag/drop capabilities into their runtime operation. Below is a partial list of drag/drop operations that are automatically handled when the AcceptDrop() is set to "true."

Operations	**Description**
`ZafString`	Accepts the Text() portion of the drag object.
`ZafDate`	Converts the Text() portion of the drag object to a date value if the value is in a format recognized by the ZafDate object.
`ZafVtList`	Duplicates the drag object by calling the virtual Duplicate() function when the S_DROP_COPY is sent, or moves the actual object (by sending the message S_SUBTRACT_OBJECT to the drag object's parent and then S_ADD_OBJECT to itself) when the S_DROP_MOVE message is sent.

Normally, programmers will not intercept drop messages since most Zinc objects have drag and drop capabilities built into their native operation. If you wish to intercept drop messages, however, these are the messages to look for:

Message	Description
`S_DROP_MOVE`	Sent to the destination object's Event() function when the user initiates a drag-move operation from one object to another. If this message is received the programmer should perform a move operation from the windowManager->dragObject to the destination. Thus, when the drag contents are moved, they should be removed from the drag object.
`S_DROP_COPY`	Sent to the destination object's Event() function when the user initiates a drag-copy operation from one object to another. If this message is received the programmer should perform a copy operation from the windowManager->dragObject to the destination. Thus, when the drag contents are copied, they should not be removed from the drag object.
`S_DROP_LINK`	Sent to the destination object's Event() function when the user initiates a drag-link operation from one object to another. This is the least common mode of dragging and dropping, but is useful when you want to access data from a particular drag source, but do not want to copy the drag object's data. If this message is received the programmer should not copy or replace the data contents of windowManager->dragObject but should instead take application-specific action.
`S_DROP_DEFAULT`	This message should only be intercepted when needing to change the default sequence of drag/drop messages. ZafWindowObject provides an algorithm for S_DROP_DEFAULT that sends messages in the following order: • S_DROP_COPY if the CopyDraggable() attribute is true • S_DROP_MOVE if S_DROP_COPY fails (returns an S_ERROR) or if the CopyDraggable() attribute is false and if the MoveDraggable() attribute is true • S_DROP_LINK if conditions in steps (1) or (2) are not met and if the LinkDraggable() attribute is true. The order of drop messages can be modified by overriding the S_DROP_DEFAULT functionality in a derived object's Event() function.

The original drag object pointer is contained in windowManager->dragObject. The following code demonstrates how to copy the text associated with a dragged object when a custom target object has been marked with the accept drop capability.

```
void MyFunction(void)
{
  MyDropObject *target = new MyDropObject;
  target->SetAcceptDrop(true);
}

ZafEventStruct MyDropObject::Event(const ZafEventStruct &event)
{
switch (event.type)
{
case S_DROP_DEFAULT:
case S_DROP_COPY_OBJECT:
  // Copy the source text information.
  SetText(windowManager->dragObject->Text());
  break;

case S_DROP_MOVE_OBJECT:
case S_DROP_LINK_OBJECT:
  // Don’t handle these cases.
  return (S_ERROR);
```

The return value for AcceptDrop() and SetAcceptDrop() is the final, or current drop attribute associated with the object (true or false). Under normal circumstances, this value will be passed into the SetAcceptDrop() function. The following example demonstrates proper use of these functions and argument:

```
// Get the attribute.
if (object->AcceptDrop())
  break;

// Set the object as "drop capable."
ZafString *string = new ZafString(0, 0, 10, "string", 100);
string->SetAcceptDrop(true);
```

AutomaticUpdate

```
bool AutomaticUpdate(void) const;
virtual bool SetAutomaticUpdate(bool automaticUpdate);
```

SetAutomaticUpdate() turns on or off an object's ability to immediately draw itself on the screen. The following function calls are affected by the state of AutomaticUpdate():Add() - for ZafWindow objects

- Add() - for ZafWindow objects
- Subtract() - for ZafWindow objects
- SetBackgroundColor()
- SetFont()
- SetTextColor()
- SetUserPaletteData()

SetAutomaticUpdate() should be set to false to change several color or font attributes at once without causing screen flashes to the object with each attribute change. The following example shows how to efficiently change these attributes on a window object.

```
// Change an object's text and background color.
object->SetAutomaticUpdate(false);
object->SetBackgroundColor(ZAF_CLR_RED);
object->SetTextColor(ZAF_CLR_WHITE);
object->SetAutomaticUpdate(true);
```

AutomaticUpdate() is a temporary setting. When an object's automatic update is set to "false," immediately make necessary color and font changes, then set the value back to "true." Delayed restoration of this attribute may cause unwanted screen updates, if other attributes, not defined above, are changed while the object's automatic update status is "false."

Setting this attribute back to true does three things:

- Matches the object's internal attributes with the particular environment values.
- Causes the displayed object to show any changes made while the attribute was set to false (by automatically redrawing the object where necessary).
- Ensures any future application activity which affects the appearance of the object will occur immediately and automatically.

The derived ZafWindow class provides additional Add()/Subtract() optimization to this function. For more information on these changes see the ZafWindow section of this manual.

The return value for AutomaticUpdate() and SetAutomaticUpdate() is the final or current update status associated with the object (true or false). Under normal circumstances this will be the update value passed into the SetAutomaticUpdate() function but may be different if the object does not allow changes to automatic updating (e.g. ZafMessageWindow always sets the value to true).

BackgroundColor

```
ZafLogicalColor BackgroundColor(ZafLogicalColor *color =
   ZAF_NULLP(ZafLogicalColor),ZafLogicalColor *mono =
   ZAF_NULLP(ZafLogicalColor));
ZafLogicalColor SetBackgroundColor(ZafLogicalColor
   color, ZafLogicalColor mono = CLR_DEFAULT);
```

Background color is the visual presentation area that encompasses the region behind an object's text or image information, excluding the object's border and shadow.

SetBackgroundColor() changes the background color associated with the normal presentation of an instantiated object. Two types of colors can be passed to SetBackgroundColor(): a color value and a monochrome value. The first parameter specifies the color for normal operation, the second specifies the black/white value for monochrome or black/white modes of operation. Here is a list of predefined ZAF color values:

Color Values	Monochrome Values
ZAF_CLR_PARENT	ZAF_MONO_PARENT
ZAF_CLR_DEFAULT	ZAF_MONO_DEFAULT
ZAF_CLR_NULL	ZAF_MONO_NULL
ZAF_CLR_BACKGROUND	ZAF_MONO_BACKGROUND
ZAF_CLR_BLACK	ZAF_MONO_BLACK
ZAF_CLR_BLUE	ZAF_MONO_DIM
ZAF_CLR_GREEN	ZAF_MONO_NORMAL
ZAF_CLR_CYAN	ZAF_MONO_WHITE
ZAF_CLR_RED	ZAF_MONO_HIGH
ZAF_CLR_MAGENTA	
ZAF_CLR_BROWN	
ZAF_CLR_LIGHTGRAY	
ZAF_CLR_DARKGRAY	
ZAF_CLR_LIGHTBLUE	
ZAF_CLR_LIGHTGREEN	
ZAF_CLR_LIGHTCYAN	
ZAF_CLR_LIGHTRED	
ZAF_CLR_LIGHTMAGENTA	
ZAF_CLR_YELLOW	
ZAF_CLR_WHITE	

In addition to the pre-defined colors described above, users can define and use their own logical colors. For more information on these color specifications, and for more details on derived color entries, see the ZafPaletteStruct and ZafDisplay sections of this manual or ZafWindowObject::UserPaletteData().

This example demonstrates the correct use of SetBackgroundColor().

```
// Change the background color of the object.
object->SetBackgroundColor(ZAF_CLR_WHITE, ZAF_MONO_WHITE);

// Check the current color of an object, and change where
    necessary.
if (object->BackgroundColor() == ZAF_CLR_NULL)
  object->SetBackgroundColor(object->parent-
    >BackgroundColor());

// Change an object’s text and background color.
object->SetAutomaticUpdate(false);
object->SetBackgroundColor(ZAF_CLR_RED);
object->SetTextColor(ZAF_CLR_WHITE);
object->SetAutomaticUpdate(true);
```

The return value for BackgroundColor() and SetBackgroundColor() is the final or current color value associated with the object. Under normal circumstances, this will be the color value passed into the SetBackgroundColor(), but may be different if the object does not allow for a particular type of color specification or if the system is running in black/white mode.

BeginDraw
EndDraw

ZafRegionStruct **BeginDraw**(void);
void **EndDraw**(void);

ZAF enables you to customize the appearance of an object by deriving from ZafWindowObject or some other displayable ZAF class and overriding the Draw() function. Before a Draw() function calls any functions that affect the appearance of a GUI object, such as DrawBorder(), DrawFocus(), or Draw-Shadow(), it must first determine the available drawing region, and set up any special environment values. This is done with calls to the object’s Begin-Draw() function.

BeginDraw() returns a region structure that defines the available drawing region of the object. The actual values in the region structure’s top, left, bot-tom, and right fields will differ depending on the particular platform you are running under, so you should not make any assumptions about the nature of these values. Here is an example that shows the proper method for finding the horizontal center of a draw region:

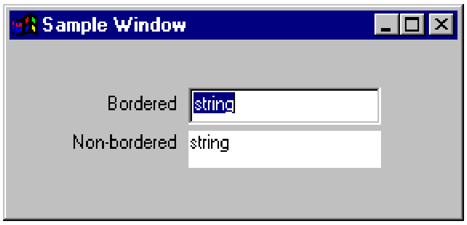
```
ZafEventType MyObject::Draw(const ZafEventStruct &event,
    ZafEventType ccode)
{
  ZafRegionStruct region = BeginDraw();
  int centerColumn = region.left + region.Width() / 2;
  ...
  EndDraw();
  return (ccode);
}
```

EndDraw() tells the system that you are finished with your drawing operation, and frees up any operating system specific memory used as part of the drawing operation.

Bordered

`bool` **`Bordered`**`(void) const;`
`bool` **`SetBordered`**`(bool bordered);`

SetBordered() is used to set the visual presentation of an instantiated object. Setting this attribute to true causes a platform-specific border to be drawn around the object. Typically, this is a 3-dimensional shadowed border that is prevalent on newer versions of GUI environments (e.g. Windows 95 and Motif), but may also be a one or two pixel black band that surrounds the object, seen on other GUI systems. If not set, the object will not have any border that frames the data portion of an object. Here is a picture of two ZafString objects, the top calling SetBordered(true), the bottom SetBordered(false).



Note that the prompts shown to the left of the strings also also respond to SetBordered() by aligning themselves differently, but do not actually draw borders. By setting the “Bordered” ZafPrompt to SetBordered(true) and the “Non-bordered” ZafPrompt to SetBordered(false) the prompts’ text automatically aligns with the text baseline of the ZafStrings to their right. Since the text baseline of input fields is different on each environment, this is the preferred method for aligning prompts with input fields.

The following code shows the proper use of these functions:

```
// Check the attribute for drawing.
if (object->Bordered())
  object->DrawShadow(drawRegion, ZAF_BORDER_WIDTH, ccode);

// Turn the border off.
ZafString *string = new ZafString(0, 0, 10, "string", 100);
string->SetBordered(false);
```

The return value for Bordered() and SetBordered() is the final, or current border attribute associated with the object (true or false). Under normal circumstances, this will be the value passed to the SetBordered() function, but may be different if the object does not allow changes to the Bordered() attribute, or if the SetBordered() function is called after the object is visible on the screen.

Changed

bool **Changed**(void) const;
bool **SetChanged**(bool changed);

These functions are used to set or evaluate the changed status of an object. Many objects derived from ZafWindowObject set this attribute to true each time a user modifies the object's data. For example, ZafString sets this attribute each time a user types a character into the string buffer. ZafVtList sets the attribute each time a user adds, deletes, or selects an item from the list.

You can determine whether an end-user has changed the contents of an object by calling the Changed() member. In addition, you can clear the changed status by calling SetChanged(false). Note, ZAF only sets the changed attribute with SetChanged(true) calls, it never clears the attribute with SetChanged(false) calls. This operation is left for the programmer's discretion. The following code shows the proper use of these functions:

```
// Check the changed attribute.
if (myString->Changed())
{
  // Save the data.
  SaveMyString(myString->Text());
  myString->SetChanged(false);
}
```

The return value for Changed() and SetChanged() is the final, or current changed attribute associated with the object (true or false). Under normal circumstances, this will be the value passed into the SetChanged() function.

ClassID
ClassName

```
static ZafClassID classID;
static ZafClassNameChar ZAF_FARDATA className[];
ZafClassID ClassID(void) const;
ZafClassName ClassName(void) const;
```

These two member functions overload the ZafElement::ClassID() and ZafElement::ClassName() functions, by returning the added class identification ID_ZAF_WINDOW_OBJECT and string "ZafWindowObject."

The static members classID and className are used as internal place-holders for the class's name and identification. They should not be used or set by the programmer.

Convert Functions

This group of advanced functions is used to convert ZAF information to OS information, or vise-versa. Typically, you will not need to use these functions. They are provided as convenience functions for derived window objects that create and manipulate OS information directly. Nevertheless, their functionality is described briefly here, to help you understand the relationship of events, coordinates and regions from ZAF to environment specific GUIs.

ZAF provides a mid-layered product that insulates you from the specific nuances of each operating environment. These differences are particularly acute in the area of coordinates and keyboard translation. The convert routines described in this section give Zinc the ability to "hide" most of the OS specific mechanics to provide a consistent cross-platform application environment. With this introduction, here are specific descriptions of the various convert functions:

ConvertCoordinates

```
virtual void ConvertCoordinates(ZafCoordinateType
    coordinateType);
```

ConvertCoordinates This function converts zafRegion using ConvertRegion() with the specified coordinate type.

ConvertRegion

```
virtual void ConvertRegion(ZafRegionStruct &region,
    ZafCoordinateType newType);
```

ConvertRegion This function encapsulates the conversion of all regions relevant to the window object. This is not a ZAF to OS conversion, rather a current type (cell, mini-cell, pixel, point, twips) to OS type (generally pixel based). This function is generally used to encapsulate a zafRegion.ConvertCoordinates() call, but for advanced or composite classes, such as scrolled window, it not only encapsulates the zafRegion conversion, but also provides a mechanism to convert private variables, such as scrollRegion.

ConvertToDraw-Region

```
virtual ZafRegionStruct ConvertToDrawRegion(const
   ZafWindowObject *object, const ZafRegionStruct
   *zafRegion = ZAF_NULLP(ZafRegionStruct)) const;
```

ConvertToDrawRegion This function converts the object's zafRegion to a region compatible with the environments display. This function is used in conjunction with BeginDraw() to determine the actual coordinates you need to use when calling display functions, such as: Text(), Rectangle(), Line(), etc. This return region can also be used directly with the environment specific display APIs. For example, the Windows API to draw a rectangle is Rectangle() or FillRect() depending on the fill specification. The region passed back from ConvertToDrawRegion() can be used directly with these native API calls, or with ZafDisplay calls.

ConvertToObject-Position

ConvertToScreen-Position

```
virtual ZafPositionStruct ConvertToObjectPosition(const
   ZafPositionStruct screenPosition) const;
virtual ZafPositionStruct ConvertToScreenPosition(const
   ZafPositionStruct objectPosition) const;
```

These functions convert a global screen display position (relative to the top left corner of the screen) to a ZAF object position, and vice-versa. These functions are particularly useful when a position must be used in a completely different context. (Programmers may also find ConvertToScreenPosition useful when preparing coordinates for a call to a native operating system API.)

For example, a programmer may trap a right-mouse click on a window and desire to display a pop-up menu at the coordinates of the click. Because the original event was trapped at the window level, LogicalEvent() will have returned window-based coordinates. The popup menu must be attached to the window manager using screen coordinates, however. ConvertToScreenPosition() is the solution. The reverse condition may exist if a position is obtained at the ZafEventManager or ZafWindowManager level and requires conversion to an object-relative coordinate for use by a window object.

Finally, these functions may be used to convert between two window object coordinate systems by using screen position as a temporary conversion. For example, a group child receives a click which must be used by its parent group's parent window. ConvertToScreenPosition() followed by parent->parent->ConvertToObjectPosition() will yield the correctly converted coordinate.

LogicalEvent() also converts mouse coordinates relative to the calling object. In some cases this may provide a more straight-forward solution. See LogicalEvent() for more information.

ConvertToOSPosition

ConvertToZafPosition

```
virtual ZafPositionStruct ConvertToOSPosition(const
   ZafWindowObject *object, const ZafPositionStruct
   *zafPosition = ZAF_NULLP(ZafPositionStruct)) const;
virtual ZafPositionStruct ConvertToZafPosition(const
   ZafWindowObject *object, const ZafPositionStruct
   *osPosition = ZAF_NULLP(ZafPositionStruct)) const;
```

These functions convert a ZAF position to an OS position, and vice-versa. Other sections of this manual describe the ZAF coordinate system. It is a 0,0 left-top based system that places objects either in a “client” region (if it is a normal window object), or in a “frame” region (if it is a support object).

Sometimes these ZAF positions match the OS, other times, they do not. These functions allow Zinc to readjust the position based on potential coordinate shifting needs, including: shadowing, bordering, native vs. non-native OS objects, etc.

ConvertToOSRegion

ConvertToZafRegion

```
virtual ZafRegionStruct ConvertToOSRegion(const
   ZafWindowObject *object, const ZafRegionStruct
   *zafRegion = ZAF_NULLP(ZafRegionStruct)) const;
virtual ZafRegionStruct ConvertToZafRegion(const
   ZafWindowObject *object, const ZafRegionStruct
   *osRegion = ZAF_NULLP(ZafRegionStruct)) const;
```

These functions are very similar to the position functions, except that they convert full regions, not just a single point. Normally, this function simply makes two calls to ConvertToOSPosition(), to compute the top-left and bottom-right positions of the region, but occasionally, the region needs additional computations. For instance, Motif automatically sizes the region of toolbars to account for a small border area around its children. This is done by computing the actual OS region, based on zafRegion, then by adding a 2-pixel boundary to the region. The overload of ConvertToOSRegion() allows for this modification.

ConvertToZafEvent

```
virtual bool ConvertToZafEvent(ZafEventStruct &event);
```

ConvertToZafEvent() is the most comprehensive of the convert functions. The main aspects of this function are to convert OS specific keyboard and mouse event data (such as KeyPress, WM_KEYPRESS, keyDown) to ZAF portable key and position interpretations. The two parts of the event structure that may be converted are event.key and event.position.

If the passed event is an OS specific keyboard event, ZAF determines the modifiers (S_SHIFT, S_CTRL, S_ALT) and key values. For instance, on Motif, a keyboard's shift state information is passed by xEvent.xkey.state and the pressed key is represented by xEvent.xkey. To get ZAF equivalents, we must look at each xkey.state and map to the ZAF equivalent, then call XLookupString() to get the ascii value of the key.

If the event is an OS specific mouse event, ZAF must not only determine the keyboard's shift state, but also convert the native OS position to a coordinate understood and relevant to ZAF. This is done by looking at OS position, looking at the intended target, and then converting the position based on our understanding of the environment specific coordinates, versus the coordinate required by portable ZAF. In Windows, this means calling the ClientToScreen() API, then adjusting the coordinate to not be Windows "client" based.

Most of these functions take object as a parameter. This can be a little confusing since the functions are, themselves, member functions that have a this pointer. The reason for this parameter is to give context to the requesting object. You should always make a position or region request to your parent, or to the window manager if there is no parent.

Here are some sample code snippets from ZAF's library that show the correct use of these convert functions.

```
void ZafWindowObject::OSSize(void)
{
  // Convert to the os region.
  ZafRegionStruct newRegion;
  if (parent)
    newRegion = parent->ConvertToOSRegion(this, &zafRegion);
  else
    newRegion = windowManager->ConvertToOSRegion(this,
    &zafRegion);
  ...
}

void ZafScrolledWindow::ConvertCoordinates(ZafCoordinateType
    newType)
{
  ConvertRegion(zafRegion, newType);
  ConvertRegion(scrollRegion, newType);
}

// Check for a converted event.
```

```
if (event.converted != this)
  ConvertToZafEvent(event);
```

CoordinateType

```
ZafCoordinateType CoordinateType(void) const;
virtual ZafCoordinateType
   SetCoordinateType(ZafCoordinateType coordinateType);
```

ZAF allows you to specify an object's initial coordinates in terms of cells, minicells, pixels, points, or twips. Here is a description of what each enumerated value means:

Type	Description

ZAF_CELL	A value based on the size of ZAF_DIALOG_FONT. This value calculates the average height and width of a character in the dialog font, and adds information such as pre- and post-spacing, margin widths, border widths, etc. to determine the optimal size of a cell on the particular environment.
	
	The pixel conversion values for ZAF_CELL are contained in two ZafCoordinateStruct members, cellHeight and cellWidth which are determined at run-time by the ZafDisplay constructor.
	
	`int ZafCoordinateStruct::cellHeight;`
	`int ZafCoordinateStruct::cellWidth;`

ZAF_MINICELL	A fractional cell. ZAF defines mini-numerator and denominator values in ZafCoordinateStruct. These values are used to subdivide a cell into programmer-defined units. Minicells provide a higher degree of positional control than cells without compromising portability more than necessary.
	
	These ZafCoordinateStruct values are pre-defined to be the following values:
	
	`long ZafCoordinateStruct::miniNumeratorX = 1;`
	`long ZafCoordinateStruct::miniDenominatorX = 10;`
	`long ZafCoordinateStruct::miniNumeratorY = 1;`
	`long ZafCoordinateStruct::miniDenominatorY = 10;`

Type	Description
`ZAF_PIXEL`	A pixel based value. Most systems run in "pixel-based" coordinates which, if specified, means your object's region will not need conversion by the operating environment. This allows the exact placement of objects in a window, sometimes essential when presenting graphical information to the display. The use of this type is discouraged on text information objects, because the size of font is environment dependent, thus causing size problems when the exact font size for a particular environment is unknown.

`ZAF_POINTS`	A value based on the size of the default system font. The relationship of this value to pixels is determined at run-time, but is based on a general formula that 72 points equal a theoretical inch.
	
	The pixel conversion values for ZAF_POINTS are contained in two ZafCoordinateStruct members, pixelsPerInchX and pixelsPerInchY and are determined at run-time by the ZafDisplay constructor.
	
	`long ZafCoordinateStruct::pixelsPerInchX;`
	`long ZafCoordinateStruct::pixelsPerInchY;`

`ZAF_TWIPS`	Defined to be 1/20 of a point. This value is computed at run-time, based on the value of the ZafCoordinateStruct pixelsPerInchX and pixelsPerInchY members.

By default, all coordinates passed to an object's constructor are considered to be ZAF_CELL based. Thus, specifying a different coordinate type requires you to pass initial coordinate values to the constructor and then to specify the changed coordinate type through the SetCoordinateType() function. Here is some sample code that show how this is accomplished.

```
// Set the window to pixel based.
ZafWindow *window = new ZafWindow(0, 0, 500, 100);
window->SetCoordinateType(ZAF_PIXEL);

// Set all children to be twip based coordinates.
for (ZafWindowObject *object = First(); object; object = object-
    >Next())
  object->SetCoordinateType(ZAF_TWIPS);
```

Resetting the coordinate type is valid up to the point when the object is presented to the screen. Actual coordinate conversion takes place when the S_INITIALIZE message is sent to the object (this message is sent when the object is added to the screen), and thus changes after this conversion are meaningless. Therefore, once the object's coordinates have been converted to native system values, calls to SetCoordinateType() are rejected.

Note, the original CoordinateType() value is preserved with the object, even though the actual coordinates are changed at run-time. Thus, even though an object may have converted its position and size to be pixel-based, the return value of CoordinateType() will still be ZAF_CELL. To view the current run-time coordinate of an object, you should evaluate the zafRegion.CoordinateType() variable. Here is some code that shows these two usages.

```
// Create a point-based object.
ZafString *string = new ZafString(20, 20, 100, "string", 100);
string->SetCoordinateType(ZAF_POINTS);
...

// Evaluate the coordinates.
if (string->CoordinateType() != string-
    >zafRegion.CoordinateType())
  ...
  // string->CoordinateType() is ZAF_POINTS, but
  // string->zafRegion.CoordinateType() will vary depending
  // on the current state of the string object.
```

The return value for CoordinateType() and SetCoordinateType() is the initial, or enumerated value associated with the object (cell, mini-cell, pixel, point, or twips). Under normal circumstances, this will be the value passed into the SetCoordinateType() function, but may be a different value if one of the conditions described above is met.

CopyDraggable

```
bool CopyDraggable(void) const;
bool SetCopyDraggable(bool copyDraggable);
```

See ZafWindowObject::Draggable().

DefaultUser-Function

```
ZafEventType DefaultUserFunction(const ZafEventStruct
   &event, ZafEventType ccode);
```

DefaultUserFunction() provides a simple notification mechanism that chains to a programmer specified user-function when the following events occur:

Event	Description
`N_NON_CURRENT`	When Focus() changes from “true” to “false.” When this event occurs, the user has either tabbed onto another field, or has moved the focus to another object using the mouse. If you have specified a user-function, it will be called with this message.
`N_CURRENT`	Focus() changes from “false” to “true.” When this event occurs, the user has selected the receiving object, moving the focus to the object. If you have specified a user-function, it will be called with this message.
`L_SELECT (keyboard)`	User presses a selection key (usually the space bar, or <Enter> key). When this occurs and if you specify a user-function, the function is called with this message, but the contents of the event argument will be event.InputType() == E_KEY, signifying that a key event caused the selection.
`L_SELECT (mouse)`	User clicks the mouse button while being positioned over the object. When this occurs and if you specify a user-function, the function is called with this message, but the contents of the event argument will contain an event.InputType() of E_MOUSE, signifying that a mouse event caused the user-function to be called.
`L_DOUBLE_CLICK`	User double-clicks on the object. When this occurs and if you specify a user-function, the user-function is called with this message. The contents of the event structure will be of type E_MOUSE, signifying that a mouse event caused the user-function to be called.

If you have not supplied a user-function with the object, this function has no effect in the application. It simply provides a “hooking” mechanism for user callbacks, rather than a more advanced concept known as derived pointers to member functions. These advanced concepts are discussed more fully in ZafWindowObject::memberUserFunction.

A user function returns 0 if no error occurs; otherwise it returns a non-zero value. Here are some sample code snippets that show how the Default-UserFunction() is set, and used in an application.

```
// Reset an object’s member function.
object->memberUserFunction = DefaultUserFunction;

// Advanced ZafButton code that resets notification.
bool ZafButton::SetSendMessageWhenSelected(bool
    setSendMessageWhenSelected)
{
  // Make sure the attribute has changed.
  if (sendMessageWhenSelected != setSendMessageWhenSelected &&
    !screenID)
  {
    sendMessageWhenSelected = setSendMessageWhenSelected;
    if (sendMessageWhenSelected)
      memberUserFunction =
    (MemberUserFunction)&ZafButton::SendMessage;
    else
      memberUserFunction = ZafWindowObject::DefaultUserFunction;
  }

  // Return the current attribute.
  return (sendMessageWhenSelected);
}
```

Disabled

bool **Disabled**(void) const;
bool **SetDisabled**(bool disabled);

When an object is “disabled” it is typically presented as a grayed out object and does not allow any user interaction. It therefore cannot receive the input focus, cannot be tabbed on, and cannot receive keyboard or mouse events. The exact visual presentation depends on the operating environment, but is typically shown as a “dithered” text with shaded, rather than full-dark borders. This immediately tells the user, the object is not available for user selection or input.

Here is some sample code that shows the correct use of SetDisabled().

```
// Place two objects in the window setting one disabled.
ZafButton *button1 = new ZafButton(2, 2, 20, "Save",
    ZAF_NULLP(ZafBitmapData));
window->Add(button1);
ZafButton *button2 = new ZafButton(22, 2, 20, "Delete",
    ZAF_NULLP(ZafBitmapData));
```

```
button2->SetDisabled(true);
window->Add(button2);

// Check the status of an object.
if (!object->Disabled())
  object->SetHelpContext("ObjectHelp");

// Disable a window, with all its children.
window->SetDisabled(true);
```

Note, setting the disabled attribute on a parent object causes all of the children to become disabled, even though their individual disabled states may not be "true." SetDisabled() functionality is thus propagated to children, grandchildren, etc., but only through inheritance, not by value replacement (i.e. the child object's disabled variable is not reset to be the same as the parent's value). Once the Disabled() state is set back to false, the visual and input settings of children are restored.

The return value for Disabled() and SetDisabled() is the final, or current disabled state of the object (true or false). Under normal circumstances, this will be the value passed into the SetDisabled() function.

display

`static ZafDisplay *`**`display`**`;`

This is a static pointer to the application's display. It is initialized when the ZafWindowManager constructor is called and should not be modified. All derived window objects use this member when drawing information to the screen. They do not use the global zafDisplay member.

Here is a code snippet that shows how the Motif ZafButton::Draw() function uses the display member variable.

```
ZafEventType ZafButton::Draw(const ZafEventStruct &,
    ZafEventType ccode)
{
  ZafRegionStruct drawRegion = BeginDraw();
  ...

  // Draw the border for flat buttons.
  if (Bordered() && buttonType != ZAF_3D_BUTTON)
  {
    display->SetPalette(LogicalPalette(ZAF_PM_OUTLINE, state));
    display->Rectangle(drawRegion, 1, false);
    drawRegion--;
  }
  ...
}
```

This member, as well as the static ZafWindowObject::eventManager and ZafWindowObject::windowManager members are duplicate copies of the global variables zafDisplay, zafEventManager, and zafWindowManager. They are defined in the base ZafWindowObject class to allow advanced ZAF programmers the opportunity of removing the static definition, thus allowing particular instance variables to be associated with each window object; a feature useful in some multi-display and embedded system applications.

DragDropEvent

```
virtual ZafEventType DragDropEvent(const ZafEventStruct
   &event);
```

This function is used internally by ZAF as a dispatch function for system defined drag/drop messages and should not normally be overloaded by the programmer. These messages include:

- `S_DRAG_DEFAULT`
- `S_DRAG_MOVE`
- `S_DRAG_COPY`
- `S_DRAG_LINK`
- `S_DROP_DEFAULT`
- `S_DROP_COPY`
- `S_DROP_MOVE`
- `S_DROP_LINK`
- `S_BEGIN_DRAG`
- `S_END_DRAG`

Whenever an object receives a drag/drop sequence of messages, the messages are first intercepted in the object's Event() function. To allow for more encapsulation and a more efficient handling of similar drag/drop functionality, ZAF defines DragDropEvent() which may be called by the base ZafWindowObject class whenever one of the aforementioned messages is generated.

The programmer should not call DragDropEvent(), but it is used internally by ZAF. When deriving to intercept drag/drop events, the programmer should always use the Event() function itself.

The return value for DragDropEvent() is normally event.type if processing is successful. Otherwise, S_ERROR or S_UNKNOWN may be returned, indicating the object either detected an error on the message, or that the function did not recognize the specified message.

Draggable
```
bool Draggable(void) const;
```
CopyDraggable
```
bool CopyDraggable(void) const;
bool SetCopyDraggable(bool copyDraggable);
```
MoveDraggable
```
bool MoveDraggable(void) const;
bool SetMoveDraggable(bool moveDraggable);
```
LinkDraggable
```
bool LinkDraggable(void) const;
bool SetLinkDraggable(bool linkDraggable);
```

These functions are part of a suite of drag/drop functions and attributes that allow the user to move, copy, or link application specific data from one object to another. Although different in actual presentation, all environments provide visual queues to the user when they permit drag and drop operations from one object to another. For example, the Windows environment shows a copy or move folder when a draggable object is picked-up in a dragging operation, then interactively shows either the continued copy/move image when positioned over a dropable object, or a cancel image if the mouse is positioned over an object that does not allow drop operations.

Draggable() is a “read-only” function that indicates whether the MoveDraggable(), CopyDraggable() or LinkDraggable() attributes are set for the object. Generally, ZAF objects provide enough drag/drop functionality so that you will not need to evaluate the drag capability of an object. But in cases where you derive window objects, or where you are working on specific drag/drop capabilities, you will want to determine whether an object can be dragged, but will not be interested in exactly what type of drag operation can be performed. This function provides an efficient method for determining this drag state without calling each drag function separately. Its “read-only” status means you must use the SetMoveDraggable(), SetCopyDraggable() and SetLinkDraggable() functions to set the drag option on an object, there is no SetDraggable() function.

The following code shows how you might use the Draggable() function in your application.

```
// Example 1: Turn on the drag capability of run-time objects.
ZafEventType MyWindow::MemberCallback(ZafEventStruct &event,
    ZafEventType ccode)
{
  // Turn on the drag capabilities of all string objects.
  if (ccode == L_SELECT && allowDragButton->Selected())
    for (ZafWindowObject *object = First(); object; object =
    object->Next())
      if (object->IsA("ZafString") && !object->Draggable())
        object->SetCopyDraggable(true);
  return (0);
}
```

```
// Example 2: A derived window object.
ZafEventType MyObject::Event(const ZafEventStruct &event)
{
  switch (LogicalEvent(event))
  {
  case L_BEGIN_SELECT:
    // Determine the drag capability of the object.
    if ((event.rawCode & M_MIDDLE) && Draggable())
      ...  // object can be dragged.
  }
}
```

The return value for each of these Draggable() functions is the final, or current drag state of the object (true or false). Under normal circumstances, this will be the value passed into the Set*Draggable() functions.

Draw

```
virtual ZafEventType Draw(const ZafEventStruct &event,
    ZafEventType ccode);
```

DrawBackground

```
virtual ZafEventType DrawBackground(ZafRegionStruct
    &region, ZafEventType ccode);
```

ZAF enables you to customize the appearance of an object by deriving from ZafWindowObject or some other displayable ZAF class and overriding the Draw() function. Draw() is called whenever the system needs the object to update part, or all of its information to the screen. In overloaded Draw() implementations, drawing should be encapsulated by BeginDraw() and End-Draw() calls, and ZafDisplay::SetPalette() should be called before using ZafDisplay's drawing primitives. Draw() returns S_ERROR if some error occurs; otherwise it returns *ccode*.

DrawBackground() is called whenever the system needs the clear the area behind an object. DrawBorder(), DrawFocus() and DrawShadow() are ZAF defined functions that perform common drawing operations. They should only be used within the context of a drawing operation.

DrawBorder

```
virtual ZafEventType DrawBorder(ZafRegionStruct &region,
    ZafEventType ccode);
```

DrawBorder() typically draws an OS specific border, generally a chiseled 3-D shape; but also detects for other GUI environments that draw a 1 pixel rectan-gle. Note, the region value passed to DrawBorder() is not a constant argument. Thus, the value associated with this region is changed according to the border width. For example, a 2-pixel border will adjust the specified region in, by 2 pixels. This allows you to automatically know what area of the object is still available for drawing operations.

DrawFocus

```
virtual ZafEventType DrawFocus(ZafRegionStruct &region,
   ZafEventType ccode);
```

DrawFocus() draws an OS specific focus rectangle that surrounds the object. This is typically a one- or two-pixel black rectangle that encompasses the object, showing it as the "point-of-focus." Note, as with DrawBorder(), the specified region is not a constant argument. On most environments, whether the focus rectangle is drawn, or not, the value of region is adjusted by the environment's natural focus rectangle size.

DrawShadow

```
virtual ZafEventType DrawShadow(ZafRegionStruct &region,
   int depth, ZafEventType ccode);
```

DrawShadow() differs from DrawBorder() because you specify the pixel depth size of the shadow to be drawn, and also because the function always draws a 3-dimensional shadow, not just the type of shadow specified by the native operating environment. The range of depth can be positive or negative. A negative value represents an indented shadow, generally associated with an object that has been "pushed-in" or that needs to be shown in a "depressed" state. As with DrawBorder() and DrawFocus(), the value of region is adjusted by the absolute depth of the shadow being drawn.

As you can see, most of the Draw*() functions described above, modify the specified region. Thus, calls to these functions should be done in a systemized manner, and should anticipate the adjustment of the region value. Here is some code that shows how one implementation of the ZafButton::Draw() function anticipates these region adjustments:

```
ZafEventType ZafButton::Draw(const ZafEventStruct &,
   ZafEventType ccode)
{
  // Compute the actual draw region.
  ZafRegionStruct drawRegion = BeginDraw();

  // Draw the focus.
  DrawFocus(drawRegion, Focus() ? S_CURRENT : S_NON_CURRENT);

  // Draw the shadow and fill the region.
  if (ButtonType() != ZAF_RADIO_BUTTON && ButtonType() !=
    ZAF_CHECK_BOX)
    DrawShadow(drawRegion, (Depressed() || Selected()) ? -depth
    : depth, ccode);
  ...
  EndDraw();
  return (ccode);
}
```

Here are a few more important notes associated with the Draw() and related functions:

- DrawBackground() should not be used within the Draw() function. All ZAF supported environments clear the background of an object with a method independent of the Draw() function. Thus, this function is generally called immediately before the Draw() function is called.
- The Draw() operation is called from the operating environment, and should not be initiated by the programmer. The correct way to cause an object's refresh is to call Redisplay() or RedisplayData(). Calling these functions causes Draw() to be called, but does it in coordination with the operating environment.
- Finally, the members BeginDraw() and EndDraw() must be called within your Draw() function to ensure the proper initialization of drawing arguments. For more information on these functions see ZafWindowObject::BeginDraw().

Here is some sample code that shows the correct use, and sequence of drawing operations within the Draw() function.

```
class TicTacToeCell : public ZafButton

ZafEventType TicTacToeCell::Draw(const ZafEventStruct &,
    ZafEventType ccode)
{
  // Compute the actual draw region.
  ZafRegionStruct drawRegion = BeginDraw();

  // Draw the focus.
  DrawFocus(drawRegion, Focus() ? S_CURRENT : S_NON_CURRENT);

  // Draw the shadow.
  DrawShadow(drawRegion, (Depressed() || Selected()) ? -depth :
    depth, ccode);

  // Draw the X or O.
  ZafPaletteState state = PaletteState();
  display->SetPalette(LogicalPalette(ZAF_PM_OUTLINE, state));
  if (MarkedWithAnX())
  {
    display->Line(drawRegion.left, drawRegion.top,
    drawRegion.right,
      drawRegion.bottom);
    display->Line(drawRegion.left, drawRegion.bottom,
    drawRegion.right,
      drawRegion.top);
  }
  else if (MarkedWithAnO())
    display->Ellipse(drawRegion.left, drawRegion.top,
    drawRegion.right,
      drawRegion.bottom, 0, 360);

  // Return the control code.
  EndDraw();
  return (ccode);
}
```

Note, the Draw() function will not be called for derived ZafWindowObjects on some environments unless “OSDraw() == false.” See ZafWindowObject::OSDraw() for more information on this function and its required use in derived class Draw() functions.

The return value for all Draw*() functions should be the passed ccode if processing is successful. Otherwise, the function should return the values S_ERROR or S_UNKNOWN indicating the object either detected an error on the message, or that the function did not recognize the specified message.

Duplicate

`virtual ZafWindowObject *`**`Duplicate`**`(void);`

This function creates a full-depth copy of “this” and returns a pointer to the copy. This function is declared virtual so derived objects can add their own copy constructors. The actual definition of this function by each ZAF object is a call to the object’s copy constructor:

```
virtual ZafWindowObject *Duplicate(void) { return (new
   ZafWindowObject(*this)); }
virtual ZafWindowObject *Duplicate(void) { return (new
   ZafWindow(*this)); }
virtual ZafWindowObject *Duplicate(void) { return (new
   ZafVtList(*this)); }
```

There is no particular advantage to using Duplicate() if you know the type of the object being copied. But if you are dealing with abstract lists of window objects or multiple-layered windows, Duplicate() is the only effective method of performing a depth copy on the object. Here is an example that shows this functionality.

```
// Example 1: Create, then copy a string object.
```

```
ZafString *string1 = new ZafString(2, 2, 20, "message1", 100);
string1->SetBordered(false);
string1->SetTextColor(ZAF_CLR_BLUE);
string1->SetAutoClear(true);

ZafString *string2 = new ZafString(*string1); // A lot easier
    than the code above.
string2->SetText("message2");

ZafString *string3 = string2->Duplicate(); // Almost like
    calling the copy constructor.
string3->SetText("message 3");

// Example 2: Depth-copy the children from one window to
    another.
extern ZafWindow *srcWindow, *dstWindow;
for (ZafWindowObject *object = srcWindow->First(); object;
    object = object->Next())
  dstWindow->Add(object->Duplicate());
```

EditMode

`bool` **`EditMode`**`(void) const;`
`virtual bool` **`SetEditMode`**`(bool editMode);`

If EditMode() is true, the object acts as if it were being editted by Zinc Designer. The EditMode() object may be moved and sized on its parent, and it receives various D_* events associated with Zinc Designer that are defined in the header file z_dsnevt.hpp. The normal value of this attribute is false, but it may be changed by calling SetEditMode().

The return value for EditMode() and SetEditMode() is the final, or current edit-mode attribute associated with the object (true or false). Under normal circumstances, this will be the value passed into the SetEditMode() function, but may be different if the object does not allow edit mode.

EndDraw

`void` **`EndDraw`**`(void);`

See ZafWindowObject::BeginDraw().

Error

`ZafError` **`Error`**`(void) const;`
`ZafError` **`SetError`**`(ZafError error);`

These functions get/set the error state of a window object. The types of errors that can be set are defined in z_env.hpp. Generally, however, only the following error values will be used by a ZafWindowObject object:

Error Value	Description
ZAF_ERROR_NONE	No error exists.
ZAF_ERROR_INVALID	The contents of the window object are invalid, meaning the object's value can be shown on the screen, but that the data is incorrect in the context of the application. For instance, the value 45 is a legitimate value for an integer field, but is invalid when used to describe the total number of days permitted in the month of February.
ZAF_ERROR_OUT_OF_RANGE ZAF_ERROR_LESS_THAN_RANGE ZAF_ERROR_GREATER_THAN_RANGE	An error occurred while trying to convert data from one type to another or where the argument was too big for the return value. For example, a value of 10E+100 will not fit into a ZafInteger type field.

In addition to the error types described above, error values greater than or equal to 10,000 are reserved for your use on user defined objects. The following code fragments show how to define and use your own error value with a derived data object.

```
// Define the class and constant.
const ZafError MY_APPLICATION_IS_DYING = 10000;
class AvailableMemory : public ZafInteger
...

// Create a new eject button.
AvailableMemory *memory = new AvailableMemory;

// Check for memory error.
if (memory->IntegerData()->Value() < someRandomValue)
  memory->SetError(MY_APPLICATION_IS_DYING);
...

// Check the error status.
if (memory->Error())
  exit(); // Die Hard!
```

Event

`virtual ZafEventType **Event**(const ZafEventStruct &event);`

This function provides the core connection between event driven environment specific architectures and the object-oriented architecture supported by ZAF. This function receives four general types of events:

- ZAF system events represented by S_* messages.
- ZAF notification events represented by N_* messages.
- ZAF logical interpreted events represented by L_* messages.
- Environment specific events where event.type is E_OSEVENT and the environment specific message is specified by event.osEvent.

Some types of events are dispatched to other functions. These functions are DragDropEvent(), MoveEvent(), and ScrollEvent(). The programmer should not call these specialized functions, but they are used internally by ZAF. When deriving to intercept events, the programmer should always use the Event() function itself.

Here is the specific handling of these types of messages within the ZafWindowObject::Event() function. (See the Event Definitions Appendix for a complete list of supported events and functionality.)

Message	Handling
`S_COMPUTE_SIZE`	Causes the object to recalculate its zafRegion. The region is not modified if RegionType() is ZAF_INSIDE_REGION, but is recomputed by the parent's MaxRegion() function if any other type is specified.
`S_CREATE`	Causes the object to be created by dispatching an S_INITIALIZE, S_REGISTER_OBJECT and S_COMPUTE_SIZE message.
`S_CURRENT` `S_NON_CURRENT`	Causes the Focus() member to be reset to "true" if S_CURRENT is sent, or "false" if the message is S_NON_CURRENT.
`S_DEINITIALIZE`	Causes the object to clear the screenID variable. This message updates the ZAF environment to match the deleted OS object.

Message	Handling
`S_DESTROY`	Destroys the OS part of the object. This message dispatches an S_DEINITIALIZE message and causes the OS object to be destroyed using environment specific API calls.

`S_DRAG_DEFAULT`
`S_DRAG_MOVE`
`S_DRAG_COPY`
`S_DRAG_LINK`
`S_DROP_DEFAULT`
`S_DROP_MOVE`
`S_DROP_COPY`
`S_DROP_LINK`
`S_BEGIN_DRAG`
`S_END_DRAG`
	These messages are dispatched to DragDropEvent(). For more information, see the ZafWindowObject::DragDropEvent() section of this chapter.

`S_INITIALIZE`	Causes the object to (1) ensure the zafRegion coordinates are converted for the native environment and (2) guarantee that the object's StringID() and NumberID() are valid. The algorithm used to set these values is to traverse to the root window, use the window's current number identification, update the root identification, then to set the StringID() according to the contents of the NumberID() (e.g. a NumberID() of 10 results in a default StringID() of "FIELD_10"). The NumberID() and StringID() variables are not reset if you have already associated a NumberID() and StringID() value with the object.
`S_REDISPLAY`	Causes the whole object to be redrawn. This message ensures that the background is cleared and all pertinent information updated on the display.

Message	Handling
`S_REDISPLAY_DATA`	Causes only the data portion of the object to be redrawn. Since ZafWindowObject has no data portion, the default operation of this message is to request the redisplay of all the object except the border and shadow area (if any).
`S_REDISPLAY_REGION`	Causes a particular area of the field to be updated. The updated area is contained in event.region and should be relative to the object's region (0,0 left-top coordinate based on the interior area of the object to be redisplayed).
`S_REGISTER_OBJECT`	Causes the object to be registered with the operating environment by calling the virtual RegisterObject() function.
`S_SIZE`	Causes the object to be re-positioned, and the size to be modified according to event.region.
`S_HELP`	Causes the help system to be called with a requested help context contained in HelpContext().

`S_VSCROLL`
`S_HSCROLL`
`S_VSCROLL_SET`
`S_HSCROLL_SET`
`S_VSCROLL_CHECK`
`S_HSCROLL_CHECK`
`S_VSCROLL_COMPUTE`
`S_HSCROLL_COMPUTE`
`N_VSCROLL`
`N_HSCROLL`
	These messages are dispatched to ScrollEvent(). For more information, see the ZafWindowObject::ScrollEvent() section of this chapter.

`N_NON_CURRENT`	Called just before the object loses focus. Causes userFunction to be called with N_NON_CURRENT as the message type. If the object cannot lose the input focus, the user-function should return a non-zero value. A zero indicates the object can lose the input focus.

Message	Handling
`N_CURRENT`	Called just after the object gains focus. Causes userFunction to be called with N_CURRENT as the message type.
`N_MOUSE_ENTER`	Causes the QuickTip() and HelpObjectTip() information to be updated on the screen, if you have attached a ZafHelpTips device to the application's event manager.
`N_MOUSE_LEAVE`	Causes the QuickTip() and HelpObjectTip() information associated with this object to be removed from the screen, if you have attached a ZafHelpTips device to the application's event manager.
`L_HELP`	Causes the ZafHelpSystem object to be called with the object's HelpContext().
`E_KEY`	Ignored by the ZafWindowObject class, but available for use with derived objects. This value is typically returned by ZafEventStruct::InputType() whenever the OS generates a key-press or key-release message. If interpreted, you should only look at the event.key.value and event.key.shiftState portion of the event structure.
`E_MOUSE`	Ignored by the ZafWindowObject class, but available for use by derived objects. Typically, this value is returned by ZafEventStruct::InputType(). If interpreted after a call to LogicalEvent(), the event structure contains portable ZAF coordinates and shift-state information in event.position, event.rawCode, and event.modifiers. The specific contents of the event structure are:
`event.position`	Contains a ZAF "0,0,left-top" based coordinate that identifies a position within the receiving window object.

Message	Handling
`event.rawCode`	Contains a combination of the ZAF defined mouse states: M_LEFT, M_LEFT_CHANGE, M_MIDDLE, M_MIDDLE_CHANGE, M_RIGHT, and/or M_RIGHT_CHANGE. These states are converted into OS specific parameters that describe the mouse on the native environment.
`event.modifiers`	Contains a combination of the ZAF keyboard shift-states including: S_SHIFT, S_RIGHT_SHIFT, S_LEFT_SHIFT, S_CTRL, S_ALT, S_CMD, S_SCROLL_LOCK, S_NUM_LOCK, S_CAPS_LOCK, S_INSERT, and S_OPT.

Events that are tagged with “event.type == E_OSEVENT” are dispatched directly to the underlying operating environment. For example, this code dispatches Windows events from within the Event() function:

```
CallWindowProc((WINDOWSPROC)GetClassLong(event.osEvent.hwnd,
    GCL_WNDPROC), event.osEvent.hwnd, event.osEvent.message,
    event.osEvent.wParam, event.osEvent.lParam));
```

All other events are considered “unknown” to the object and result in the S_UNKNOWN message being returned from the Event() function. Here is some sample code that shows how you could use, or override the default operation of ZafWindowObject::Event().

```
ZafEventType ZafString::Event(const ZafEventStruct &event)
{
...
default:
  // Defer to the immediate base class.
  ccode = ZafWindowObject::Event(event);
  break;
}

ZafEventType ZafWindow::Event(const ZafEventStruct &event)
{
...
case S_REGISTER_OBJECT:
  // Register the object.
  RegisterObject();

  // Register all of the children.
  BroadcastEvent(event);
}

ZafEventType ZafButton::Event(const ZafEventStruct &event)
{
...
case S_INITIALIZE:
  // Override the base class functionality.
  ccode = ZafWindowObject::Event(event);
  if (ButtonType() == ZAF_RADIO_BUTTON && !bitmapData)
  {
    int size = display->cellHeight / 2;
    bitmapData = radioBitmap;
    bitmapData->SetBitmap(size, size, bitmapData->Array());
  }
  else if (ButtonType() == ZAF_CHECK_BOX && !bitmapData)
  {
    int size = display->cellHeight / 2 - display->cellHeight /
    10; // motif algorithm.
    bitmapData = checkBitmap;
    bitmapData->SetBitmap(size, size, bitmapData->Array());
  }
}
```

eventManager

static ZafEventManager ***eventManager**;

This is a static pointer to the application’s event manager. It is initialized when the ZafWindowManager constructor is called and should not be modified. All derived window objects use this member when making requests to the event manager. They do not use the global zafEventManager member.

Here is a code snippet that shows how a derived window object would use eventManager to change the state of the mouse cursor:

```
MyDerivedWindowObject::MemberFunction(void)
{
  // Change the mouse image.
  eventManager->Event(DM_MOVE, E_MOUSE);
}
```

This member, as well as the static ZafWindowObject::display and ZafWindowObject::windowManager members are duplicate copies of the global variables zafDisplay, zafEventManager, and zafWindowManager. They are defined in the base ZafWindowObject class to allow advanced ZAF programmers the opportunity of removing the static definition, thus allowing particular instance variables to be associated with each window object; a feature useful in some multi-display and embedded system applications.

Focus

```
bool Focus(void) const;
bool SetFocus(bool focus);
```

The term “focus” has slightly different definitions, depending on the type of environment you are running under. A good general description of getting “focus” is simply specifying where keyboard and mouse events will be processed and identifying where visual queues, such as highlights or blinking cursors will be presented. When an object has focus, it can generally be distinguished as being at the “center of attention”, whereas, objects that do not have focus, are presented in a manner that does not distinguish them from other objects on the screen.

If you pass “true” as the argument to SetFocus(), the object you specified will become the new focal point on the screen. As mentioned earlier, this will cause a visual and interactive change in your application, so that the specified object is seen as both current, and as receiving all user interaction.

There are two proper ways to call SetFocus(). First, you can always call SetFocus() for the exact object you want to receive the focus.

```
// Give an object focus.
object->SetFocus(true);
```

Second, you can call a parent class instance to give focus to a composite class such as a window or group, but allow the actual focus object to be determined by the window or group that is receiving the focus.

```
// Attach a vertical list to the window.
ZafVerticalList *vtList = new ZafVerticalList(0, 0, 20, 5);
for (int i = 0; i < 10; i++)
  vtList->Add(new ZafString(0, 0, 20, "item", -1));
window->Add(vtList);
...

// Give the vertical list focus.
vtList->SetFocus(true);
```

When such a call is made to any type of object that has children, the focus is pushed down to the current child, or the last child that previously may have had the focus. In this manner, you can programmatically specify a parent object, but really have the focus be applied to a particular child. An extreme example of this would be to give the focus to a particular window, that may have many levels of children. The specification of the root window will ensure the window gets general focus (which may be distinguished by the user by a highlighted title bar), but will cause the focus to be progressively pushed down to the window's current child, grandchild, etc. until a specific focus change is performed.

On most environments, you cannot pass "false" to an object that currently has the focus. The reason is that nearly all environments force a point of focus somewhere on the screen. For portability reasons, ZAF does not define the results of a SetFocus(false) function call.

The window manager's Focus() attribute is true when the application is in the foreground, and false when the application is in the background.

The return value for Focus() and SetFocus() is the final, or current focus state of the object. Under normal circumstances, this value will be the value passed into the SetFocus() function, but may differ if the object is disabled, or does not allow focus changes for a particular reason.

FocusObject

`virtual ZafWindowObject *`**`FocusObject`**`(void);`

FocusObject() returns a pointer to the current object that has the keyboard input focus. The algorithm to determine focus is a depth traversal function that first determines if the focus is on, or within the specified object, then progressively works its way through children, grandchildren, etc. to find the current focus object. If the focus is on another object that is not in the specified object's inheritance tree, then the return value is null.

This function is useful when you want to determine exactly where the focus is in a given application. In DOS, one of the windows attached to the window manager will always have input focus. On other environments, such as Windows, Motif, and Macintosh, the focus may actually be on another application, thus rendering a return value of null.

Here are some simple code samples that shows how to determine the focus of an application, a window, and of a particular window object.

```
// Determine the application’s focus.
if (zafWindowManager->FocusObject())
  ...  // application has focus.

// Change the visual presentation of a window’s current object.
case N_CURRENT:
  if (Current() && FocusObject() == Current())
    Current()->SetBackgroundColor(ZAF_CLR_YELLOW);
  ...
```

```
// Check the current object’s focus.
if (FocusObject() == this)
  printf("Current focus is %s\n", Text());
```

Font

```
ZafLogicalFont Font(void) const;
virtual ZafLogicalFont SetFont(ZafLogicalFont font);
```

Fonts affect the visual presentation of an object’s textual information. Each logical font contains implied information about the font, such as the font family, weight, slant, and point size.

SetFont() changes the logical font associated with the normal presentation of an instantiated object. The following predefined ZAF fonts are supported:

- ZAF_FNT_PARENT
- ZAF_FNT_DEFAULT
- ZAF_FNT_NULL
- ZAF_FNT_SMALL
- ZAF_FNT_DIALOG
- ZAF_FNT_APPLICATION
- ZAF_FNT_SYSTEM
- ZAF_FNT_FIXED

In addition to the pre-defined fonts described above, users can define and use their own logical fonts. For more information on these font specifications, and for more details on derived font entries, see the ZafPaletteStruct and ZafDisplay sections of this manual or ZafWindowObject::UserPaletteData().

Here is some sample code that shows the correct use of SetFont().

```
// Change the text font of the object.
object->SetFont(ZAF_FNT_SMALL);

// Check the current font of an object, and change where
    necessary.
if (object->Font() == ZAF_FNT_NULL)
  object->SetFont(object->parent->Font());

// Change an object’s text font.
object->SetAutomaticUpdate(false);
object->SetBackgroundColor(ZAF_CLR_RED);
object->SetTextColor(ZAF_CLR_WHITE);
object->SetFont(ZAF_FNT_FIXED);
```

```
object->SetAutomaticUpdate(true);
```

The return value for Font() and SetFont() is the final, or current font associated with the object. Under normal circumstances, this will be the font passed into SetFont(), but may be different if the object does not allow for a particular type of font specification.

GetObject

```
virtual ZafWindowObject *GetObject(ZafNumberID numberID);
virtual ZafWindowObject *GetObject(const ZafIChar
    *stringID);
```

These overloaded functions get a child object using the object's NumberID() or StringID() as the matching data. The algorithm for these functions is a depth first search of the children. For example, here is a partial listing of the ZafWindow and ZafWindowObject code used in GetObject:

```
ZafWindowObject *ZafWindow::GetObject(ZafNumberID matchID)
{
  // Try to match on the current object.
  ZafWindowObject *match = ZafWindowObject::GetObject(matchID);

  // All others are depth first searches.
  ZafWindowObject *object;
  for (object = SupportFirst(); object && !match; object =
    object->Next())
    match = object->GetObject(matchID);
  for (object = First(); object && !match; object = object-
    >Next())
    match = object->GetObject(matchID);

  // Return the matching item.
  return (match);
}

ZafWindowObject *ZafWindowObject::GetObject(ZafNumberID
    matchID)
{
  return ((numberID == matchID) ? this :
    ZAF_NULLP(ZafWindowObject));
}
```

Be careful not to associate the same NumberID() or StringID() with two children in the window's search hierarchy. Only the first matching object will be returned.

The following code shows the proper use of this overloaded function:

```
// See if an object exists.
if (window->GetObject("MyTable"))
  break;

// Use the contents of a found class.
ZafWindowObject *object = window->GetObject(ID_NAME_FIELD);
if (object)
  printf("Object found: %s\n", object->StringID());

// Check the condition of an object.
ZafButton *button = DynamicPtrCast(window-
    >GetObject("OK_BUTTON"), ZafButton);
if (button && button->Selected())
  windowManager->Add(new ZafWindow(0, 0, 40, 10));
```

HelpContext

ZafIChar ***HelpContext**(void) const;
virtual ZafIChar ***SetHelpContext**(ZafIChar *helpContext);

SetHelpContext() allows you to specify a particular help context with an object that will be shown in the ZafHelpSystem anytime a user moves to the object and presses the help key (<F1> on most environments).

The help context string needs to be a pre-defined context defined by the ZafHelpSystem. (For more information on creating help contexts see the Zaf-HelpSystem section of this manual.)

The return value for HelpContext() and SetHelpContext() is the current help context string associated with the object (null if no help context is associated with the object). This will always be the value passed into the SetHelpContext() function. The following code shows how to correctly use these functions.

```
// Associate a help context with the window’s children.
window->Add(new ZafPrompt(2, 1, 8, "name:"));
ZafString *name = new ZafString(10, 1, 40, ZAF_NULLP(ZafIChar),
    100);
name->SetHelpContext("NameHelp");
window->Add(name);

window->Add(new ZafPrompt(2, 2, 8, "address:"));
ZafString *address = new ZafString(10, 2, 40,
    ZAF_NULLP(ZafIChar), 100);
address->SetHelpContext("AddressHelp");
window->Add(address);
```

HelpObjectTip

```
const ZafIChar *HelpObjectTip(void) const;
virtual const ZafIChar *SetHelpObjectTip(const ZafIChar
    *helpObjectTip);
```

SetHelpObjectTip(), along with SetQuickTip() allows you to associate help messages with the run-time presentation of an object. HelpObjectTip() generally presents a “status-bar” update of the current window object and is generally more descriptive than a quick-tip. The HelpObjectTip may be displayed on any object that provide Text() and SetText() functions. It is important to note that a ZafHelpTips device must be added to the event manager for help object tips to function (see ZafHelpTips for more information).

The initialization of HelpObjectTip() is slightly different than that of SetQuickTip() because a receiving object must be specified to present the help-tip information. Here is some sample code the shows the initialization of both HelpObjectTip() and QuickTip() for a button object.

```
// Stage 1-Create the help-tip device.
ZafHelpTips *helpTip = new ZafHelpTips(D_ON, ZAF_HELPTIPS_BOTH);
zafEventManager->Add(helpTip);

// Stage 2-Set up the help-object tip.
ZafWindow *window = new ZafWindow(0, 0, 50, 10);
window->AddGenericObjects(new ZafStringData("File Operation"));
ZafStatusBar *helpBar = new ZafStatusBar(0, 0, 0, 1);
ZafString *helpBarString = new ZafString(0, 0, 32, "", 64);
helpBar->Add(helpBarString);
window->Add(helpBar);

helpTip->SetHelpObject(helpBarString);

// Stage 3-Create two objects with quick- and help-tip
    information.
ZafButton *save = new ZafButton(25, 0, 20, "Save",
    ZAF_NULLP(ZafBitmapData));
save->SetQuickTip("Save the application.");
save->SetHelpObjectTip("Select this button to save the
    application.");
window->Add(save);

ZafButton *cancel = new ZafButton(0, 0, 20, "Cancel",
    ZAF_NULLP(ZafBitmapData));
cancel->SetQuickTip("Cancel the save operation.");
cancel->SetHelpObjectTip("Select this button to cancel the save
    operation.");
window->Add(cancel);
```

Note, the help-tip device created above (helpTip) received an associated help object (helpBarString). This object is called with the help-tip information (through the SetText() function) whenever an object needs to update the help-tip information presented to the window.

The return value for HelpObjectTip() and SetHelpObjectTip() is the current string associated with the object. Under normal circumstances, this will be the value passed into the SetHelpObjectTip() function.

InitialDelay

`static int` **`InitialDelay`**`(void);`

`static int` **`SetInitialDelay`**`(int initialDelay);`

RepeatDelay

`static int` **`RepeatDelay`**`(void);`

`static int` **`SetRepeatDelay`**`(int repeatDelay);`

These environment specific functions set the initial and repeat time period, in milliseconds, that a user must press a mouse button and wait, before a repeat signal is sent to a particular object. The most common use of these values is in advanced programming such as that found with the DOS and Motif implementations of ZafScrollBar and ZafSpinControl objects. Although these values are not generally set or used by programmers, the information presented here will help you understand the nuances of user interface.

When a user presses the mouse key over the down-arrow on a scrollbar, there is an initial delay before the text or visual presentation of an associated object begins a continuous scrolling motion. In a multi-line text field, the information will scroll one line up, then, after a short delay will begin repeating the scroll motion, as long as the mouse continues to be pressed over the down-arrow. The initial period of time between the down-click, and the auto-repeated motion is called the initial delay. Once the object begins scrolling, the initial delay is replaced by a repeat delay. It may not seem like there is a difference between these values, but when you analyze this interaction, you will notice there is a slight difference. Repeat delays are typically shorter than initial delays, giving the user time to end a clicking operation before the auto-repeat operation takes effect.

Here is some advanced code that shows how Motif hooks initial and repeat delays with the AutoRepeat() functionality of the ZafButton object.

```
ZafEventType ZafButton::Event(const ZafEventStruct &event)
{
case L_BEGIN_SELECT:
  // Set the repeat process.
  if (AutoRepeatSelection() && SystemObject())
{
    lastMousePosition = event.position;
    if (intervalID)
      XtRemoveTimeOut(intervalID);
    intervalID = XtAppAddTimeOut(display->xAppContext,
    InitialDelay(),
      (XtTimerCallbackProc)Repeat, (XtPointer)this);
  }
  break;

case L_CONTINUE_SELECT:
  // Update the button information.
  if (AutoRepeatSelection() && SystemObject() && Depressed())
  {
    // Continue the repeat process.
    lastMousePosition = event.position;
    if (intervalID)
      XtRemoveTimeOut(intervalID);
    intervalID = XtAppAddTimeOut(display->xAppContext,
    RepeatDelay(),
      (XtTimerCallbackProc)Repeat, (XtPointer)this);
  }
  break;

case L_END_SELECT:
  // End the repeat process.
  if (intervalID)
     XtRemoveTimeOut(intervalID);
  intervalID = 0;
}
```

Note, the use of these variables is environment specific. On systems and classes where default initial and repeat values are used (e.g. all of Windows, ZafScrollBar support object on Motif, etc.) these values have no effect.

The return value for InitialDelay() and RepeatDelay() is the current time interval, in milliseconds, of the delay. These values are static, so a call to SetInitialDelay() and SetRepeat(delay), affect the time intervals on all objects that use the variables.

IsA

```
virtual bool IsA(ZafClassID compareID) const;
virtual bool IsA(ZafClassName compareName) const;
```

These overloaded functions add the const value ID_ZAF_WINDOW_OBJECT and string “ZafWindowObject” to the hierarchical chain of inheritance relationships. Thus, a ZafWindowObject object will not only match IsA() queries for ZafElement, but also for the added ZafWindowObject identification.

```
// Check for a window object.
if (object->IsA(ID_ZAF_WINDOW_OBJECT))
  break;
```

The value returned is "true" if the object is an instantiation of the ZafWindowObject class, or a derived window object class. Otherwise, the return value is "false."

LinkDraggable

```
bool LinkDraggable(void) const;
```

See ZafWindowObject::Draggable().

LogicalEvent

```
ZafLogicalEvent LogicalEvent(const ZafEventStruct
    &event);
```

This function determines the "logical interpretation" of a native OS event, for use in ZAF programming. It should not be confused with the event handling functions of Event(), DragDropEvent(), MoveEvent(), and ScrollEvent().

In particular, this function looks at particular OS events, such as WM_KEYDOWN and WM_KEYUP events on Windows, KeyPress and KeyRelease events on Motif, and keyDown and keyUp events on Macintosh to determine their logical ZAF interpretation (E_KEY, L_SELECT, L_DOWN, etc.) The type of interpretation depends on the receiving object (e.g. ZafString, ZafButton) and the type of event being dispatched (e.g., WM_KEYDOWN, MotionNotify, mouseUp).

A partial list of the default event table associated with the ZafWindow and ZafWindowObject classes follows:

```
ZafEventMap ZAF_FARDATA ZafWindow::defaultEventMap[] =
{
  { L_NEXT, E_KEY, TAB, S_KEYDOWN },
  { L_PREVIOUS, E_KEY, TAB, S_KEYDOWN | S_SHIFT },
  { L_NONE, 0, 0, 0 }
};
ZafEventMap ZAF_FARDATA ZafWindowObject::defaultEventMap[] =
{
  { L_BEGIN_SELECT, E_MOUSE, M_LEFT | M_LEFT_CHANGE, 0 },
  { L_CONTINUE_SELECT, E_MOUSE, M_LEFT, 0 },
  { L_DOUBLE_CLICK, E_MOUSE, M_LEFT | M_LEFT_CHANGE,
    S_DOUBLE_CLICK },
  { L_END_SELECT, E_MOUSE, M_LEFT_CHANGE, 0 },
  { L_VIEW, E_MOUSE, 0, 0 },
  { L_NONE, 0, 0, 0 }
};
```

When a user presses a key, or moves the mouse, an OS specific event is generated. This event has definitions that only apply to the currently running operating environment, but are of little use to ZAF programmers. LogicalEvent() matches these OS specific messages against class event tables, to produce a logical event. For instance, the pressing of a <tab> key produces the following information on Windows and Motif:

```
int ZafEventManager::Get(ZafEventStruct &event, ZafQFlags flags)
{
  #if defined(ZAF_Windows)
  MSG msg;
  if ((Blocked(flags) && !queueBlock.First()) ||
    (!queueBlock.Full() && PeekMessage(&msg, 0, 0, 0,
    PM_NOREMOVE)))
  {
    // Get a Windows message and place it in the Zinc event
    queue.
    GetMessage(&msg, 0, 0, 0);
    Put(ZafEventStruct(E_Windows, &msg));
  }
  #elif defined (ZAF_MOTIF)
  if ((Blocked(flags) && !queueBlock.First()) ||
    (!queueBlock.Full() && XtAppPending(ZafDevice::display-
    >xAppContext)))
  {
    // Block if necessary and process one X event.
    XEvent message;
    XtAppNextEvent(ZafDevice::display->xAppContext, &message);
    ZafEventStruct event(E_MOTIF, &message);
    Put(event, Q_BEGIN);
  }
  #endif
...
}

// Windows.
msg.message == WM_KEYDOWN
msg.wParam == 0x0009

// Motif.
message.type == KeyPress
message.key == XLookupString() which passes back a value of
    XK_Tab.
```

Keyboard definitions, such as TAB, SPACE, ESCAPE, etc. are defined in z_keymap.hpp and contain environment specific values that allow ZAF to match OS specific information with ZAF const values, in order to determine what type of key is pressed:

```
#if defined(ZAF_Windows)
const ZafRawCode ESCAPE = 0x001B;
const ZafRawCode ENTER = 0x000D;
const ZafRawCode TAB = 0x0009;
const ZafRawCode SPACE = 0x0020;
const ZafRawCode BACKSPACE = 0x0008;
#elif defined(ZAF_MOTIF)
const ZafRawCode ESCAPE = XK_Escape;
const ZafRawCode ENTER = XK_Return;
const ZafRawCode TAB = XK_Tab;
const ZafRawCode SPACE = XK_space;
const ZafRawCode BACKSPACE = XK_BackSpace;
#endif
```

These raw OS values are then matched against <defaultMap>.rawCode to determine a match. If a match exists then <defaultMap>.logicalValue is returned.

Coordinate Conversions

In addition to this simple event translation (raw event -> logical mapping), LogicalEvent() also causes mouse coordinates to be converted relative to the calling object. For example, a mouse click on a group child generates a raw event that ultimate arrives at the group child. The programmer calls LogicalEvent(event) to interpret the event, and in the process the mouse pointer coordinates are converted relative to *this*. If the programmer then needs these coordinates at the parent group level or higher, parent->LogicalEvent(event) will remap the coordinates relative to the calling object (“parent” in this case). This remapping of coordinates may be done by any window object up the window object hierarchy, ultimately terminating at the ZafWindowManager. The ZafWindowManager will map coordinates relative to the global display—the entire screen.

Converting coordinates relative to various objects may be accomplished using other methods as well. These alternatives are particularly useful when converting to or from screen coordinates. See ConvertToScreenPosition() and ConvertToObjectPosition() for details.

There are many more details associated with LogicalEvent() that are not discussed in this section. These details are necessary for the internal workings of the ZAF libraries, but should not be necessary for full use of ZAF by developers.

As a real-world example, the following code shows how the derived ZafDate and ZafTable use LogicalEvent() to determine child movement.

```
ZafEventType ZafDate::Event(const ZafEventStruct &event)
{
  // Check for logical events.
  ZafEventType ccode = event.type;
  if (event.InputType() == E_KEY)
    ccode = LogicalEvent(event);

  switch (ccode)
  {
  case L_SELECT:
  ...
  break;
  }
}


ZafEventType ZafTable::Event(const ZafEventStruct &event)
{
  // Check for logical events.
  ZafEventType ccode = LogicalEvent(event);

  // Check for zinc events.
  switch (ccode)
  {
  case L_BEGIN_SELECT:
  ...
  break;
  }
}
```

Each window object may map raw events differently. A complete table of possible "Logical Events" is contained in the "Event Definitions" appendix. The ZafWindowObject class provides logical mapping for the following logical events:

Logical Event	Description
`L_BEGIN_ESCAPE`	Mapped in response to a right mouse button down-click event.
`L_CONTINUE_ESCAPE`	Mapped when the mouse moves while the right mouse button is still depressed.
`L_END_ESCAPE`	Mapped in response to a right mouse button up-click event.

Logical Event	Description
`L_BEGIN_SELECT`	Mapped in response to a left mouse button down-click event.
`L_CONTINUE_SELECT`	Mapped when the mouse moves while the left mouse button is still depressed.
`L_END_SELECT`	Mapped in response to a left mouse button up-click event.
`L_CANCEL`	Mapped in response to an <escape> event.
`L_DOUBLE_CLICK`	Mapped when the left mouse button is quickly clicked twice in a row. The maximum time between the first up-click and the second down-click is determined by the native environment, or ZafWindowObject::doubleClickRate.
`L_VIEW`	Mapped when an unpressed mouse is positioned over a window object.

LogicalPalette

```
virtual ZafPaletteStruct LogicalPalette(ZafPaletteType
    type, ZafPaletteState state);
```

This function returns a portable color/font description given a requested palette type and state. The allowed arguments for “ZafPaletteType type” are:

Argument	Description
`ZAF_PM_OUTLINE`	This requests a palette entry that contains border colors. This request should only be made if the object’s Bordered() flag is “true,” and when you want to draw an encompassing border around the object’s specified region. This value should not be used when drawing a 3-dimensional border around the object.
`ZAF_PM_BACKGROUND`	Used when you want to clear or draw to the background portion of the object. The background palette specifies a pattern, and foreground/background color that can be used in clearing operations.

Argument	Description
`ZAF_PM_FOREGROUND`	Used when you want to draw graphic information, such as lines, rectangles, and ellipses within a window object. This palette is used after the background has been cleared, and additional information, such as a check-mark, or radio-button still need to be rendered on the display. Note, both the ZAF_PM_FOREGROUND and ZAF_PM_BACKGROUND colors are combined only when the fill pattern is a non-solid type fill (e.g., ZAF_PTN_INTERLEAVE_FILL).
`ZAF_PM_TEXT`	This requests a palette that has font, pattern, foreground and background entries that will be used in text drawing operations.
`ZAF_PM_HOT_KEY`	This requests an entry to be used when drawing the “hotkey” portion of a string value. Normally, this value is only used on text based environments, since GUI environments generally show hotkey information with an underline.
`ZAF_PM_LIGHT_SHADOW`	This requests the light colors of a 3-dimensional shadow. This is used in conjunction with ZAF_PM_DARK_SHADOW to present a shadowed appearance on the object. When the object appears raised, this entry is used on the left and top sides of the object. If the object appears depressed, this entry is used for the right and bottom sides of the object.
`ZAF_PM_DARK_SHADOW`	This requests the dark colors of a 3-dimensional shadow. This is used in conjunction with ZAF_PM_LIGHT_SHADOW to present a shadowed appearance on the object. When the object appears raised, this entry is used on the right and bottom sides of the object. If the object appears depressed, this entry is used for the left and top sides of the object.
`ZAF_PM_FOCUS`	This requests a color value to be used when drawing the focus rectangle around a window object. Typically, this entry is used with ZAF_PM_ANY_STATE so the focus is drawn in a consistent color.

Argument	Description
`ZAF_PM_ANY_TYPE`	Specifying this value will match any palette request, as long as the specified state is ZAF_PM_ANY_STATE or the value matches the palette map entry.

The associated values of “ZafPaletteState state” are generally determined at run-time (see the example below) but may include:

Value	Description
`ZAF_PM_ANY_STATE`	Specifying this value will match any palette request, as long as the specified type is ZAF_PM_ANY_TYPE or the value matches the palette map entry.
`ZAF_PM_ACTIVE`	This state is typically used when you want to show the window, or window object, in an active state; meaning the window has input focus and objects can be immediately selected or focused.
`ZAF_PM_CURRENT`	This state is typically used when you want to show that the object has the focus. This is particularly useful when you want to distinguish items that have the input focus in a more distinctive way than just drawing a focus rectangle.
`ZAF_PM_INACTIVE`	This is a special request that is used when the object distinguishes between a parent that does, or does not have the input focus. For example, ZafTitle is drawn with different colors that have a unique presentation to show the window either does or does not have the immediate input focus.
`ZAF_PM_SELECTED`	This state is used when the object’s Selected() attribute is “true.” Many objects, such as vertical and horizontal lists, show their “selected” children in a highlighted state, giving immediate visual queues to the user, that the object has been selected from among the list of siblings.
`ZAF_PM_DISABLED`	This state is used when the object’s Disabled() attribute is “true.” Typically, this palette contains a “dithered” font and color setting that shows the object in a diminished, or incapacitated state.

Value	Description
`ZAF_PM_ENABLED`	This state is used when the object's Disabled() attribute is "false." This palette typically contains the normal presentation of font and color settings.

The returned ZafPaletteStruct, is the class or instance palette that matches the type and state argument supplied by the programmer. You are guaranteed a valid palette definition as the return argument for LogicalPalette() because ZAF automatically provides default matching palettes for all their ZAF classes.

The palette structure contains the following information:

Palette Attribute	Description
`lineStyle`	This is the type of line (solid, dotted) that can be drawn.
`fillPattern`	This is the type of pattern (solid, interleaved) that can be used either in the clearing of background information, or in the display of text information.
`colorForeground` `colorBackground`	These are the foreground/background color pairs used on color systems when drawing the object's visual information.
`monoForeground` `monoBackground`	These are the foreground/background monochrome color pairs used on black/white systems when drawing the object's visual information.
`font`	This is the logical font to be used when rendering text information to the display.
`osPalette`	This is an OS specific value that provides optimization of palette information. For instance, Motif uses objects called "graphic contexts" that contain information similar to ZafPaletteStruct. Whenever default color and font information is used with a Motif widget, the optimal drawing mechanism is through the graphic contexts, not ZAF's palettes. This "opaque" handle allows ZAF to optimize drawing operations on Motif, while providing override information in the ZafPaletteStruct.

This function is normally used in conjunction with an object's draw operations. In general, the type argument of the request does not change, but the state argument depends on the current run-time status of the object. Here is some sample code from the Windows implementation of ZafString::Draw() function.

```
ZafEventType ZafString::Draw(const ZafEventStruct &,
    ZafEventType ccode)
{
  // Begin drawing operation.
  ZafRegionStruct drawRegion = BeginDraw();

  ...
  // Set the text palette.
  ZafPaletteState state = PaletteState();
  display->SetPalette(LogicalPalette(ZAF_PM_TEXT, state));

  // Draw the text.
  display->Text(drawRegion.left + 1, drawRegion.top + 1,
    stringData->Text(), -1);
  ...
}
```

MemberUser-Function

```
typedef ZafEventType
   (ZafWindowObject::*MemberUserFunction)(const
   ZafEventStruct &event, ZafEventType ccode);
```

memberUser-Function

```
MemberUserFunction memberUserFunction;
```

The variable memberUserFunction provides a pointer-to-member C++ capability at the window object level. This member is generally used in conjunction with userFunction to “hook” between functional techniques and the more powerful member replacement. A user function returns 0 if no error occurs; otherwise it returns a non-zero value. To illustrate its use, lets look at three default override member functions that are declared in ZAF:

- ZafButton::SendMessage(),
- ZafString::DefaultValidateFunction()
- ZafWindowObject::DefaultUserFunction.

Each one of these functions provides a specific type of interface that is used with derived window objects. For instance, the ZafButton member SendMessage() simply packages up a message and places it in the event queue, whenever the L_SELECT or L_DOUBLE_CLICK messages are received. The member DefaultUserFunction() calls the associated user-function, whenever focus changes from one object to another, or when a selection sequence is processed. And finally, DefaultValidateFunction() maintains all the functionality of DefaultUserFunction(), but also provides simple validation for dates, times, numbers, etc. whenever the user presses <enter> or tabs off the field.

Each member provides a unique mechanism for user callback, depending on the state and type of message being processed. As a developer, you can also replace memberUserFunction to give program specific handling of events through derived classes, rather than a flat function based interface (the architecture supported by the userFunction variable). It is important that you understand the subtle difference between the member pointer, and the simple function pointer methods supported by ZAF. To illustrate this difference, examine the following section of code:

```
class MyButton : public ZafButton
{
  MyDatabase *database;
public:
  MyButton(void);
  ZafEventType MyNotification(const ZafEventStruct &event,
    ZafEventType ccode);
};

ZafEventType MyButton::MyNotification(const ZafEventStruct
    &event, ZafEventType ccode)
{
  database->CallTheDatabase(ccode);
  return (0);
}

ZafEventType MyCallback(MyButton *myButton, ZafEventStruct
    &event, ZafEventType ccode)
{
  myButton->database->CallTheDatabase(ccode); // oops! database
    is private!
  return (0);
}

MyButton *button1 = new MyButton;
button1->userFunction = (ZafUserFunction)MyCallback;
MyButton *button2 = new MyButton;
button2->memberUserFunction =
    (MemberUserFunction)MyButton::MyNotification;
```

Obviously, this code is simplistic. Things could be moved around MyCallback could be made a static member of MyButton, database could be made public, etc. But hopefully you see the added benefit of using a pointer-to-member. These benefits include, but are not limited to:

- the class member function gives you real access to the data, at any level,
- the member does not require the use of a globally visible function,
- there are no typecasts necessary for the member pointer.

MoveDraggable

`bool **MoveDraggable**(void) const;`

See ZafWindowObject::Draggable().

MoveEvent

```
virtual ZafEventType MoveEvent(const ZafEventStruct
    &event);
```

The Event() function dispatches some events to MoveEvent() which provides filtered input of movement events. The programmer should not generally overload MoveEvent() but should instead trap all events in Event().

The following events may be dispatched to MoveEvent():

- `L_LEFT`
- `L_RIGHT`
- `L_UP`
- `L_DOWN`
- `L_FIRST`
- `L_LAST`
- `L_NEXT`
- `L_PREVIOUS`
- `L_PGDN`
- `L_PGUP.`

Whenever an object receives a movement event, the messages are first intercepted in the object's Event() function. To allow for more encapsulation and a more efficient handling of similar movement functionality, ZAF defines MoveEvent() which may be called by the base ZafWindowObject class whenever one of the aforementioned messages is generated.

The programmer should not call MoveEvent(), but it is used internally by ZAF. When deriving to intercept movement events, the programmer should always use the Event() function itself.

The return value for MoveEvent() is normally event.type if processing is successful. Otherwise, S_ERROR or S_UNKNOWN may be returned, indicating the object either detected an error on the message, or that the function did not recognize the specified message.

Next

```
ZafWindowObject *Next(void) const;
```

This overloaded function adds a type-safe cast of "ZafWindowObject *" to the object while accessing the next sibling in a window's list of children. The overload allows you to initialize and manipulate a list of associated window objects with the proper base type declaration. Here is a code snippet that shows the proper use of this overloaded member.

```
// Select all of the objects in the group.
for (ZafWindowObject *object = group->First(); object; object =
    object->Next())
  object->SetSelected(true);
```

Noncurrent

```
bool Noncurrent(void) const;
virtual bool SetNoncurrent(bool noncurrent);
```

The term “non-current” specifies whether an object can receive system focus and subsequent keyboard input. If an object sets SetNoncurrent(true), then the user will not be able to tab or set the focus on the object, but will still be able to use the mouse to select or click within the specified object. For instance, one common use of the Noncurrent() attribute is with scrollbars. Normally, the end-user clicks the mouse to “activate” up- and down-arrows, to select page-up and page-down options, or to grab the thumb control on the center portion of the scrollbar. The visual focus never moves to the scrollbar, nor does the scrollbar ever accept keyboard control. It simply modifies the visual presentation of an adjacent object, such as a multi-line text field. Another typical application is the use of Noncurrent() with toolbars. Toolbars typically have button children that allow the user to select application options (open, close, cut, copy, paste, etc.). As with scrollbar, the mouse is used to select one of the toolbar items, causing application changes. You may have noticed that the focus is never changed to a field inside the toolbar, but rather, still resides on another field within the window. The toolbar simply processes mouse information, never receiving focus or keyboard control. This is accomplished by calling SetNoncurrent(true) on the toolbar object.

The use of SetNoncurrent() is somewhat restricted. For instance, ZafBorder, ZafTitle, ZafMinimizeButton, ZafMaximizeButton never allow you to change the value of Noncurrent() (they automatically set this value to true). You are encouraged to refer to the associated section of the object you are creating to understand any restrictions or limitations on this function.

Here is some sample code that shows the correct use of these functions:

```
// Set the button’s noncurrent state.
button->SetNoncurrent(true);

// Check all the object’s noncurrent status.
for (ZafWindowObject *object = First(); object; object = object-
    >Next())
  if (object->Noncurrent())
    printf("NO! Object %s does not allow keyboard focus.\n",
    object->StringID())
  else
```

```
    printf("YES! Object %s allows keyboard focus.\n", object-
    >StringID())

// This code has no effect since you cannot reset the noncurrent
    state of a ZafPrompt object.
extern ZafPrompt *prompt;
prompt->SetNoncurrent(false); // error!
```

Note, setting the noncurrent attribute on a parent object causes all of the children to become noncurrent, even though their individual noncurrent states may not be "true." SetNoncurrent() functionality is thus propagated to children, grandchildren, etc., but only through inheritance, not by value replacement (i.e. the child object's noncurrent value is not reset to be the same as the parent's value). Once the Noncurrent() state is set back to false, the input and focus aspects of children are restored.

The return value for Noncurrent() and SetNoncurrent() is the final, or current state of the object (true or false). Under normal circumstances, this value will be the value passed into the SetNoncurrent() function, but may differ if the derived class restricts its use.

NotifyFocus

virtual ZafWindowObject ***NotifyFocus**(ZafWindowObject
    *object, bool focus);

This is an advanced function that is used to notify a parent object, or set of hierarchical objects, that the focus of a child is in the process of being changed. Under normal conditions, you will not need to explicitly call this function. Subsequent discussion of this function is intended for advanced ZAF programmers, and as adeptly stated by many reference manuals as not indented for the "faint of heart."

The consequences of changing focus are fairly dramatic for most windows and window objects. For instance, changing the focus from one window to another, requires all of the ancestors of the old focus object to be notified of a focus change (their Focus() attribute changes to false), and all the ancestors of the new focus object to be notified of their focus change (their Focus() attribute changes to true). A fairly complicated endeavor when you consider all the ways in which an object may gain focus! NotifyFocus() provides a consistent method of notification for these affected objects.

The illustration below demonstrates one simple aspect of focus notification from one child object to another:

```
// Sample code to move the focus on another window.
window1->Current()->SetFocus(true); // Assume this is the base
    state.
```

```
...
window2->Current()->SetFocus(true); // This focus change is
    described by the algorithm.
```

When window2 resets the focus for its Current() object, the following algorithm is executed:

- SetFocus() is called on the current object of window2. If a focus change is allowed by the current object, it proceeds to step 2. Otherwise the function ends and SetFocus() returns false.
- Current() calls NotifyFocus() for itself, beginning the process of notification. This is done with the following arguments:

  NotifyFocus(this, true);

  The return value for NotifyFocus() will be null if the object can obtain the focus, or non-null if another object will become "invalid" if the focus is moved. A non-null return value is the final chance of the "old focus" object to request a cancellation of focus change.
- NotifyFocus() calls its parent's NotifyFocus() function as follows:

  parent->NotifyFocus(this, true);

  The "this" pointer is a pointer to itself, whereas "true" tells the parent object that the focus is being turned on for the object.
- The parent propagates the "focus" up, if it does not currently have the focus, or notifies the old focus object that it will lose the focus. Notification of focus change is made by sending the N_NON_CURRENT and S_NON_CURRENT messages to the old focus object's Event() function, in the following manner:

  ```
  if (Event(N_NON_CURRENT) == 0)
    Event(S_NON_CURRENT);
  ```

  These messages allow the object to call associated user or validate functions, in preparation of losing the input focus.
- If the return "invalidObject" argument is null, the parent finalizes the objects focus by calling the object's Event() function with S_CURRENT and N_CURRENT. The default operation of these messages is to reset the Focus() variable and to call any associated user-functions.

One way to view this algorithm is to envision a pyramid.

We start on a corner of the pyramid and walk all the way to its peak. This represents traversing all the non-focus objects in our parent's hierarchy. Once we reach the top, we have reached the root object that currently contains the system focus. Now we must walk all the way down the other side of the pyramid to find the exact object that currently has the system focus. Once this is accomplished, we begin walking back up the pyramid, systematically turning off the focus of the old focus object's parent hierarchy. This is done by sending N_NON_CURRENT and S_NON_CURRENT messages to the objects, allowing them to turn off their focus attributes, to call associated user-functions, etc. Once we reach the top of the pyramid, the focus value changes from "false" to "true" and all ancestors are systematically notified of their new focus state. The process ends when we reach the beginning spot on the pyramid.

It would be impractical to describe all the combinations and possible variations of NotifyFocus(). The example above is intended as a simplified explanation to the types of operations that are occurring whenever the NotifyFocus() function is called.

In order to fully explain the nature of NotifyFocus(), a partial code snippet from ZafWindow::NotifyFocus() is shown below:

```
ZafWindowObject *ZafWindow::NotifyFocus(ZafWindowObject
    *focusObject, bool setFocus)
{
...
// Check for algorithm direction.
ZafWindowObject *invalidObject = ZAF_NULLP(ZafWindowObject);
if (!setFocus) // down
{
  // Remove focus from the current branch.
  if (Current())
    invalidObject = Current()->NotifyFocus(focusObject, false);

  // Remove focus from the "this"
  if (!invalidObject)
    invalidObject = ZafWindowObject::NotifyFocus(focusObject,
    false);
}
else if (!focus) // up
{
  // Recurse the entire focus path.  Give this object focus.
  invalidObject = ZafWindowObject::NotifyFocus(this, true);

  // This window is now the root of the focus path.  Transition
    focus
  // if focusObject doesn't already have it.
  if (!invalidObject && Current() && Current() != focusObject)
    invalidObject = Current()->NotifyFocus(this, false);

  // Set focus if validation succeeded.
  if (!invalidObject)
    ZafList::SetCurrent(focusObject);
}
else // transition
{
  // This window is the root of the focus path.  Transition focus
  // if focusObject doesn't already have it.
  if (Current() && Current() != focusObject)
    invalidObject = Current()->NotifyFocus(this, false);

  // Set focus if validation succeeded.
  if (!invalidObject)
    ZafList::SetCurrent(focusObject);
}
...
}
```

NotifySelection

virtual ZafWindowObject ***NotifySelection**(ZafWindowObject
  *object, bool selected);

This is an advanced function that is used to notify a parent object, or set of hierarchical objects, that the selection state of a child is in the process of being changed. Under normal conditions, you should not call this function directly. A description of this function follows as "useful information" in your programming endeavors.

For simple objects, a call to SetSelected() simply changes the state of the object and reflects the change on the display. It does not, however, take into account the consequences of such an action on other siblings, or as it may affect the state of an application. In addition, since some simple objects (list and tree items) do not know what consequence the change of its state will have, it does not update its visual representation if its SystemObject() status is "false." This aspect of selection is deferred to the parent's NotifySelection() function.

Let's briefly look at the selection process of two objects: a basic window and a vertical list to give you better insight into the selection process.

In a basic window, the mechanics of selection are straight forward. If SelectionType() is ZAF_MULTIPLE_SELECTION or ZAF_EXTENDED_SELECTION no additional processing is needed on the window's children. The object simply marks itself as selected, calls parent->NotifySelection() which returns without action, and redisplays its changes. The selection process then continues within the context of the application.

In the case of ZAF_SINGLE_SELECTION, however, ZafWindow::NotifySelection() traverses all children to either turn off their selection status (if the selection state of the notify child is "true"), or to check for another selected object (if the child requests the selection status to be turned off). Note the ZafWindow class simply calls SetSelected() on the children, no special OS processing is needed.

```
ZafWindowObject *ZafWindow::NotifySelection(ZafWindowObject
    *selectedObject, bool setSelected)
{
  ...
  if (setSelected && SelectionType() == ZAF_SINGLE_SELECTION)
  {
    // Deselect all objects except "selectedObject."
    for (ZafWindowObject *object = First(); object; object =
    object->Next())
      if (object->Selected() && object != selectedObject)
        object->SetSelected(false);
  ...
  }
  // Return the object selection.
  return (selectedObject);
}
```

In the case of ZafVtList, there is an important component added to the selection process; the native operating system's update of list items. If the vertical list is set with a selection type of ZAF_SINGLE_SELECTION, the list must not only turn off the selection status of all other selected children, but must also redisplay the child's visual information in accordance with proper API calls, to reflect the changed status on the display. For this object, the particular aspects of redisplay are environment specific.

For instance, Windows must send an LB_SETCURSEL message to the parent list of a single-select list item, a message that automatically causes the item to be redisplayed in its new state.

```
ZafWindowObject *ZafVtList::NotifySelection(ZafWindowObject
    *object, bool setSelected)
{
  ZafWindow::NotifySelection(object, setSelected);
  int index = Index(object);
  ...
  SendMessage(screenID, LB_SETCURSEL, (WPARAM)index, (LPARAM)0);
}
```

If the list is ZAF_MULTIPLE_SELECTION or ZAF_EXTENDED_SELECTION, however, it must process an LB_SETSEL message for the selected child, in order to redisplay correctly:

```
  SendMessage(screenID, LB_SETSEL, (WPARAM)setSelected,
    (LPARAM)index);
```

Each environment has specific methods for accessing and manipulating native lists and list items. Thus, the rendering of these changes is overridden through environment specific implementations of the ZafVtList::NotifySelection() member function. (Note, the children will not automatically update themselves when SetSelected(true/false) is called, because they are marked by the list as non-system objects.)

The methods of selection for other derived windows is similar. If the object has a native implementation, API calls are intermixed with ZAF functionality to properly reflect changes to the object's status. Otherwise, the derived window defers the notification process to the base ZafWindow class.

Here is some sample code that shows the use of NotifySelection().

```
bool ZafWindowObject::SetSelected(bool setSelected)
{
  ...
  // Check the object selection with its parent.
  ZafWindow *window = DynamicPtrCast(parent, ZafWindow);
  if (window)
    window->NotifySelection(this, setSelected);
  ...
}
```

The return value for NotifySelection() is a pointer to the current selected item. Typically, this is the object you passed to NotifySelection(), but may be different if an associated user-function or derived object does not allow selection of the item specified.

OSDraw

bool **OSDraw**(void) const;
virtual bool **SetOSDraw**(bool osDraw);

This is a special attribute function that combines with derived Draw() functions to "reconnect" OS specific display calls. Some operating environments provide special mechanisms for drawing native objects. These methods should not be overridden unless you have specific drawing needs that are not automatically handled by the native object. You should only clear OSDraw() when you derive a particular window object and need to override the Draw() functionality of that object. Here is some sample code that shows how this is done:

```
class MyButton : public ZafButton
{
  virtual ZafEventType Draw(const ZafEventStruct &event,
    ZafEventType ccode);
  ...
};

MyButton::MyButton(int left, int top, int width, int height) :
  ZafButton(left, top, width, height, ZAF_NULLP(ZafIChar),
    ZAF_NULLP(ZafBitmapData))
{
  // Make sure Draw() gets the proper update calls.
  SetOSDraw(false);
  ...
}
```

Note that overloading the draw capabilities requires two operations: the definition of a derived Draw() function, and the clearing of the OSDraw() variable. If both steps are not taken, the results are undefined and environment dependent.

The return value for OSDraw() and SetOSDraw() is the final, or current draw attribute associated with the object (true or false). Under normal circumstances, this will be the value passed into the SetOSDraw() function, but may be different if the object does not allow you to override this functionality.

OSScreenID

`virtual OSWindowID` **`OSScreenID`**`(ZafScreenIDType type =`
`    ZAF_SCREENID) const;`

This virtual function provides access to OS specific information associated with a window object. The screenID value represents a “hook” from the ZAF class hierarchy, to the underlying operating environment. *type* indicates an OS specific value indicating which type of OS handle is to be returned, and may be any of the following according to OS:

Platform	Possible Values	
MS Windows	`ZAF_SCREENID`	`(lowest level of OS object, HWND)`
	`ZAF_CLIENTID`	`(client handle)`
	`ZAF_FRAMEID`	`(frame handle)`
Motif	`ZAF_SCREENID`	`(lowest level of OS object, Widget)`
	`ZAF_CLIENTID`	`(client handle)`
	`ZAF_FRAMEID`	`(frame handle)`
	`ZAF_SHELLID`	`(shell handle)`
Macintosh	`ZAF_SCREENID`	`(lowest level of OS object)`
	`ZAF_WINDOWREF`	`(parent window, WindowRef)`

Platform	Possible Values

OS/2	`ZAF_SCREENID (lowest level of OS object, HWND)`
	`ZAF_CLIENTID (client handle)`
	`ZAF_FRAMEID (frame handle)`

DOS	`ZAF_SCREENID (lowest level of OS object)`

See ZafWindowObject::screenID for more information.

PaletteState

`virtual ZafPaletteState` **`PaletteState`**`(void);`

This function indicates the current state of an instantiated object, in values recognized by palette computation functions such as ZafWindowObject::LogicalPalette() and ZafPaletteData::GetPalette(). The following values are inclusively defined by ZAF:

- `ZAF_PM_ANY_STATE (0x0000)`
- `ZAF_PM_ACTIVE    (0x0001)`
- `ZAF_PM_CURRENT   (0x0002)`
- `ZAF_PM_INACTIVE  (0x0004)`
- `ZAF_PM_SELECTED  (0x0008)`
- `ZAF_PM_DISABLED  (0x0010)`
- `ZAF_PM_ENABLED   (0x0020)`

This function is generally used within drawing operations to determine the current drawing state of an object. Here is some code from ZafString::Draw(), that shows the use of PaletteState() to determine the proper color to use in drawing text information.

```
ZafEventType ZafString::Draw(const ZafEventStruct &,
    ZafEventType ccode)
{
  // Begin drawing operation.
  ZafRegionStruct drawRegion = BeginDraw();

  ...
  // Set the text palette.
  ZafPaletteState state = PaletteState();
  display->SetPalette(LogicalPalette(ZAF_PM_TEXT, state));

  // Draw the text.
  display->Text(drawRegion.left + 1, drawRegion.top + 1,
    stringData->Text(), -1);
  ...
}
```

Note, the function call LogicalPalette() uses two variables to associate the proper color/font information: ZAF_PM_TEXT and state. ZAF_PM_TEXT is a “static” request that tells LogicalPalette() that we want to retrieve the proper color associated with the textual information of the object. The state argument, however, is “dynamic,” meaning its value must be determined at run-time, (in this case as determined by the return value of PaletteState() function) in order to obtain the correct color and font information.

For more information on palette settings, see ZafWindowObject::UserPalette-Data() or the ZafPaletteMap section of this manual.

Parent

```
ZafWindowObject *Parent(void) const;
ZafWindowObject *SetParent(ZafWindowObject *parent);
```

These functions set or provide access to an object’s instance hierarchy. Parent(), combined with the Next(), Previous(), ZafWindow::First() and ZafWindow::Last() give programmers the ability to move bidirectionally within a window.

Here are some code snippets that show the use of the Parent() function.

```
ZafWindowObject *ZafWindow::Add(ZafWindowObject *object,
    ZafWindowObject *position)
{
  // Make sure add is allowed.
  if (object->Parent())
    return (object);

  // Set object’s parent.
  object->SetParent(this);
  ...
}

// Find the root window object.
ZafWindowObject *ZafWindowObject::RootObject(void)
{
  ZafWindowObject *object = this;
  while (object->Parent())
    object = object->Parent();
  return (object);
}

// Notify the parent of a pending action.
if (buttonToDisableWindow->Selected())
```

```
  buttonToDisableWindow->Parent()->SetDisabled(true);
```

Under normal circumstances, you will not use the SetParent() function, because the Parent() value is automatically set when the ZafWindow::Add() function is called.

The return value for Parent() and SetParent() is the current parent associated with the object. This value will always be the value passed into SetParent().

ParentDrawBorder

```
bool ParentDrawBorder(void) const;
virtual bool SetParentDrawBorder(bool parentDrawBorder);
```

ParentDrawFocus

```
bool ParentDrawFocus(void) const;
virtual bool SetParentDrawFocus(bool parentDrawFocus);
```

ParentPalette

```
bool ParentPalette(void) const;
virtual bool SetParentPalette(bool parentPalette);
```

These functions are used to defer drawing or the retrieval of color information from a child to its parent. In general, you should not set these values because they are automatically set by advanced ZAF objects such as ZafVtList and ZafTree. These list objects set the Parent*() values, of children added to them, to “true” in order to give all their children a consistent presentation to the screen. Here is a brief explanation of these functions.

SetParentDrawBorder() Causes the object to defer the border drawing operation to its immediate parent. In this case, the corresponding colors of the immediate object are ignored.

SetParentDrawFocus() Causes the object to defer the focus drawing operation to its immediate parent. As with SetParentDrawBorder(), setting this attribute to “true” causes the object to ignore any colors that correspond to its own focus rendering.

SetParentPalette() Causes the child to ignore its default class palette information and use the parent object’s class or instance palette information. Note, this flag is ignored if you specify a UserPalette(). The child only refers to parent information if the user palette does not contain the information necessary for the requested drawing operations. Normally, this operation is desired when all the children of an object (ZafVtList, ZafTreeList) need to be presented in a uniform manner.

Here is some sample code that shows the proper use of these functions.

```
ZafWindowObject *ZafVtList::Add(ZafWindowObject *object,
    ZafWindowObject *position)
{
  ...
  // Add the object to the list.
  object->SetSystemObject(false);
  object->SetParentPalette(true);
  ZafWindow::Add(object, position);
  ...
}
```

All of these functions return the current attribute associated with the object (true or false). Normally, this will be the original value passed to the SetParent*() function, but may be different if the derived window object does not allow changes to the Parent*() attributes.

Previous

`ZafWindowObject *`**`Previous`**`(void) const;`

This overloaded function adds a type-safe cast of “ZafWindowObject *” to the object while accessing the previous sibling in a window’s list of children. The overload allows you to initialize and manipulate a list of associated window objects with the proper base type declaration. Here is a code snippet that shows the proper use of this overloaded member.

```
// Clear all the entries in a window.
for (ZafWindowObject *object = window->Last(); object; object =
    object->Previous())
  object->SetText(ZAF_NULLP(ZafIChar));
```

QuickTip

`const ZafIChar *`**`QuickTip`**`(void) const;`
`virtual const ZafIChar *`**`SetQuickTip`**`(const ZafIChar`
`    *quickTip);`

SetQuickTip(), along with SetHelpObjectTip() allows you to associate particular help messages with the run-time presentation of an object. QuickTip() is the “pop-up” portion of the ZafHelpTips object that appears below the mouse cursor anytime the mouse is idle and positioned over an object that has a QuickTip() string. It is important to note that a ZafHelpTips device must be added to the event manager for quick tips to function (see ZafHelpTips for more information).

The return value for QuickTip() and SetQuickTip() is the current string associated with the object. This will always be the value passed into the SetQuickTip() function. Here is a code snippet that shows the correct usage of these functions:

```
// Create two objects with quick-tip information.
```

```
ZafButton *save = new ZafButton(0, 0, 20, "Save",
   ZAF_NULLP(ZafBitmapData));
save->SetQuickTip("Save the application.");

ZafButton *cancel = new ZafButton(25, 0, 20, "Cancel",
   ZAF_NULLP(ZafBitmapData));
cancel->SetQuickTip("Cancel the save operation.");
```

Read

`static ZafElement *`**`Read`**`(const ZafIChar *name,`
`   ZafObjectPersistence &persist);`

This static function defines a pointer to the persistent constructor (see ZafWindowObject::ZafWindowObject()) which reads a window object from a persistent file. This function should not be used directly with object construction. Rather, it is used by the ZafObjectPersistence class to allow the run-time determination of window object constructors. Here is a portion of the default ZafObjectPersistence table used when constructing a persistence object along with code that constructs a persistent window:

```
ZafObjectPersistence::ObjectConstructor
   ZafObjectPersistence::defaultObjectConstructor[] =
{
  // --- Window objects ---
  { 0, ID_ZAF_BIGNUM, ZafBignum::className, ZafBignum::Read },
  { 0, ID_ZAF_BORDER, ZafBorder::className, ZafBorder::Read },
  { 0, ID_ZAF_BUTTON, ZafButton::className, ZafButton::Read },
  { 0, ID_ZAF_WINDOW, ZafWindow::className, ZafWindow::Read },
  ...
  // --- End-of-array ---
  { 0, ID_END, 0, 0 }
};

// Load a persistent window.
ZafStorage *storage = new ZafStorage("myfile.dat");
ZafObjectPersistence persist(storage,
   zafDefaultDataConstructor, zafDefaultObjectConstructor);
windowManager->Add(new ZafWindow("MyWindow", persist));
```

The return value for Read() is a newly instantiated object. If an error occurred during the creation of the object, the object’s Error() value will be ZAF_ERROR_CONSTRUCTOR or ZAF_ERROR_FILE_READ.

Redisplay
RedisplayData

```
void Redisplay(void);
void RedisplayData(void);
```

These two functions send appropriate ZAF messages (S_REDISPLAY and S_REDISPLAY_DATA) that cause the object to either redisplay the data portion of its area (e.g. The ZafString field redisplays only the text associated with the object) or the entire object's region.

zafRegion
Region

```
ZafRegionStruct zafRegion;
virtual ZafRegionStruct Region(void) const;
virtual void SetRegion(const ZafRegionStruct &region);
```

This function and member gives the current position and size of a window object. In ZAF, all regions are defined to be positioned on a "0,0 left-top" based coordinate system, the coordinate system either specified as "client" based relative to their parent if they are normal window objects, or based on a "frame" area of their parent if they are support objects.

The zafRegion values for more complex objects also fit within the "frame/client" specification described above. Thus, the 0,0 left-top based coordinate not only applies to top-level windows, but also to sub-windows contained within a parent object.

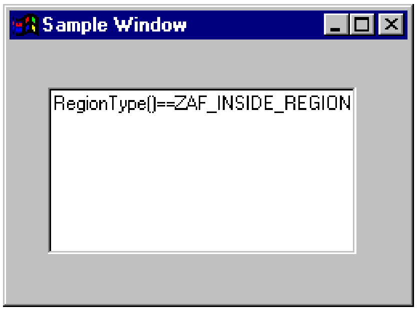
Although this member is publicly available, it is recommended you never change its contents directly. Rather, the constructor for each object, the message S_SIZE, and the member functions ZafWindowObject::SetRegion(), ZafWindowObject::SetCoordinateType() and ZafWindowManager::Center() can be used to effect a change in the zafRegion structure. Here are some code snippets that show the various operations that can be used to modify the size and position of a window object.

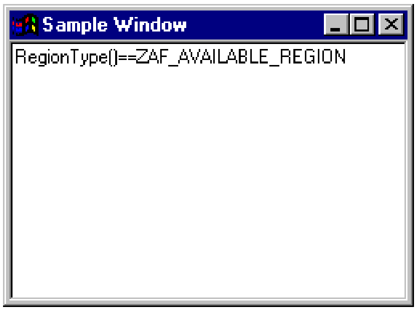
```
// Create a string and reset its coordinate type.
// These calls set:
// string->zafRegion.left = 20,
// string->zafRegion.top = 20,
// string->zafRegion.right = 119,
// string->zafRegion.bottom (depends on
//   ZafCoordinateStruct::cellHeight), and
// string->zafRegion.coordinateType = ZAF_PIXEL.

ZafString *string = new ZafString(20, 20, 100, "string", 50);
string->SetCoordinateType(ZAF_PIXEL);

// Reset the position of a sub-object.
ZafEventStruct event(S_SIZE);
event.region.left = event.region.top = 100;
event.region.right = 600;
event.region.bottom = 400;
object->Event(event);

// Center a window on the screen.
zafWindowManager->Center(window);
zafWindowManager->Add(window);
```

RegionType

```
ZafRegionType RegionType(void) const;
virtual ZafRegionType SetRegionType(ZafRegionType
    regionType);
```

SetRegionType() is used to specify the type of area that an object occupies within its parent. The initial region is defined by zafRegion, which is used or modified according to the following specifications:

Region Type	Description
`ZAF_INSIDE_REGION`	Tells the parent object that the object overlays its region within the parent according to the object's zafRegion member. This is the default type for most ZAF objects and is commonly referred to as a "field" object. Note, this type of region allows multiple objects to be overlaid on the same position in a window at one time. The presentation of overlapping window object's is environment specific. While not normally used in such a manner, it clarifies the non-ownership relation of the object with its specified zafRegion. Here is a picture that shows a normal window object that uses the ZAF_INSIDE_REGION type:  RegionType()==ZAF_INSIDE_REGION

Region Type	Description
ZAF_AVAILABLE_REGION	Specifies ownership of a particular screen area within its parent. A simple way of thinking about this type of region is to imagine an object that “hogs” or “reserves” a particular area of a window, not allowing other sibling objects to occupy the same area. Another way to think about this attribute is in conjunction with geometry management. Setting this flag would be equivalent to specifying geometry attributes that “pinned” the left, top, right, and bottom areas of the object to specific positions within its parent window and disallowed any other object to occupy the same area on the window.  RegionType()==ZAF_AVAILABLE_REGION The ZAF_AVAILABLE_REGION attribute is mainly associated with support objects, but can also be associated with child objects such as ZafText and ZafVtList when you want the object to occupy all the remaining area of the window.

Region Type	Description
`ZAF_OUTSIDE_REGION`	Specifies ownership of an area directly outside the specified zafRegion. This setting is similar to ZAF_AVAILABLE_REGION, but the ownership area is defined to be outside the zafRegion, not inside. Currently, only the ZafBorder class uses this type of region.

The return value for RegionType() and SetRegionType() is the final, or current attribute associated with the object. Under normal circumstances, this will be the value passed into the SetRegionType() function but can differ if the specified object does not allow the resetting of this attribute.

Here is some sample code that shows the correct use of these functions.

```
// Create a text view window.
ZafWindow *window = new ZafWindow(0, 0,
    50, 10);
window->AddGenericObjects(new
    ZafStringData("View Text"));
ZafText *text = new ZafText(0, 0, 0, 0,
    "text", 1000);
text-
    >SetRegionType(ZAF_AVAILABLE_REGIO
    N);
window->Add(text);

ZafEventType
    ZafWindowObject::Event(const
    ZafEventStruct &event)
{
...
case S_COMPUTE_SIZE:
  if (RegionType() !=
    ZAF_INSIDE_REGION)
      zafRegion = parent ? parent-
    >MaxRegion(this) : windowManager-
    >MaxRegion(this);
  break;
}
```

RepeatDelay

```
static int RepeatDelay(void);
```

See ZafWindowObject::InitialDelay().

RootObject

```
ZafWindowObject *RootObject(void) const;
```

This function traverses an object's Parent() hierarchy to find the root ZAF object (typically a ZafWindow or derived window). The return value is the root, or final object in the instance hierarchy that can be attached to the window manager or MDI child. Here is some code that shows effective use of the RootObject() function.

```
ZafPaletteState ZafWindowObject::PaletteState(void)
{
  // Check for the matching palette state.
  ZafPaletteState state = ZAF_PM_ANY_STATE;
  if (RootObject()->Focus())
    state |= ZAF_PM_ACTIVE;
  ...
}

// Determine if my non-MDI window is attached to the window
    manager.
extern ZafButton *myButton;
ZafWindowObject *root = myButton->RootObject();
if (windowManager->Index(root) == -1)
  printf("My window is not attached to the window manager\n");
else if (root->Visible())
  printf("%s is visible to the user\n", root->StringID());
```

screenID

```
OSWindowID screenID;
```

This variable provides access to OS specific information associated with a window object. The screenID value represents a "hook" from the ZAF class hierarchy, to the underlying operating environment. The following definitions apply to screenID:

Platform	Description
MS Windows	Represents an HWND. For example, the Windows implementation of ZafString creates an "EDIT" with a call to the Windows API CreateWindowEx().

Platform	Description
Motif	Represents a Widget. For example, screenID for a ZafString object corresponds to a derived Motif “XmTextField” widget; ZafWindow corresponds to a derived “XmBulletinBoard” widget, and ZafButton corresponds to a derived “XmPush-Button” widget.
Macintosh	Represents a class-specific API reference. For example, the Macintosh implementation of ZafString creates a TEHandle object by calling the Macintosh API TENew().
OS/2	Represents an HWND. For example, the OS/2 implementation of ZafString creates an “EDIT” with a call to the OS/2 API CreateWindowEx().
DOS	Represents a unique screen identifier generated by the display. This environment has no specific OS hook. The value is simply used to reserve a region of the display.

Normally, you will not use screenID directly in your application. For advanced ZAF programming, however, this provides a fundamental mechanism for deriving objects that ZAF does not provide, but that may have native implementation on certain GUI environments. See ZafWindowObject::OSScreenID() for more information.

Another possible use of screenID is to check if an object is on the screen or not. Since the Visible() attribute may be set to true before the object’s parent window is actually added to the screen, Visible() may be true before the object is really on the screen. On the other hand, none of a parent window’s children receive screenIDs until the parent window is added to the screen. So if screenID is null the object is not on the screen yet. See Visible() for more information.

Here are some sample code snippets that show how screenID is used in the implementation of S_REDISPLAY to make native API calls on Windows and Motif.

```
// Windows implementation of S_REDISPLAY.
if (SystemObject())
  RedrawWindow(screenID, NULL, 0, RDW_INVALIDATE | RDW_ERASE |
    RDW_ALLCHILDREN);
else
{
  // Get the object region in OS coordinates.
  ZafRegionStruct region = parent ? parent-
    >ConvertToDrawRegion(this) :
    windowManager->ConvertToDrawRegion(this);
  RECT rect;
  region.ExportPoint(rect);

  // Invalidate the object region.
  RedrawWindow(screenID, &rect, 0, RDW_INVALIDATE | RDW_ERASE |
    RDW_ALLCHILDREN);
}

// Motif implementation of S_REDISPLAY.
if (SystemObject())
  XClearArea(XtDisplay(screenID), XtWindow(screenID), 0, 0, 0,
    0, true);
else
{
  // Dismiss border area for non-system objects (complex motif
  // object) such as list and tool-bar overlap their children by
  // the border area of their children).
  ZafRegionStruct updateRegion = zafRegion;
  updateRegion -= ZAF_BORDER_WIDTH;
  XClearArea(XtDisplay(screenID), XtWindow(screenID),
    updateRegion.left, updateRegion.top, updateRegion.Width(),
    updateRegion.Height(), true);
}
```

ScrollEvent

`virtual ZafEventType` **`ScrollEvent`**`(const ZafEventStruct &event);`

The Event() function may dispatch some events to ScrollEvent which provides filtered input of scrolling events. The programmer should not overload ScrollEvent, but instead trap all events in Event().

The following events may be dispatched to ScrollEvent():

- N_VSCROLL
- N_HSCROLL
- S_VSCROLL
- S_HSCROLL
- S_VSCROLL_SET
- S_HSCROLL_SET
- S_VSCROLL_CHECK
- S_HSCROLL_CHECK
- S_VSCROLL_COMPUTE
- S_HSCROLL_COMPUTE

Whenever an object receives a scrolling messages, the messages are first intercepted in the object's Event() function. To allow for more encapsulation and a more efficient handling of similar scrolling functionality, ZAF defines ScrollEvent() which may be called by the base ZafWindowObject class whenever one of the aforementioned messages is generated.

The programmer should not call ScrollEvent(), but it is used internally by ZAF. When deriving to intercept scrolling events, the programmer should always use the Event() function itself.

The return value for ScrollEvent() is normally event.type if processing is successful. Otherwise, S_ERROR or S_UNKNOWN may be returned, indicating the object either detected an error on the message, or that the function did not recognize the specified message.

Selected

ToggleSelected

```
bool Selected(void) const;
virtual bool SetSelected(bool selected);
virtual bool ToggleSelected(void);
```

The term selected, specifies a programming state where an object becomes peculiar or “stands out” within its context with respect to other sibling objects. For example, you may want to create a vertical list that allows end-users to select a set of files to be deleted from a directory. If the user clicks the mouse over a particular item in the list, the item becomes selected. When the user finishes his/her selection, a set of programming code traverses the list of files to determine which items the user wants deleted. This is done by looking at the selected state of a particular item and deleting the associated file when its selected state is set to true.

If you pass true as the argument to SetSelected(), the object will become selected. In addition, setting this attribute causes the object to notify its parent, such as a group, list, or window, to tell the parent of its intended changed state. The parent then determines if other siblings need to have their states changed in response to this sibling’s new state. Generally their selection states will be changed to false if the parent does not allow multiple objects to be selected at one time (specified by the ZafWindow::SelectionType() member).

If, on the other hand, you specify false as the argument to SetSelected(), the object will turn off its selected state, will notify its parent that the state has changed, and will then give the parent final control to determine whether the specified object can really be de-selected within its context to other sibling objects.

The return value for Selected() and SetSelected() is the final, or current selected state of the object. Under normal circumstances, this value will be the value passed into the SetSelected() function, but may vary if the parent object does not allow the de-selection or automatic selection of a particular object.

The following code shows the proper use of these functions:

```
// Modify the selected attribute on some combo-boxes.
if (userHasPhone)
  phone->SetSelected(true);
if (userKnowsPassword)
  password->SetSelected(true);
if (userHasOfficeKeys)
  keys->SetSelected(true);
...
userHasPhone = phone->Selected();
userKnowsPassword = password->Selected();
userHasOfficeKeys = keys->Selected();
```

Text

```
virtual const ZafIChar *Text(void);
virtual ZafError SetText(const ZafIChar *text);
```

These functions allow you to retrieve or change the textual information associated with an object. The base ZafWindowObject class contains no textual information, but many derived objects such as ZafString, ZafDate, ZafGroup, etc., do contain textual input or output information.

The exact implementation of these functions depends on the derived object, but here are a few explanations of its use with some common ZAF objects:

ZafString Resets the string according to the specified “text” parameter. The argument is accepted “as is” and will only be truncated if the specified string is larger than the buffer allocated by the instantiated ZafString object (as determined by ZafString::MaxLength()).

ZafDate Interprets the contents of the string based on its internal ZafDate::InputFormatData(). The value is thus “filtered” by the ZafDate object, then presented to the screen in a format consistent with the ZafDate::OutputFormatData(). For example, a partial “dec 95” string may be formatted as “December 1, 1995.”

ZafFormattedString Interprets the contents of the string as either “compressed,” or “expanded” data. For instance, the string value “8017858900” may be re-formatted to be “(801) 785-8900,” as seen by the user.

The return value for Text() is a const pointer, which indicates the current textual information associated with the object. Under normal circumstances, this value will be the same as the value passed to SetText(), but may differ if the object filters the text information in a manner similar to that described with the ZafDate and ZafFormattedString object definitions given above.

The return value for SetText() is an error indicator. The following general error conditions apply to window objects:

Error	Description
ZAF_ERROR_NONE	The value passed to SetText() was accepted without any errors.
ZAF_ERROR_INVALID	The value passed to SetText() was invalid for the receiving object. An example of this type of error would be passing “10:00am” to a ZafDate object.

Here is some sample code that shows the correct usage of Text() and SetText() with derived window objects.

```
// Reset the string information.
if (strcmp(string->Text(), "Stop"))
  string->SetText("Stop");

// Reset the date.
date->SetText("January 1, 2001");

// Clear all the editable object fields of a window.
for (ZafWindowObject *object = First(); object; object = object-
    >Next())
  if (object->IsA(ID_ZAF_STRING) && !object->Disabled())
    object->SetText("");
```

TextColor

```
ZaflogicalColor TextColor(ZafLogicalColor *color =
    ZAF_NULLP(ZafLogicalColor), ZafLogicalColor *mono =
    ZAF_NULLP(ZafLogicalColor));
ZafLogicalColor SetTextColor(ZafLogicalColor color,
    ZafLogicalColor mono = CLR_NULL);
```

Text color is the color associated with the textual presentation of an object.

SetTextColor() changes the foreground color associated with the normal presentation of an instantiated object. There are two types of colors that can be passed to SetTextColor(): a color value and a monochrome value. The first parameter specifies the color for normal operation, the second specifies the black/white value for monochrome or black/white modes of operation. Here is a list of predefined ZAF color values:

Color Values	Monochrome Values
ZAF_CLR_PARENT	ZAF_MONO_PARENT
ZAF_CLR_DEFAULT	ZAF_MONO_DEFAULT

Color Values	Monochrome Values
ZAF_CLR_NULL	ZAF_MONO_NULL
ZAF_CLR_BACKGROUND	ZAF_MONO_BACKGROUND
ZAF_CLR_BLACK	ZAF_MONO_BLACK
ZAF_CLR_BLUE	ZAF_MONO_DIM
ZAF_CLR_GREEN	ZAF_MONO_NORMAL
ZAF_CLR_CYAN	ZAF_MONO_WHITE
ZAF_CLR_RED	ZAF_MONO_HIGH
ZAF_CLR_MAGENTA	
ZAF_CLR_BROWN	
ZAF_CLR_LIGHTGRAY	
ZAF_CLR_DARKGRAY	
ZAF_CLR_LIGHTBLUE	
ZAF_CLR_LIGHTGREEN	
ZAF_CLR_LIGHTCYAN	
ZAF_CLR_LIGHTRED	
ZAF_CLR_LIGHTMAGENTA	
ZAF_CLR_YELLOW	
ZAF_CLR_WHITE	

In addition to the pre-defined colors described above, users can define and use their own logical colors. For more information on these color specifications, and for more details on derived color entries, see the ZafPaletteStruct and ZafDisplay sections of this manual or ZafWindowObject::UserPaletteData().

Here is some sample code that shows the correct use of SetTextColor().

```
// Change the text color of the object.
object->SetTextColor(ZAF_CLR_BLACK, ZAF_MONO_BLACK);

// Check the current color of an object, and change where
    necessary.
if (object->TextColor() == ZAF_CLR_NULL)
  object->SetTextColor(object->parent->TextColor());

// Change an object’s text and background color.
object->SetAutomaticUpdate(false);
object->SetBackgroundColor(ZAF_CLR_RED);
object->SetTextColor(ZAF_CLR_WHITE);
object->SetAutomaticUpdate(true);
```

The return value for TextColor() and SetTextColor() is the final, or current color value associated with the object. Under normal circumstances, this will be the color value passed into the SetTextColor(), but may be different if the object does not allow for a particular type of color specification or if the system is running in black/white mode.

userFlags

```
typedef ZafUInt16 ZafFlags;
ZafFlags userFlags;
```

userFlags is a member of ZafWindowObject provided exclusively for the programmer's use, and is only initialized to 0 at the ZafWindowObject level. Since userFlags is defined at the ZafWindowObject level, it may be useful for storing user-defined bit flags in any object derived from ZafWindowObject (including built-in ZAF objects).

userFunction
UserFunction

```
typedef ZafEventType (*ZafUserFunction)(ZafWindowObject
    *, ZafEventStruct &, ZafEventType);
ZafUserFunction userFunction;
ZafUserFunction UserFunction(void) const;
virtual ZafUserFunction SetUserFunction(ZafUserFunction
    userFunction);
```

These functions provide a callback mechanism for operation with an instantiated window object. When the userFunction variable is set, the programmer does not need to derive an object to implement multiple types of selection, coloration, or application control. For instance, the ZafButton class is frequently used to "Accept" changes to a dialog window, to "Cancel" changes, or the get "Help" for a specified operation. In traditional function based programming, these methods would be implemented using Accept(), Cancel(), and Help() functions. The use of userFunction allows you to chain these traditional methods of programming with a derived window object.

```
// Hook up normal functions.
ZafEventType Accept(ZafWindowObject *object, ZafEventStruct &,
    ZafEventType ccode)
{ ...  }

ZafEventType Cancel(ZafWindowObject *object, ZafEventStruct &,
    ZafEventType ccode)
{ ...  }

ZafEventType Help(ZafWindowObject *object, ZafEventStruct &,
    ZafEventType ccode)
{ ...  }
```

```
// Connect the user functions.
button1->SetUserFunction(Accept);
button2->SetUserFunction(Cancel);
button3->SetUserFunction(Help);
```

The default callback sequence of an object is defined as follows:

- When Focus() changes from “true” to “false” the associated user-function is called with an N_NON_CURRENT message. When this event occurs, the user has either tabbed onto another field, or has moved the focus to another object using the mouse.
- When Focus() changes from “false” to “true” the associated user-function is called with an N_CURRENT message. When this event occurs, the user has selected the receiving object, moving the focus to the object.
- When the user presses a selection key (usually the space bar, or <enter> key) the user-function is called with an L_SELECT message. The contents of the event argument will be an event.InputType() of E_KEY, signifying that a key event caused the selection.
- When the user clicks the mouse button while being positioned over the object the user-function is called with an L_SELECT message. When this occurs, the contents of the event argument will contain an event.InputType() of E_MOUSE, signifying that a mouse event caused the user-function to be called.
- When the user double-clicks on the object the user-function is called with L_DOUBLE_CLICK. The contents of the event structure will be of type E_MOUSE, signifying that a mouse event caused the user-function to be called.

The user-function should return 0 on success, and if some error occurred, anything non-zero should be returned. Here are several sample code snippets that show the correct use of the userFunction variable.

```
// Specify the callbacks.
ZafEventType MyStringCallback(ZafWindowObject *object,
    ZafEventStruct &, ZafEventType ccode)
{
  if (ccode == N_NON_CURRENT)
    object->SetText("Oh No! I’m losing focus.\n");
  else if (ccode == N_CURRENT)
    object->SetText("Yea! I’m back in control.\n");
  return (0);
}

ZafEventType MyButtonCallback(ZafWindowObject *object,
    ZafEventStruct &, ZafEventType ccode)
{
  if (ccode == L_SELECT && object->Selected())
    object->SetBackgroundColor(ZAF_CLR_RED);
  else if (ccode == L_SELECT)
    object->SetBackgroundColor(ZAF_CLR_DEFAULT);
  else if (ccode == L_DOUBLE_CLICK && object->Selected())
    object->SetText("OK");
  else if (ccode == L_DOUBLE_CLICK)
    object->SetText("Cancel");
  return (0);
}

// Set the user-functions.
stringField->SetUserFunction(MyStringCallback);
buttonField->SetUserFunction(MyButtonCallback);
```

UserInformation

```
virtual void *UserInformation(ZafInfoRequest request,
    void *data, ZafClassID classID = ID_DEFAULT);
```

UserInformation() is a virtual function provided for the programmer's use, and is a stub at the ZafWindowObject level. Since UserInformation() is defined at the ZafWindowObject level, it may be useful for getting class-specific information from a derived object through a ZafWindowObject pointer to the object. To do so, UserInformation() definitions may be provided by the programmer in derived classes. ZafInfoRequest is an unsigned int.

userObject

```
void *userObject;
```

This is a void pointer, reserved for your use during the run-time operation of your application. ZAF sets this value to null in the ZafWindowObject constructor, but does not evaluate or modify its contents during the instantiated object's run-time operation. Since this is a void pointer, you must dynamically cast the object in your application. Here is some sample code, showing two possible implementations of the userObject member.

```
// Derived object implementation.
class MyObject : public ZafButton
{
public:
  MyDatabase *Database(void) const
    { return ((MyDatabase *)userObject); }
  MyDatabase *SetDatabase(MyDatabase *database)
    { userObject = database; return (database); }
};

// User callback implementation.
```

```
ZafEventType MyUserFunction(ZafWindowObject *object,
   ZafEventStruct &, ZafEventType ccode)
{
  MyDatabase *database = (MyDatabase *)object->userObject;
  ...
  return (0);
}
```

userPaletteData
UserPaletteData

ZafPaletteData ***userPaletteData**;
ZafPaletteData ***UserPaletteData**(void) const;
ZafPaletteData ***SetUserPaletteData**(ZafPaletteData
   *userPaletteData);

These functions provide an instance override for default object color and font attributes. On each environment, ZAF coordinates its color and font rendering with the underlying operating environment, giving you a native looking application whether you are running on Windows, Motif, Macintosh, or even DOS based applications. These functions allow you a rich set of mechanisms that override these system colors, in order to show specific object information, such as selection states, specific object errors, or particular points of emphasis. Whenever you define user palettes, the instantiated object's Draw() function uses these color and font definitions in its drawing process. A brief description of the palette color and attribute overrides follows (A more complete discussion can be read in the ZafPaletteData section of this manual).

There are three main aspects of a user palette that determine the override functionality of an object.

(1) Color/font/style attributes. This is the actual palette information that will apply in the drawing operation if the conditions set in (2) and (3) are met. This part of the palette map is specified by "ZafPaletteStruct palette," which contains the following members:

Member	Description
`lineStyle`	This is the type of line (solid, dotted) that can be drawn.
`fillPattern`	This is the type of pattern (solid, interleaved) that can be used either in the clearing of background information, or in the drawing of textual information.
`colorForeground` `colorBackground`	These are the foreground/background color pairs used on color systems when drawing the object's visual information.
`monoForeground` `monoBackground`	These are the foreground/background monochrome color pairs used on black/white systems when drawing the object's visual information.

Member	Description
`font`	This is the logical font to be used when rendering text information to the display.

(2) Object Type. This part of the ZafPaletteMap structure, defined by "Zaf-PaletteType type," specifies the type of drawing that you want to override. The following values are defined by ZAF:

Value	Definition
`ZAF_PM_ANY_TYPE`	This matches any palette request. If used, this should be the last matching entry (just before ZAF_PM_NONE) in the palette array since its value is the OR'ed composite of all other types.
`ZAF_PM_NONE`	This is an end-of-array indicator. This entry must be the last entry of an array. It is used by ZAF when counting the number of palette entries available in a given ZafPaletteData object. It should not be used as a sole member of a palette table.
`ZAF_PM_OUTLINE`	This specifies a palette entry that contains border colors. This is only used when the Bordered() flag is set, and the requesting object wants to draw an encompassing border around its specified region. This value is not used when a 3-dimensional border is drawn around the object.
`ZAF_PM_BACKGROUND`	Used when clearing or drawing to the background portion of the object. The background clears to the pattern specified in this palette using the foreground, background and pattern for the cleared area.
`ZAF_PM_FOREGROUND`	Used when drawing graphic information, such as lines, rectangles, and ellipses within a window object. This palette is used after the background has been cleared, and additional information, such as a check-mark, or radio-button still need to be rendered on the display.
`ZAF_PM_TEXT`	This indicates a palette to be used when drawing textual information. Window objects typically use the font, pattern, foreground and background entries of the associated palette entry when rendering text information to the screen.

Value	Definition
`ZAF_PM_HOT_KEY`	This indicates an entry to be used when drawing the “hotkey” portion of a string value. Normally, this value is only set and used on text based environments, since GUI environments generally show hot key information with an underline.
`ZAF_PM_LIGHT_SHADOW`	This is the light area of a 3-dimensional shadow. This palette is used in conjunction with ZAF_PM_DARK_SHADOW to present a shadowed appearance on the object. When the object appears raised, this entry is used on the left and top sides of the object. If the object appears depressed, this entry is used for the right and bottom sides of the object.
`ZAF_PM_DARK_SHADOW`	This is the dark area of a 3-dimensional shadow. This palette is used in conjunction with ZAF_PM_LIGHT_SHADOW to present a shadowed appearance on the object. When the object appears raised, this entry is used on the right and bottom sides of the object. If the object appears depressed, this entry is used for the left and top sides of the object.
`ZAF_PM_FOCUS`	This specifies the color value to be used when drawing the focus rectangle around a window object. Typically, this entry is used with ZAF_PM_ANY_STATE so the focus is drawn in a consistent color.

(3) Object state. This part of the ZafPaletteMap structure, defined by “ZafPaletteState state,” is used in conjunction with ZafPaletteType, and specifies the state the object must be in, in order for the palette to be used in the current drawing operation. The following values are defined by ZAF:

Value	Definition
`ZAF_PM_ANY_STATE`	This value matches any logical palette request, as long as the specified type is ZAF_PM_ANY_TYPE or the value matches the requested palette type. This is typically used as the “final” matching entry in a palette array, so objects automatically match a default request.

Value	Definition
`ZAF_PM_ACTIVE`	This state is used when the window, or window object, is shown as the front window. The colors in this entry are typically the same as ZAF_PM_INACTIVE, but may be different for objects that show different colors when shown as the front window (e.g. a window's title bar is typically shown in an active color when the window has input focus, or inactive when it does not have the focus).
`ZAF_PM_CURRENT`	This matches when the requested object has the focus. This entry can be used if you want to distinguish items that have the input focus in more dramatic ways than just drawing a focus rectangle.
`ZAF_PM_INACTIVE`	This state is used when the parent does not have the input focus. As stated in ZAF_PM_ACTIVE, most objects do not use this setting. It is provided for special visual objects such as ZafTitle, that have a unique presentation to show the window either does or does not have the immediate input focus.
`ZAF_PM_SELECTED`	This state is used when the object's Selected() attribute is "true." Many objects, such as vertical and horizontal lists, show their "selected" children in a highlighted state, giving immediate visual queues to the user that the object has been selected from among the list of siblings.
`ZAF_PM_DISABLED`	This state is used when the object's Disabled() attribute is "true." Typically, this palette contains a "dithered" font and color setting that shows the object in a diminished, or unselectable state.
`ZAF_PM_ENABLED`	This state is used when the object's Disabled() attribute is "false." This palette typically contains the normal font and color setting associated with window objects.

There are three pre-defined ZafWindowObject functions that actually make changes to the user palette. These functions are SetBackgroundColor(), SetTextColor() and SetFont(). Evaluation of the SetTextColor() function provides a good tutorial on the proper use of user palettes.

```
ZafLogicalColor ZafWindowObject::SetTextColor(ZafLogicalColor
    color, ZafLogicalColor mono)
{
  // Make sure there is a userPalette.
  if (!userPaletteData)
    SetUserPaletteData(new ZafPaletteData());

  // Add the new entry.
  ZafPaletteStruct textPalette = userPaletteData->
    GetPalette(ZAF_PM_TEXT, ZAF_PM_ANY_STATE);
  textPalette.colorForeground = color;
  textPalette.monoForeground = mono;
  userPaletteData->AddPalette(ZAF_PM_TEXT, ZAF_PM_ANY_STATE,
    textPalette);

  // Return the current color.
  return (color);
}
```

The code above shows two main pieces. The first part shows the creation and specification of a new default ZafPaletteData object, if no user palette currently exists. The ZafPaletteData object provides a “container” for all color and font modifications. The second part adds a particular palette entry by either retrieving the palette entry if it already exists, or by creating a new entry if it does not exist (both operations accomplished within the GetPalette() function). The new palette is then modified by setting the color and monochrome text values, and finally, added as a new entry with the AddPalette() function.

Here is another code snippet that reinforces the palette creation techniques used in an application.

```
// Create a new button.
ZafButton *button = new ZafButton(0, 0, 20, "button",
    ZAF_NULLP(ZafBitmapData));

// Modify the selected background of the button to be yellow.
ZafPaletteData *palette = new ZafPaletteData();
ZafPaletteStruct entry = palette->GetPalette(ZAF_PM_BACKGROUND,
    ZAF_PM_SELECTED);
entry.colorBackground = ZAF_CLR_YELLOW;
palette->AddPalette(ZAF_PM_TEXT, ZAF_PM_SELECTED, entry);
button->SetUserPaletteData(palette);
```

Note that SetUserPaletteData() is an instance replacement of color and font information, not a class replacement. Thus, setting a new user palette will only affect the instantiated object where the information is specified, not all objects associated with the instance’s class (e.g. a new button object vs. the ZafButton class). Also, be careful to examine the present contents of UserPalette-Data() before replacing those contents. As mentioned above, the

SetBackgroundColor(), SetTextColor() and SetFont() functions create a user palette before adding a particular font or color specification.

The return value for UserPaletteData() and SetUserPaletteData() is the current user palette data associated with the object. This will always be the color value passed into the SetUserPaletteData().

typedef ZafUInt16 *ZafStatus*;

userStatus

`ZafStatus` **`userStatus`**`;`

userStatus is a member of ZafWindowObject provided exclusively for the programmer's use, and is only initialized to 0 at the ZafWindowObject level. Since userFlags is defined at the ZafWindowObject level, it may be useful for storing user-defined bit flags in any object derived from ZafWindowObject (including built-in ZAF objects).

Visible

`bool` **`Visible`**`(void) const;`
`virtual bool` **`SetVisible`**`(bool visible);`

A visible object is one that can be viewed by the user from within a window or on the screen. There are many occasions where changing an object's visibility may be appropriate. These may include, but are not restricted to:

- Overlaying multiple objects on the same window location, then making one object visible according to the current state of the application.
- Making the object invisible while performing extensive changes to the object. These changes may include modifying text information, removing presentation bitmaps, changing the selected state of the object, etc. Changing a single piece of information would not require temporarily making the object invisible. Multiple changes in succession, however, are greatly enhanced while the object is invisible because it dramatically reduces the amount of object refreshing.
- Modifying the object while preserving the object's position, relative to other siblings. You can always remove an object using Subtract(), but this causes the object's OS representation to be destroyed, and its position, relative to other siblings to be removed. Thus, Subtract() should only be used when extensive changes, that cannot be accomplished by toggling either AutomaticUpdate() or Visible(), are performed.

As stated above, using SetVisible(false) simply removes the object's visual presentation from the screen. It does not affect the object's current settings, its position within the parent window, the space the object occupies, or its created state with the underlying GUI environment.

Here is some sample code that shows the correct use of SetVisible().

```
// Make extensive changes to the object.
object->SetVisible(false);
object->SetText("Continue with the application?");
object->Disabled(false);
object->SetViewOnly(true);
object->SetHzJustification(ZAF_HZ_CENTER);
object->SetVisible(true);

// Place two objects on the same screen location,
// setting one invisible.
ZafButton *button1 = new ZafButton(2, 2, 20, "No Error",
    ZAF_NULLP(ZafBitmapData));
window->Add(button1);

ZafButton *button2 = new ZafButton(2, 2, 20, "Kill
    Application!", ZAF_NULLP(ZafBitmapData));
button2->SetBackgroundColor(ZAF_CLR_RED);
button2->SetTextColor(ZAF_CLR_WHITE);
button2->SetVisible(false);
window->Add(button2);
```

Note, you can also use the SetAutomaticUpdate() function to prevent flashing of an object when color, font, or child additions and subtractions are being performed in your application. It is recommended you review ZafWindowObject::SetAutomaticUpdate() to understand the benefits and limitations of this related function.

Since the Visible() attribute may be set to true before the object's parent window is actually added to the screen, Visible() may be true before the object is really on the screen. One way to see if the object is on the screen or not is to check its screenID. See screenID for more information.

Finally, note that setting the visible attribute on a parent object to false causes all of the children to become invisible, even though their individual visible states may be preset to be true. The functionality of SetVisible() is thus propagated to children, grandchildren, etc., but only through inheritance, not by value replacement (i.e. the child object's visible member is not reset to be the same as the parent's value). Once the Visible() state is set back to true, the visual aspects of the children are restored.

The return value for Visible() and SetVisible() is the final, or current visible state of the object (true or false). Under normal circumstances, this will be the value passed into the SetVisible() function. It is only if a derived object overrides the functionality of SetVisible(), that the return state may be different from the value passed to SetVisible().

windowManager

```
static ZafWindowManager *windowManager;
```

This is a static pointer to the application's window manager. It is initialized when the ZafWindowManager's constructor is called and should not be modified. All derived window objects use this member when making requests to the window manager. They do not use the global variable zafWindowManager.

Here is a code snippet that shows how a derived window object can use the window manager to determine the current drag object.

```
ZafEventType MyDerivedWindowObject::DragDropEvent(const
    ZafEventStruct &event)
{
  if (event.type == S_DROP_DEFAULT && windowManager->dragObject)
    SetText(windowManager->dragObject->Text());
  ...
}
```

This member, as well as the static ZafWindowObject::display and ZafWindowObject::eventManager members are duplicate copies of the global variables zafDisplay, zafEventManager, and zafWindowManager. They are defined in the base ZafWindowObject class to allow advanced ZAF programmers the opportunity of removing the static definition, thus allowing particular instance variables to be associated with each window object; a feature useful in some multiple-display and embedded-system applications.

Write

```
virtual void Write(ZafObjectPersistence &persist);
```

This function is used to persist a ZAF object. Typically, objects are persisted to a Zinc specified .DAT file using the ZAF Designer. But ZAF objects may also be persisted "in-code," if they have been instantiated and have received an S_INITIALIZE message (This message causes the object to register string and number identifications, essential to object persistence). The following code shows how this type of persistence is performed.

```
// Create a window, then persist it to the specified file.
ZafWindow *window = new ZafWindow(0, 0, 50, 10);
window->AddGenericObjects(ZafStringData("Window"));
window->Add(new ZafPrompt(2, 2, 10, "name:");
window->Add(new ZafString(12, 2, 30, ZAF_NULLP(ZafIChar), 100));
...

window->Event(S_INITIALIZE);

// Create the persist object.
```

```
ZafStorage *storage = new ZafStorage("myfile.dat");
ZafObjectPersistence persist(storage,
   zafDefaultDataConstructor, zafDefaultObjectConstructor);
window->Write(persist);
delete storage;
```

As shown above, this function is generally used when storing a complete window, not just a window object. Nevertheless, the advanced definition of .DAT files allows the persistence of single window objects, if the associated file system allows directory traversal and independent object storage (both features available with the ZafStorage object). Here is a code snippet that shows how to persist a ZafButton object inside a parent window's directory.

```
// Persist a ZafButton to ~ZafWindow~MyWindow~MyButton.
ZafButton *button = new ZafButton(2, 2, 10, "OK",
   ZAF_NULLP(ZafBitmapData));
button->SetStringID("MyButton");
button->Event(S_INITIALIZE);

ZafStorage *storage = new ZafStorage("myfile.dat");
ZafObjectPersistence persist(storage,
   zafDefaultDataConstructor, zafDefaultObjectConstructor);
storage->ChDir(~ZafWindow~MyWindow");
button->Write(persist);
```

For in-depth information on object persistence, refer to the source code for ZafWindow::Write() and the ZafWindowObject constructor section of this chapter.

zafRegion

ZafRegionStruct **zafRegion**;

See Region().

Utility Reference

Convert

"Convert" provides support for converting ZAF 4.x persistent object data files (such as those created with Zinc Designer) to their ZAF version 5 equivalents. Convert persistent data files is one of three major steps in converting a ZAF 4.x project to ZAF 5. (The other steps are running "Rep4to5" and manually converting logic). Convert is not needed when creating new ZAF 5 applications.

Usage

```
convert [source file] [target file]
```

Convert may be passed two command line parameters to specify the original ZAF 4.x data file and the ZAF 5 output file name. If the file names are not specified, the user may provide them using the supplied graphical user interface. The ZAF 4.x data file name is specified for "Source file:" and the output file name is specified for "Destination file:". To begin the conversion process, select the "Convert" button. The names of the objects converted will appear in the scrolling text field.

Convert has limitations:

- User data is not converted. For example, if the programmer has derived an object and overloaded the ZAF 4 Store() function to store custom data, this data cannot be automatically converted. If customer data is encountered during the conversion process, the converter may terminate unexpectedly, or the data file may not be properly converted.
- Only data file directories containing "known" data are searched during the conversion process. If the programmer has stored user data or Zinc objects in custom directories, the information will not be converted. However, these unknown directories will not affect the conversion of other directories.
- After conversion, objects may be stored in different directory names. The programmer should examine the file using Zinc Designer to become familiar with the new structure. Note that different window types (normal, dialog, scrolled, etc.) are stored in different directories.

Source code (convert.cpp) is supplied, and may be modified to handle special cases.

Rep

"Rep" provides support for replacing strings in a file, and can be useful when changing class names or other symbols in source code files. A modification of this utility, Rep4to5, is available to automatically replace many of the ZAF 4.x symbols with their version 5 equivalents. See Rep4to5 for more information.

Rep modifies the source file in place. Backup of the source file is therefore recommended.

Usage

```
rep [options] <file> <oldString,newString>
   [oldString,newString [...]]
```

The command line options for the Rep utility are as follows:

Option	Description
`/word`	Match complete words only
`/force`	Force replacement without asking the user to verify

Some examples of using the ZMake utility follow:

Command Line	Description
`rep *.?pp dog,rat`	"dog" is replaced with "rat", "dogbert" is replaced with "ratbert", each replacement is verified with "y" or "n". All occurrences of "dog" are replaced whether complete words or portions of words.
`rep /word /force *.?pp dog,rat cat,mouse`	"dog" is replaced with "rat", "cat" is replaced with "mouse", "dogbert" remains "dogbert", replacements are made without verification.

Rep4to5

“Rep4to5” automatically replaces most of the ZAF 4.x symbols to their version 5 equivalents. Rep4to5 is one step in converting a ZAF 4.x project to ZAF 5. (Other steps include running “Convert” and manually converting program logic).

Rep4to5 is a simple string replacement utility. As such, it does not reorder parameters or handle other sophisticated code conversion tasks. It is intended only to provide a quick head start to the code conversion process by pointing the programmer in the right direction.

“Rep4to5” is a customized version of the ZAF 5 “Rep” utility.

Usage

`rep4to5` `<file>`

file specifies the filename to be converted. This file is modified in place and should be backed up before converting.

Rep4to5 may be customized by modifying *replacementArray[]* in rep4to5.cpp and rebuilding the application. The programmer may modify which symbols are replaced, and their replacements. The first field in an element of replacementArray[] is the old symbol, and the second field is the replacement symbol. The array must be terminated with “{ 0, 0 }”.

Conversions

The pairs of strings used by rep4to5 is listed below as a ZAF 4 alphabetical reference to new names used in ZAF 5.

You will notice that many ZAF 4 strings, particularly flag names, cannot be directly converted to ZAF 5. In ZAF 4 these flags were used both to *set* and *get* values. In ZAF 5 setting of properties is accomplished using Set* functions while querying the same properties use different accessor functions. In these cases, where the original string was ambiguous, Rep4to5 adds a comment to the converted code to help identify the proper ZAF 5 member. It is left to the programmer to complete the conversion.

ZAF 4 symbol (old)	**ZAF 5 replacement**
`_classID`	`classID`
`_className`	`className`
`AcceptsDrop`	`AcceptDrop`
`AllowsCheckMark`	`AllowToggling`
`AllowsDragSelection`	
`AllowsMultipleSelection`	`AllowsMultipleSelection /* SelectionType() == ZAF_MULTIPLE_SELECTION */`

ZAF 4 symbol (old)	ZAF 5 replacement
AllowsToggling	AllowToggling
ALT_STATE	ZafDevice::ZafAltState
AppliesToOppositeSide	OppositeSide
ATCF_BOTTOM	ATCF_BOTTOM /* Type() == ZAF_ATCF_BOTTOM */
ATCF_LEFT	ATCF_LEFT /* Type() == ZAF_ATCF_LEFT */
ATCF_OPPOSITE	ATCF_OPPOSITE /* OppositeSide() */
ATCF_RIGHT	ATCF_RIGHT /* Type() == ZAF_ATCF_BOTTOM */
ATCF_STRETCH	ATCF_STRETCH /* Stretch() */
ATCF_TOP	ATCF_TOP /* Type() == ZAF_ATCF_TOP */
AutoRepeatsSelection	AutoRepeatSelection
AutoSizes	AutoSize
AutoSortsData	AutoSortData
BTF_AUTO_SIZE	BTF_AUTO_SIZE /* AutoSize() */
BTF_CHECK_BOX	BTF_CHECK_BOX /*ButtonType() == ZAF_CHECK_BOX */
BTF_DEFAULT_BUTTON	BTF_DEFAULT_BUTTON /* parent->DefaultButton() */
BTF_DOUBLE_CLICK	BTF_DOUBLE_CLICK /* SelectOnDoubleClick() */
BTF_DOWN_CLICK	BTF_DOWN_CLICK /* SelectOnDownClick() */
BTF_NO_3D	BTF_NO_3D /* ButtonType() == ZAF_FLAT_BUTTON */
BTF_NO_TOGGLE	BTF_NO_TOGGLE /* !AllowToggling() */
BTF_RADIO_BUTTON	BTF_RADIO_BUTTON /* ButtonType() == ZAF_RADIO_BUTTON */
BTF_REPEAT	BTF_REPEAT /* AutoRepeatSelection() */
BTF_SEND_MESSAGE	BTF_SEND_MESSAGE /* SendMessageWhenSelected() */
BTF_STATIC_BITMAPARRAY	BTF_STATIC_BITMAPARRAY /* bitmapData->staticArray */
BUTTON_TYPE	ZafButtonType

ZAF 4 symbol (old)	ZAF 5 replacement
BUTTON_TYPE	BUTTON_TYPE /* ButtonType() */
DEVICE_IMAGE	ZafDeviceImage
DeviceImage	SetDeviceImage
DevicePosition	SetDevicePosition
DeviceState	SetDeviceState
EVENT_TYPE	ZafEventType
FALSE	false
Get	Get /*Possibly GetObject*/
ICF_DOUBLE_CLICK	ICF_DOUBLE_CLICK /* SelectOnDoubleClick() */
ICF_MINIMIZE_OBJECT	ICF_MINIMIZE_OBJECT /* IconType() == ZAF_MINIMIZE_ICON */
ICF_STATIC_ICONARRAY	ICF_STATIC_ICONARRAY /* IconData()->staticArray*/
ICHAR_T	ZafIChar
ID_ATTACHMENT	ID_ZAF_ATTACHMENT
ID_BIGNUM	ID_ZAF_BIGNUM
ID_BORDER	ID_ZAF_BORDER
ID_BUTTON	ID_ZAF_BUTTON
ID_CHECK_BOX	ID_ZAF_CHECK_BOX
ID_COMBO_BOX	ID_ZAF_COMBO_BOX
ID_CONSTRAINT	ID_ZAF_CONSTRAINT
ID_DATE	ID_ZAF_DATE
ID_DIALOG_WINDOW	ID_ZAF_DIALOG_WINDOW
ID_DIMENSION_CONSTRAINT	ID_ZAF_DIMENSION_CONSTRAINT
ID_EVENT_MANAGER	ID_ZAF_EVENT_MANAGER
ID_FORMATTED_STRING	ID_ZAF_FORMATTED_STRING
ID_GEOMETRY_MANAGER	ID_ZAF_GEOMETRY_MANAGER
ID_GROUP	ID_ZAF_GROUP
ID_HLIST	ID_ZAF_HZ_LIST
ID_HZ_LIST	ID_ZAF_HZ_LIST
ID_ICON	ID_ZAF_ICON
ID_IMAGE	ID_ZAF_IMAGE
ID_INTEGER	ID_ZAF_INTEGER
ID_LIST	ID_ZAF_LIST
ID_MAXIMIZE_BUTTON	ID_ZAF_MAXIMIZE_BUTTON
ID_MINIMIZE_BUTTON	ID_ZAF_MINIMIZE_BUTTON

ZAF 4 symbol (old)	ZAF 5 replacement
ID_NOTEBOOK	ID_ZAF_NOTEBOOK
ID_POP_UP_ITEM	ID_ZAF_POP_UP_ITEM
ID_POP_UP_MENU	ID_ZAF_POP_UP_MENU
ID_PROMPT	ID_ZAF_PROMPT
ID_PULL_DOWN_ITEM	ID_ZAF_PULL_DOWN_ITEM
ID_PULL_DOWN_MENU	ID_ZAF_PULL_DOWN_MENU
ID_RADIO_BUTTON	ID_ZAF_RADIO_BUTTON
ID_REAL	ID_ZAF_REAL
ID_RELATIVE_CONSTRAINT	ID_ZAF_RELATIVE_CONSTRAINT
ID_SCROLL_BAR	ID_ZAF_SCROLL_BAR
ID_SPIN_CONTROL	ID_ZAF_SPIN_CONTROL
ID_STATUS_BAR	ID_ZAF_STATUS_BAR
ID_STRING	ID_ZAF_STRING
ID_SYSTEM_BUTTON	ID_ZAF_SYSTEM_BUTTON
ID_TABLE	ID_ZAF_TABLE
ID_TABLE_HEADER	ID_ZAF_TABLE_HEADER
ID_TABLE_RECORD	ID_ZAF_TABLE_RECORD
ID_TEXT	ID_ZAF_TEXT
ID_TIME	ID_ZAF_TIME
ID_TITLE	ID_ZAF_TITLE
ID_TOOL_BAR	ID_ZAF_TOOL_BAR
ID_VLIST	ID_ZAF_VT_LIST
ID_VT_LIST	ID_ZAF_VT_LIST
ID_WINDOW	ID_ZAF_WINDOW
ID_WINDOW_MANAGER	ID_ZAF_WINDOW_MANAGER
ID_WINDOW_OBJECT	ID_ZAF_WINDOW_OBJECT
IMF_AUTO_SIZE	IMF_AUTO_SIZE /* AutoSize() */
IMF_BACKGROUND	IMF_BACKGROUND /* Wallpaper() */
IMF_SCALED	IMF_SCALED /* Scaled() */
IMF_TILED	IMF_TILED /* Tiled() */
Inherited	IsA
Is3D	Is3D /* ButtonType() != ZAF_FLAT_BUTTON */
IsAutoClear	AutoClear
IsBackground	Wallpaper
IsBordered	Bordered

ZAF 4 symbol (old)	ZAF 5 replacement
IsCheckBox	IsCheckBox /*ButtonType() == ZAF_CHECK_BOX */
IsCopyDraggable	CopyDraggable
IsDefaultButton	IsDefaultButton /*parent->DefaultButton() == ...*/
IsDefaultInvalid	Invalid
IsDefaultUnanswered	Unanswered
IsDestroyable	Destroyable
IsLocked	Locked
IsLowerCase	LowerCase
IsMinimizeIcon	IsMinimizeIcon /* IconType() == ZAF_MINIMIZE_ICON */
IsModal	Modal
IsMoveable	Moveable
IsMoveDraggable	MoveDraggable
IsNoncurrent	Noncurrent
IsNonselectable	Disabled
IsPasswordStyle	Password
IsRadioButton	ButtonType() == ZAF_RADIO_BUTTON
IsScaled	Scaled
IsSelectable	!Disabled()
IsSeparator	ItemType() == ZAF_SEPARATOR
IsSizeable	Sizeable
IsSupport	SupportObject
IsTemporary	Temporary
IsTiled	Tiled
IsUpperCase	UpperCase
IsViewOnly	ViewOnly
MNIF_ABOUT	MNIF_ABOUT /*ItemType() == ZAF_ABOUT_OPION */
MNIF_CHECK_MARK	MNIF_CHECK_MARK /* AllowToggling */
MNIF_CLOSE	MNIF_CLOSE /*ItemType() == ZAF_CLOSE_OPION */
MNIF_MAXIMIZE	MNIF_MAXIMIZE /* ItemType() == ZAF_MAXIMIZE_OPTION */

ZAF 4 symbol (old)	ZAF 5 replacement
MNIF_MINIMIZE	MNIF_MINIMIZE /* ItemType() == ZAF_MINIMIZE_OPION */
MNIF_MOVE	MNIF_MOVE /*ItemType() == ZAF_MOVE_OPTION */
MNIF_NON_SELECTABLE	MNIF_NON_SELECTABLE /* Disabled() */
MNIF_RESTORE	MNIF_RESTORE /* ItemType() == ZAF_RESTORE_OPION */
MNIF_SEND_MESSAGE	MNIF_SEND_MESSAGE /* SendMessageWhenSelected() */
MNIF_SEPARATOR	MNIF_SEPARATOR /* ItemType() == ZAF_SEPARATOR */
MNIF_SIZE	MNIF_SIZE /*ItemType() == ZAF_SIZE_OPTION */
MNIF_SWITCH	MNIF_SWITCH /*ItemType() == ZAF_SWITCH_OPTION */
NOTIFY_ELEMENT	ZafNotifyElement
NOTIFY_LIST	ZafNotifyList
NUMBERID	ZafNumberID
NUMID_BORDER	ZAF_NUMID_BORDER
NUMID_C_SCROLL	ZAF_NUMID_C_SCROLL
NUMID_CNR_HEADER	ZAF_NUMID_CORNER_HEADER
NUMID_COL_HEADER	ZAF_NUMID_COLUMN_HEADER
NUMID_GEOMETRY	ZAF_NUMID_GEOMETRY
NUMID_HZ_SCROLL	ZAF_NUMID_HZ_SCROLL
NUMID_MAXIMIZE	ZAF_NUMID_MAXIMIZE
NUMID_MINIMIZE	ZAF_NUMID_MINIMIZE
NUMID_OPT_CLOSE	ZAF_NUMID_OPT_CLOSE
NUMID_OPT_MAXIMIZE	ZAF_NUMID_OPT_MAXIMIZE
NUMID_OPT_MINIMIZE	ZAF_NUMID_OPT_MINIMIZE
NUMID_OPT_MOVE	ZAF_NUMID_OPT_MOVE
NUMID_OPT_RESTORE	ZAF_NUMID_OPT_RESTORE
NUMID_OPT_SIZE	ZAF_NUMID_OPT_SIZE
NUMID_OPT_SWITCH	ZAF_NUMID_OPT_SWITCH
NUMID_ROW_HEADER	ZAF_NUMID_ROW_HEADER
NUMID_SYSTEM	ZAF_NUMID_SYSTEM

ZAF 4 symbol (old)	ZAF 5 replacement
NUMID_TITLE	ZAF_NUMID_TITLE
NUMID_VT_SCROLL	ZAF_NUMID_VT_SCROLL
OBJECTID	ZafNumberID
relative	ZafRegion
S_CURRENT	N_CURRENT
S_DISPLAY_ACTIVE	S_DISPLAY_ACTIVE /*Redisplay() or S_REDISPLAY_REGION */
S_DISPLAY_INACTIVE	S_DISPLAY_INACTIVE /*Redisplay() or S_REDISPLAY_REGION */
S_NON_CURRENT	N_NON_CURRENT
SBF_CORNER	SBF_CORNER /* ScrollType() == ZAF_CORNER_SCROLL */
SBF_HORIZONTAL	SBF_HORIZONTAL /* ScrollType() == ZAF_CORNER_SCROLL */
SBF_SCALE	SBF_SCALE /* ScrollType() */
SBF_SLIDER	SBF_SLIDER /* ScrollType() */
SBF_VERTICAL	SBF_VERTICAL /* ScrollType() == ZAF_VERTICAL_SCROLL */
searchID	searchID /*Use ClassName()*/
SEEK	ZafSeek
SelectsOnDoubleClick	SelectOnDoubleClick
SelectsOnDownClick	SelectOnDownClick
SendsMessageWhenSelected	SendMessageWhenSelected
STF_LOWER_CASE	STF_LOWER_CASE /* LowerCase() */
STF_PASSWORD	STF_PASSWORD /* Password() */
STF_UPPER_CASE	STF_UPPER_CASE /* UpperCase() */
STF_VARIABLE_NAME	STF_VARIABLE_NAME /* VariableName() */
storageError	Error()
TBLF_GRID	TBLF_GRID /* Grid() */
THF_COLUMN_HEADER	THF_COLUMN_HEADER /* HeaderType() == ZAF_COLUMN_HEADER */

ZAF 4 symbol (old)	ZAF 5 replacement
THF_CORNER_HEADER	THF_CORNER_HEADER /* HeaderType() == ZAF_CORNER_HEADER */
THF_GRID	THF_GRID /* Grid() */
THF_ROW_HEADER	THF_ROW_HEADER /*HeaderType() == ZAF_ROW_HEADER*/
TRUE	true
true.	/* */
UCHAR	ZafUInt8
UI_APPLICATION	ZafApplication
UI_ATTACHMENT	ZafAttachment
UI_CONSTRAINT	ZafConstraint
UI_DEVICE	ZafDevice
UI_DEVICE	ZafDevice
UI_DIMENSION_CONSTRAINT	ZafDimensionConstraint
UI_DISPLAY	ZafDisplay
UI_DISPLAY	ZafDisplay
UI_DISPLAY_IMAGE	ZafDisplayImage
UI_ELEMENT	ZafElement
UI_ERROR_STUB	ZafErrorStub
UI_ERROR_SYSTEM	ZafErrorSystem
UI_EVENT	ZafEventStruct
UI_EVENT	ZafEventStruct
UI_EVENT_MANAGER	ZafEventManager
UI_EVENT_MANAGER	ZafEventManager
UI_EVENT_MAP	ZafEventMap
UI_GEOMETRY_MANAGER	ZafGeometryManager
UI_GRAPHICS_DISPLAY	ZafDisplay
UI_HELP_CONTEXT	UI_HELP_CONTEXT /* ZafIChar[lookupString]*/
UI_HELP_STUB	ZafHelpStub
UI_HELP_SYSTEM	ZafHelpSystem
UI_KEY	ZafKeyStruct
UI_LIST	ZafList
UI_LIST_BLOCK	ZafListBlock
UI_MACINTOSH_DISPLAY	ZafDisplay
UI_META_DISPLAY	ZafDisplay
UI_MSC_DISPLAY	ZafDisplay

ZAF 4 symbol (old)	ZAF 5 replacement
UI_MSWINDOWS_DISPLAY	ZafDisplay
UI_NEXTSTEP_DISPLAY	ZafDisplay
UI_OS2_DISPLAY	ZafDisplay
UI_PALETTE	ZafPaletteStruct
UI_PALETTE_MAP	ZafPaletteMap
UI_PATH	ZafPath
UI_PATH_ELEMENT	ZafPathElement
UI_POSITION	ZafPosition
UI_PRINTER	ZafPrinter
UI_QUEUE_BLOCK	ZafQueueBlock
UI_QUEUE_ELEMENT	ZafQueueElement
UI_REGION	ZafRegionStruct
UI_REGION_ELEMENT	ZafRegionElement
UI_REGION_LIST	ZafRegionList
UI_RELATIVE_CONSTRAINT	ZafRelativeConstraint
UI_SCROLL_INFORMATION	ZafScrollStruct
UI_TEXT_DISPLAY	ZafDisplay
UI_WCC_DISPLAY	ZafDisplay
ui_win.hpp	zaf.hpp
UI_WIN.hpp	zaf.hpp
UI_WINDOW_MANAGER	ZafWindowManager
UI_WINDOW_MANAGER	ZafWindowManager
UI_WINDOW_OBJECT	ZafWindowObject
UI_WINDOW_OBJECT	ZafWindowObject
UI_WINDOW_OBJECT::helpSystem	zafHelpSystem
UI_WINDOW_OBJECT:: errorSystem	zafErrorSystem
UI_WINDOW_OBJECT:: defaultStorage	UI_WINDOW_OBJECT::defaultStorage /*Use zafObjectPersistence*/
UI_XT_DISPLAY	ZafDisplay
UID_CURSOR	ZafCursor
UID_KEYBOARD	ZafKeyboard
UID_MOUSE	ZafMouse
UID_TIMER	ZafTimer
UIW_BIGNUM	ZafBignum
UIW_BORDER	ZafBorder
UIW_BUTTON	ZafButton

ZAF 4 symbol (old)	ZAF 5 replacement
UIW_COMBO_BOX	ZafComboBox
UIW_DATE	ZafDate
UIW_FORMATTED_STRING	ZafFormattedString
UIW_GROUP	ZafGroup
UIW_HZ_LIST	ZafHzList
UIW_ICON::_questionIconName	ZAF_QUESTION_ICON
UIW_ICON::_handIconName	ZAF_HAND_ICON
UIW_ICON:: _exclamationIconName	ZAF_EXLAMATION_ICON
UIW_ICON::_asteriskIconName	ZAF_ASTERISK_ICON
UIW_ICON:: _applicationIconName	ZAF_APPLICATION_ICON
UIW_ICON	ZafIcon
UIW_IMAGE	ZafImage
UIW_INTEGER	ZafInteger
UIW_MAXIMIZE_BUTTON	ZafMaximizeButton
UIW_MINIMIZE_BUTTON	ZafMinimizeButton
UIW_NOTEBOOK	ZafNotebook
UIW_POP_UP_ITEM	ZafPopUpItem
UIW_POP_UP_MENU	ZafPopUpMenu
UIW_PROMPT	ZafPrompt
UIW_PROMPT	ZafPrompt
UIW_PULL_DOWN_ITEM	ZafPullDownItem
UIW_PULL_DOWN_MENU	ZafPullDownMenu
UIW_REAL	ZafReal
UIW_SCROLL_BAR	ZafScrollBar
UIW_SCROLL_BUTTON	ZafScrollButton
UIW_SPIN_BUTTON	ZafSpinButton
UIW_SPIN_CONTROL	ZafSpinControl
UIW_STATUS_BAR	ZafStatusBar
UIW_STRING	ZafString
UIW_SYSTEM_BUTTON	ZafSystemButton
UIW_TABLE	ZafTable
UIW_TABLE_HEADER	ZafTableHeader
UIW_TABLE_RECORD	ZafTableRecord
UIW_TEXT	ZafText
UIW_TIME	ZafTime

ZAF 4 symbol (old)	ZAF 5 replacement
UIW_TITLE	ZafTitle
UIW_TOOL_BAR	ZafToolBar
UIW_VT_LIST	ZafVtList
UIW_WINDOW	ZafWindow
UsesAvailableRegion	UsesAvailableRegion /* RegionType() == ZAF_AVAILABLE_REGION */
UsesDefaultCellCoordinate	UsesDefaultCellCoordinate /* CoordinateType() == ZAF_CELL */
UsesDefaultMinicell-Coordinate	UsesDefaultMinicellCoordinate /* CoordinateType() == ZAF_MINICELL */
UsesDefaultPixelCoordinate	UsesDefaultPixelCoordinate /*CoordinateType() == ZAF_PIXEL */
UsesNormalHotKeys	NormalHotkeys
UsesOutsideRegion	UsesOutsideRegion /* RegionType() == ZAF_OUTSIDE_REGION */
VirtualGet	VirtualGet /*Use ZafWindowObject::BeginDraw()*/
VirtualPut	VirtualPut /*Use ZafWindowObject::EndDraw()*/
WNF_AUTO_SELECT	WNF_AUTO_SELECT /* AutoSelect() */
WNF_AUTO_SORT	WNF_AUTO_SORT /* AutoSortData() */
WNF_BITMAP_CHILDREN	WNF_BITMAP_CHILDREN /*!OSDraw() */
WNF_NO_WRAP	WNF_NO_WRAP /* !WrappedData() */
WNF_OWNERDRAW_CHILDREN	WNF_OWNERDRAW_CHILDREN /* !OSDraw() */
WNF_SELECT_MULTIPLE	WNF_SELECT_MULTIPLE /* SelectionType() == ZAF_MULIPLE_SELECTION */
WOAF_ACCEPTS_DROP	WOAF_ACCEPTS_DROP /* AcceptDrop() */
WOAF_COPY_DRAG_OBJECT	WOAF_COPY_DRAG_OBJECT /* CopyDraggable() */
WOAF_DIALOG_OBJECT	WOAF_DIALOG_OBJECT /* ZafDialogWindow */
WOAF_LOCKED	WOAF_LOCKED /* Locked() */
WOAF_MDI_OBJECT	WOAF_MDI_OBJECT /* ZafMDIWindow */
WOAF_MODAL	WOAF_MODAL /* Modal() */

ZAF 4 symbol (old)	ZAF 5 replacement
`WOAF_MOVE_DRAG_OBJECT`	`WOAF_MOVE_DRAG_OBJECT /* MoveDraggable() */`
`WOAF_NO_DESTROY`	`WOAF_NO_DESTROY /* !Destroyable() */`
`WOAF_NO_MOVE`	`WOAF_NO_MOVE /* !Moveable() */`
`WOAF_NO_SIZE`	`WOAF_NO_SIZE /* !Sizeable() */`
`WOAF_NON_CURRENT`	`WOAF_NON_CURRENT /* Noncurrent() */`
`WOAF_NORMAL_HOT_KEYS`	`WOAF_NORMAL_HOT_KEYS /* NormalHotKeys() */`
`WOAF_OUTSIDE_REGION`	`WOAF_OUTSIDE_REGION /* RegionType() == ZAF_OUTSIDE_REGION */`
`WOAF_TEMPORARY`	`WOAF_TEMPORARY /* Temporary() */`
`WOF_AUTO_CLEAR`	`WOF_AUTO_CLEAR /* AutoClear() */`
`WOF_BORDER`	`WOF_BORDER /* Bordered() */`
`WOF_INVALID`	`WOF_INVALID /* Invalid() */`
`WOF_MINICELL`	`WOF_MINICELL /* CoordinateType() == ZAF_MINICELL */`
`WOF_NON_FIELD_REGION`	`WOF_NON_FIELD_REGION /* RegionType() == ZAF_AVAILABLE_REGION */`
`WOF_NON_SELECTABLE`	`WOF_NON_SELECTABLE /*Disabled() */`
`WOF_PIXEL`	`WOF_PIXEL /*CoordinateType() == ZAF_PIXEL */`
`WOF_SUPPORT_OBJECT`	`WOF_SUPPORT_OBJECT /* SupportObject() */`
`WOF_UNANSWERED`	`WOF_UNANSWERED /* Unanswered() */`
`WOF_VIEW_ONLY`	`WOF_VIEW_ONLY /* ViewOnly() */`
`WOS_CHANGED`	`WOS_CHANGED /* Changed() */`
`WOS_EDIT_MODE`	`WOS_EDIT_MODE /* EditMode() */`
`WOS_GRAPHICS`	`WOS_GRAPHICS /*CoordinateType() */`
`WOS_INVALID`	`WOS_INVALID /* Invalid() */`
`WOS_MAXIMIZED`	`WOS_MAXIMIZED /* Maximized() */`
`WOS_MINIMIZED`	`WOS_MINIMIZED /* Minimized() */`
`WOS_OWNERDRAW`	`WOS_OWNERDRAW /* !OSDraw() */`
`WOS_READ_ERROR`	`WOS_READ_ERROR /* Error() == ZAF_ERROR_READ */`

ZAF 4 symbol (old)	ZAF 5 replacement
WOS_REDISPLAY	WOS_REDISPLAY /* S_REDISPLAY_DATA */
WOS_SELECTED	WOS_SELECTED /* Selected() */
WOS_UNANSWERED	WOS_UNANSWERED /* Unanswered() */
Z_ERROR	ZafError
ZAF_DIALOG_WINDOW	ZafDialogWindow
ZAF_GEOMETRY_MANAGER	ZafGeometryManager
ZAF_MESSAGE_WINDOW	ZafMessageWindow
ZAF_WINDOW	ZafWindow
ZIL_BIGNUM	ZafBignumData
ZIL_CHAR_MAP	ZafCodeSetData
ZIL_COLOR	ZafLogicalColor
ZIL_COMPARE_FUNCTION	ZafCompareFunction
ZIL_DATE	ZafDateData
ZIL_DESIGNER_EVENT	ZafDesignerEvent
ZIL_DEVICE_STATE	ZafDeviceState
ZIL_DEVICE_TYPE	ZafDeviceType
ZIL_DIALOG_EVENT	ZafDialogEvent
ZIL_DLG_ABORT	S_DLG_ABORT
ZIL_DLG_CANCEL	S_DLG_CANCEL
ZIL_DLG_IGNORE	S_DLG_IGNORE
ZIL_DLG_NO	S_DLG_NO
ZIL_DLG_OK	S_DLG_OK
ZIL_DLG_RETRY	S_DLG_RETRY
ZIL_DLG_YES	S_DLG_YES
ZIL_ERA_TABLE	ZafEraStruct
ZIL_EVENT_TYPE	ZafEventType
ZIL_EXIT_FUNCTION	ZafExitFunction
ZIL_EXPORT_CLASS	ZAF_EXPORT
ZIL_EXPORT_CLASS	ZAF_EXPORT
ZIL_FILE	ZafFile
ZIL_FILE_CHAR	char
ZIL_I18N	ZafI18nData
ZIL_IBIGNUM	ZafIBignum
ZIL_ICHAR	ZafIChar
ZIL_ICHAR	ZafIChar
ZIL_IMAGE_HANDLE	OSImageID

ZAF 4 symbol (old)	ZAF 5 replacement
ZIL_IMAGE_TYPE	ZafDeviceType
ZIL_INT16	ZafInt16
ZIL_INT32	ZafInt32
ZIL_INT8	ZafInt8
ZIL_INTERNATIONAL::	<no replacement, not needed>
ZIL_LANGUAGE	ZafLanguageData
ZIL_LANGUAGE_ELEMENT	ZafLanguageData
ZIL_LOCALE	ZafLocaleData
ZIL_LOCALE_ELEMENT	ZafLocaleData
ZIL_LOGICAL_EVENT	ZafLogicalEvent
ZIL_LOGICAL_FONT	ZafLogicalFont
ZIL_LOGICAL_PALETTE	ZafPaletteState
ZIL_LOGICAL_PATTERN	ZafLogicalFillPattern
ZIL_MAXPATHLEN	ZAF_MAXPATHLEN
ZIL_MSG_ABORT	ZAF_DIALOG_ABORT
ZIL_MSG_CANCEL	ZAF_DIALOG_CANCEL
ZIL_MSG_HELP	ZAF_DIALOG_HELP
ZIL_MSG_IGNORE	ZAF_DIALOG_IGNORE
ZIL_MSG_NO	ZAF_DIALOG_NO
ZIL_MSG_OK	ZAF_DIALOG_OK
ZIL_MSG_RETRY	ZAF_DIALOG_RETRY
ZIL_MSG_YES	ZAF_DIALOG_YES
ZIL_NEW_FUNCTION	ZafObjectConstructor
ZIL_NULLP	ZAF_NULLP
ZIL_NUMBER	ZafNumber
ZIL_NUMBERID	ZafNumberID
ZIL_OBJECTID	ZafNumberID
ZIL_PRINTER_MODE	ZafPrinterMode
ZIL_RAW_CODE	ZafRawCode
ZIL_RBIGNUM	ZafRBignum
ZIL_REVISION	ZAF_REVISION
ZIL_SCREENID	ZafScreenIDType
ZIL_STDARG	ZafStandardArg
ZIL_STORAGE	ZafStorage
ZIL_STORAGE_DIRECTORY	ZafStorageDirectory
ZIL_STORAGE_OBJECT	ZafStorageFile
ZIL_STORAGE_OBJECT_READ_ONLY	ZafStorageFile

ZAF 4 symbol (old)	ZAF 5 replacement
ZIL_STORAGE_OBJECT_READ_ONLY	ZafStorageFile
ZIL_STORAGE_READ_ONLY	ZafStorage
ZIL_STORAGE_READ_ONLY	ZafStorage
ZIL_SYSTEM_EVENT	ZafSystemEvent
ZIL_SYSTEM_EVENT	ZafSystemEvent
ZIL_TIME	ZafTimeData
ZIL_UINT16	ZafUInt16
ZIL_UINT32	ZafUInt32
ZIL_UINT8	ZafUInt8
ZIL_USER_EVENT	ZafUserEvent
ZIL_USER_FUNCTION	ZafUserFunction
ZIL_UTIME	ZafUTimeData
ZIL_VERSION	ZAF_VERSION
ZINC_SIGNATURE	ZafSignature

ZMake

"ZMake" is a make utility providing support for portable, compiler-independent make files. Although make utilities provided with various compilers may be used to build ZAF projects, Zinc provides ZMake as an alternate, preferred method. ZMake supports the same concepts and most of the same syntax as compiler-supplied make utilities.

ZMake make files are easier to create and use than traditional make files since much of their internal complexity is off loaded to sub-make files supplied by Zinc. (This is largely a product of make file organization, however, and is not specifically related to ZMake.) By abstracting make syntax slightly, ZMake allows a single make file to support many different compilers. This greatly reduces make file maintenance issues for both Zinc and its customers.

Make files shipped with PC versions of ZAF are named ZMAKE.MAK, the default file name of a ZMake make file. Currently, ZMake is implemented for all compilers supported by ZAF for Microsoft Windows and MS DOS. Support for other environments is planned. Currently, make files for Motif are generated from POSIX.MAK and do not use the utility or concepts discussed in this reference.

Usage

```
zmake [options] <target>
```

The command line options for the ZMake utility are as follows:

Option	Description
`-f [makefile]`	Uses [makefile] instead of the default ZMAKE.MAK
`-k`	Keeps temporary response files
`-p`	Shows pre-parser output (for make file debugging)
`[macro=myString]`	Defines a macro that may be used in the make file

Some examples of using the ZMake utility follow:

Command Line	Description
`zmake win16`	Builds a ZAF program for 16-bit Microsoft Windows using the make file ZMAKE.MAK.
`zmake -f MAKEFILE.MAK win32`	Builds a ZAF program for 32-bit Microsoft Windows using the make file MAKEFILE.MAK instead of the default ZMAKE.MAK file.

Environment Variables

Before ZMake can be executed successfully, environment variables must be defined. These environment variables may be used to define the compiler-specific aspects of the make, thereby allowing the make files themselves to remain compiler-independent.

Note that, like other make utilities, ZMake treats make file macros and environment variables identically. Therefore it is possible to define environment variables inside the make file itself, or to define the make file macros (discussed later) in the OS environment. Zinc has chosen to define the following variables in the environment to maximize compiler independence and ease of use. See Macros for more information.

The ZMake-compatible make files provided with ZAF utilize the following environment variables:

Environment Variable	Description
`ZAF_ROOT`	*Required.* Specifies the top-level directory containing the ZAF 5 installation. This directory is referenced to find source files, include files, libraries, etc.
`ZINC_COMPILER`	*Required.* Specifies which compiler and linker ZMake should invoke during the build process. ZINC_COMPILER may be any of the following: BORLAND, MICROSOFT, WATCOM.
`INCLUDE`	*Required for all compilers except Borland.* Specifies a complete include path. When specified, INCLUDE should list the paths to compiler and ZAF headers, plus any other headers required by the project. If not specified (Borland only), the include path specified in the compiler configuration file (turboc.cfg or bcc32.cfg) will be used. Note that the INCLUDE environment variable is not specifically used by ZMake, but is required by some compilers.
`LIB`	*Required for all compilers except Borland.* Specifies a complete library path. When specified, LIB should list the paths to compiler and ZAF libraries, plus any other libraries required by the project (ChartFolio, for example). If not specified (Borland only), the lib path specified in the linker configuration file (tlink.cfg or tlink32.cfg) will be used. Note that the INCLUDE environment variable is not specifically used by ZMake, but is required by some linkers.

Macros

During the build process, ZMake make files expect several symbols to be defined. Some of these symbols may be defined as environment variables (see the preceding section), and others may be defined as make file macros. If a symbol is defined *both* as an environment variable and as a macro, the later macro definition is used.

The following macros are specifically supported:

Macro	Definition
`ZAF_ROOT`	*Required.* Normally specified as an environment variable. See Environment Variables for more information.
`ZINC_COMPILER`	*Required.* Normally specified as an environment variable. See Environment Variables for more information.

`PLATFORM`	*Required.* Specifies the target platform supported by the current build option. Multiple build options (and therefore multiple platforms) may be supported by a single make file. Refer to make file examples (below) for sample usage. Valid options:
	`WIN16   (16 bit Microsoft Windows platforms)`
	`WIN32   (32 bit Microsoft Windows platforms)`

`TARGET_TYPE`	*Required.* Specifies the target type supported by the current build option. Valid options:
	`EXE     (Executable. ZAF statically linked)`
	`EXEDLL  (Executable. ZAF dynamically linked)`
	`LIB     (Library)`
	`LIBDLL  (Library. Calls functions in ZAF DLL)`
	`DLL     (Library. Dynamically linked)`

`TARGET`	*Required.* Specifies the name of the target file.
`SOURCE_FILES`	*Required.* Specifies the source code files needed to build the target.
`IMPORT_LIBRARY`	*Required for DLLs only.* Specifies the name of the Windows import library that will be generated when the TARGET_TYPE is “DLL”.
`ADD_OBJECT_FILES`	*Optional.* Specifies the names of additional object files to be used in this build, if any.
`ADD_LIBRARIES`	*Optional.* Specifies the names of additional library files to be used in this build, if any.
`DEFINITION_FILE`	*Optional.* Specifies the name of the Windows ".def" file to be used in this build, if any.

Macro	Definition
RESOURCE_FILE	*Optional*. Specifies the name of the Windows ".res" file to be used in this build, if any.

DEBUG	*Optional*. Specifies whether the code is compiled with debug information or not. Valid options:
	`off      (No debug information - default)`
	`on       (Build with debug information)`

MAKE	*Internal*. Returns the name of the make utility currently running. This will normally be “ZMAKE”.

Example

```
# --- zake.mak ------------------------------------------------
# Define macros used by main make file

# These macros are usually defined by environment variables.
ZAF_ROOT = c:\zaf500
ZINC_COMPILER = borland   (options: borland, microsoft, watcom)

# Options common to all targets
DEBUG = off
SOURCE_FILES = myapp1.cpp myapp2.cpp

# 16 bit windows target.
TARGET = myapp.exe
TARGET_TYPE = exe      (options: exe, exedll, lib, libdll, dll)
PLATFORM = win16       (options: win32, win16)
DEFINITION_FILE = myapp.def
RESOURCE_FILE = bitmaps.rc
!include <zaf.mak>    (required. generate rules for this target)

# 32 bit windows target.
TARGET = myapp32.exe
TARGET_TYPE = exe
PLATFORM = win32
DEFINITION_FILE =
RESOURCE_FILE = bitmaps.rc
!include <zaf.mak>

# 32 bit windows target linked to dll.
TARGET = myapp32d.exe
TARGET_TYPE = exedll
PLATFORM = win32
DEFINITION_FILE =
RESOURCE_FILE = bitmaps.rc
!include <zaf.mak>
```

Internal Make Files

Most ZMake users will not need to understand the internal workings of traditional make files and their different syntaxes. Those who need such information should consult the documentation for their specific make utility and study the internal ZAF make files introduced in this section.

ZAF make files for PC platforms (Motif currently uses a different system) are easy to understand and use, in part because Zinc has hidden much of the normal make file complexity in other make files typically unseen by the programmer. In the above example, “!include <zaf.mak>” triggers these other make files to complete the build process.

The following information provides insight into the internal organization of these “internal” make files. This information is considered “advanced” and is not necessary for the full utilization of Zinc Application Framework.

As shipped, the ZMake build process actually interprets and executes four different make files. All internal make files are found in the “\include” directory and should be individually studied by programmers interested in full control over the build process.

The four make files, and the order in which they are referenced, follow:

Make file	**Purpose**
`zmake.mak`	The user-supplied make file. (See the example above.) This make file is the one initially invoked by ZMake. This file must include the command "!include <zaf.mak>" to trigger the remainder of the build process.
`zaf.mak`	The main ZAF make file. The primary purpose of this file is to ensure that all necessary macros are defined and available to subsequent steps in the build process.
`opts???.mak`	These files specify compiler options unique to each compiler. By placing the compiler options in this file, Zinc ensures that the options used to build the library match the options used to build applications. (Non-matching compile options can cause difficult bugs.) Note: these files have been created to allow non-ZMake users to access them in their own compiler-specfic make files.
`zaf???.mak`	These files specify build rules unique to each linker.

Note: The “???” in the above filenames refers to a three letter abbreviation for each compiler. For example, actual names include: optsbor.mak (for Borland), optsmsc.mak (for Microsoft) and optswat.mak (for Watcom).

Appendices

Zinc Coding Standards

Zinc Software specifies standards for all code written for internal or external distribution. These standards improve the readability, organization and maintenance of source code and header files and are used when writing library code, example programs, tutorial programs, etc.

Naming Conventions

CLASSES AND STRUCTURES

Class names should be self-explanatory and should be in name-case format: first letter in uppercase lettering, all remaining characters in lowercase lettering, with no underscores used to separate words. Some example class and structure names are shown below.

```
struct ZafEventStruct
struct ZafPaletteStruct
class ZafElement
class ZafEventManager : public ZafList
class ZafButton : public ZafWindowObject
```

All class and structure names unique to Zinc Application Framework use the prefix “Zaf”. Names unique to Zinc DataConnect use the prefix “Zdc”. Other Zinc products may introduce unique three-character prefixes. Shared names (used by multiple products) currently use the prefix “Zaf”.

In addition, many Zinc classes and structures use suffixes:

```
Struct   // denotes a general structure
Data     // denotes a data object
```

FUNCTIONS

Function names should be self explanatory and should be in name-case format (see above). In addition, the function name should describe what the function does. Some example class and regular function names are shown below:

```
ZafElement *Previous(void) const;
ZAF_EVENT_TYPE Event(const ZafEvent &event);
static ZafWindowObject *Read(const ZAF_ICHAR *name, ZafIO *io,
   ZafIOObject *ioObject, ZafPersistence *persist);
```

VARIABLES

Variable names should be self-explanatory and use lowercase lettering for the first word, then name case for each word thereafter. Global variables should always be prefixed by the three character product prefix. Some example variable names are shown below.

```
extern ZafIO *ZafDefaultStorage;
static int virtualCount = 0;
int ZafBorder::width = 4;
```

Each variable should be declared on a separate line when it is needed by the function. When declaring a list of variables, the following order should be followed:

- External variables
- Static variables
- Variables with complex structures
- All other variables according to need within the application

In addition, only one space, and not tabs, should exist between the type and the variable. Comments should be aligned evenly after the variable list.

CONSTANTS

Constant variables should be self-explanatory and should be in all uppercase, with an underscore separating the words. Some example constant names are shown below:

```
const ZAF_ERROR ZAF_ERROR_NONE = 0;     // comment
const ZAF_LOGICAL_EVENT L_VIEW = 1001;  // comment
```

In addition to the information described above:

- Constants should be placed before the definition of the class for which they apply, or at the beginning of the module.
- If several related constants are defined, the definitions should be grouped together with a preceding comment.
- Constant values should be tab-aligned to the right.
- Comments for each line, if any, should be aligned to the right of the value.

TYPEDEFS

Typedefs should use the same naming conventions as classes and structures. (However, as of this printing, ZAF typedefs are not yet using this convention.)

Organization

CLASS SCOPES

The class declaration in an include file should list public members first, protected members next, and private members last. Each major section should list static member variables first, member variables next, and member functions last, listed in alphabetical order. (Be sure to list the constructor and destructor first.) In addition, each scope section should contain a short comment telling where its members are documented. The following example shows a class containing the three scope sections:

```
class ZafExportClass ZafTimeData : public ZafUtimeData
{
public:
  // -- General members ---
  ZafTimeData(void);
  ZafTimeData(int hour, int minute, int second, int
    milliSecond);
  ZafTimeData(const ZAF_ICHAR *string, const ZAF_ICHAR *format =
    ZAF_NULLP(ZAF_ICHAR));
  ZafTimeData(const ZafTimeData &copy);
  virtual ~ZafTimeData(void);

protected:
  // --- Persistence ---
  friend class ZafExportClass ZafPersistence;
  static ZafElement *Read(const ZAF_ICHAR *name, ZafIO *io,
    ZafIOObject *ioObject) { return (new ZafTimeData(name, io,
    ioObject)); }
};
```

FILES

Source code modules that contain class member functions should contain the copyright notice, then any include files, static member variables, and member functions, described in alphabetical order. An example of BORDER.CPP's file layout is shown below:

```
// Zinc Application Framework - Z_BORDER.CPP
// COPYRIGHT (C) 1990-1996.  All Rights Reserved.
// Zinc Software Incorporated.  Pleasant Grove, Utah  USA

#include "z_border.hpp"

// ----- ZafBorder -------------------------------------------
ZAF_CLASSID ZafBorder::classID = ID_ZAF_BORDER;
ZAF_CLASSNAME_CHAR ZafBorder::className[] =
    ZAF_ITEXT("ZafBorder");
static ZAF_STRINGID_CHAR _stringID[] =
    ZAF_ITEXT("ZAF_NUMID_BORDER");

ZafBorder::ZafBorder(void) :
  ZafWindowObject(0, 0, 0, 0,
    ZafSupportObject, true,
    ZafRegionType, ZAF_OUTSIDE_REGION,
    ZafNoncurrent, true,
    0)
```

```
{
}

ZafBorder::~ZafBorder(void)
{
}
```

Comments

FILES

Each source file (.CPP or .HPP) should contain a three-line comment that contains the library or program name, the name of the file and copyright information. A sample header is shown below:

```
// Zinc Application Framework - BUTTON.CPP
// COPYRIGHT (C) 1990-1996.  All Rights Reserved.
// Zinc Software Incorporated.  Pleasant Grove, Utah  USA
```

The copyright information should be copied as shown above. The copyright year should include the original year when the product was created and all subsequent years when major revisions were made.

Code not copyrighted by Zinc Software should generally be placed in separate files from Zinc code whenever possible. The same three-line comment should begin the file, followed by whatever copyright information is required by the owner of the source code.

FUNCTIONS

Each routine may be preceded by a short description giving the routine's purpose and any related algorithms. If the routine name intuitively describes the routine, no comment is needed. The example below shows the use of a function comment:

```
// This member function displays the biorhythm information in
// the window.  As the size of the window object changes (by
// changing the parent window), the size of the biorhythm chart
// also changes.  A horizontal change results in a change in the
// number of days displayed.  A vertical change results in a
// dynamic change in the height of the biorhythm curve.

void Biorhythm::UpdateBiorhythm(void)
  {
    ...
  }
```

VARIABLES

Function arguments and local variables should only have descriptive comments if their names are not descriptive. These comments should be lined up on a right tab region. In addition, all comments should start with a capital letter and be followed by a period. An example of two variable declarations is shown below.

```
ZAF_EVENT_TYPE ccode;   // The control code for an event.
int cardFile;           // File handle for the disk file.
```

BLOCKS

Block comments are used to describe a group of related code. Most block comments should be one line, if possible, and reside immediately above the block being commented. If more than a one line comment is needed, the extra lines should each begin with the double slash. Block comments should be indented to match the indentation of the line of code following it. A single blank line should precede the comment and the block of code should follow immediately after. Small blocks of code that do a specific job should be commented but not individual lines, unless the line is complex or not intuitive). Some example block comments are shown below.

```
// Destroy all of the items within the list.
Destroy();

// When the user selects a button, ccode
// is checked to see what type of event was received.
switch (ccode)
{
...
}
```

PRIVATE COMMENTS

Infrequently, it may be helpful to add source code comments for the personal reference of the Zinc developer, but that should not be shipped with production code. In general, private comments are discouraged and should be used sparingly. When necessary, these comments should use the following format:

```
//??? This algorithm needs more attention before shipping.
```

A source code utility will be run on the code prior to creating master diskettes. The utility will remove any lines that begin with "//???". Previous standards that allowed "//***" as an alternate prefix to private comments are superseded, and these comments should be removed or replaced.

Indentation

CLASSES AND STRUCTURES

Structures and classes should have all members listed on individual lines and should be indented with one tab from the left margin. Several sample indentations are shown below:

```
class ZafExportClass ZafIcon : public ZafButton
{
public:
  // --- General members ---
  ZafIcon(int left, int top, ZafIconData *iconData, const
    ZAF_ICHAR *title, ZAF_ATTRIBUTE attribute = 0, ...);
  virtual ~ZafIcon(void);
  virtual ZAF_EVENT_TYPE Event(const ZafEventStruct &event);

protected:
  // --- General members ---
  ZAF_ICON_TYPE iconType;
  ZafIconData *iconData;

  ZafIcon(const ZafIcon &copy);
  virtual ZAF_EVENT_TYPE DragDropEvent(const ZafEventStruct
    &event);
  virtual ZafWindowObject *Duplicate(void) { return (new
    ZafIcon(*this)); }
  virtual ZAF_EVENT_TYPE DrawFocus(ZafRegionStruct &region,
    ZAF_EVENT_TYPE ccode);
  virtual ZAF_EVENT_TYPE DrawItem(const ZafEventStruct &event,
    ZAF_EVENT_TYPE ccode);
  virtual ZAF_EVENT_TYPE DrawShadow(ZafRegionStruct &region, int
    depth, bool fillRegion, ZAF_EVENT_TYPE ccode);
  virtual ZafPaletteStruct *MapClassPalette(ZAF_PALETTE_TYPE
    type, ZAF_PALETTE_STATE state);

private:
  static ZafPaletteMap defaultPaletteMap[];
};
```

FUNCTIONS

The main body of routines should have braces below the function declaration. All function code should be indented one tab. An example of this indentation is shown below:

```
void ZafButton::SetText(const ZAF_ICHAR *string)
{
  // Reset the button’s string information.
  ...
}
```

FUNCTION CALLS

Parameters in a function call should be listed with each argument, followed by a comma and one space. If a routine call cannot fit on one line on the screen, it should be broken with the next half of the call indented one tab farther over. It should be split after a comma or logic symbol if possible. Several examples of this calling convention are shown below:

```
ZafWindow *ZafWindow::Generic(int left, int top, int width,
  int height,
  ZAF_ICHAR *title, ZafWindowObject *minObject,
    ZAF_ATTRIBUTE attribute, ...)
{
  // Create the window.
  ZafWindow *window = new ZafWindow(left, top, width, height);
}

STRING_WINDOW::STRING_WINDOW(int left, int top) :
  ZafWindow(left, top, 40, 9)
{
  // Set the window information.
  SetStringID("String Window");

  // Create the window fields.
  *this
    + new ZafBorder
    + new ZafMaximizeButton
    + new ZafMinimizeButton
    + new ZafSystemButton
    + new ZafTitle("String Window")
    ...
    ;
}
```

CASE STATEMENTS

The reserved word case should be aligned with the switch statement, but all code information should be indented an additional tab. Each additional level of logic should be indented one tab. The colon should immediately follow each case and the statement(s) should start on a new line. The break should also be on a separate line. An example of this organization is shown below:

```
EventType ZafPrompt::Event(const ZafEvent &event)
{
  // Switch on the event type.
  ZAF_EVENT_TYPE ccode = event.type;
  switch (ccode)
  {
  case S_CREATE:
```

```
  case S_SIZE:
    ...
    break;

  case S_CURRENT:
  case S_NON_CURRENT:
    if (ZafWindowObject::NeedsUpdate(event, ccode))
      ZafWindowObject::Text(prompt, 0, ccode, lastPalette);
  break;
  default:
  ccode = ZafWindowObject::Event(event);
  break;
  }

  // Return the control code.
  return (ccode);
}
```

SCOPING

Normally, scoping is done with an expression, and indents with level.

```
if (expression)
{
  statement1
  statement2
}
```

Simple scoping should not indent, however.

```
{
statement1
statement2
}
```

IF AND FOR STATEMENTS

Statements following an if or for should be indented one tab, and simple conditionals should use the inline ? operator. An example of these statements is shown below:

```
left = (left < 1) ? 1 : right;

if (event->type == E_KEY &&
  (event->rawCode == ESCAPE || event->rawCode ==
  BACKSPACE || event->rawCode == ENTER))
{
  offset = length;
  length = 0;
}
```

```
for (number = 0; number < noOfCalls; number++)
  ; // Do nothing.
```

DynamicPtrCast

```
#define DynamicPtrCast(arg, type)
```

DynamicPtrCast() is a macro provided by ZAF that aids in supporting RTTI. If a compiler doesn't support RTTI via dynamic_cast(), DynamicPtrCast() provides similar functionality for classes derived from ZafElement by calling ZafElement::EvaluateIsA(). For compilers that support RTTI, DynamicPtrCast() simply calls dynamic_cast(). See ZafElement::EvaluateIsA() for more information.

The following code snippet shows how to use DynamicPtrCast():

```
ZafEventType MyClass::Event(const ZafEventStruct &event)
{
  ZafEventType ccode = LogicalEvent(event);
  switch (ccode)
  {
  ...
  case MY_STRING_EVENT:
    {
    // We know event.windowObject is a ZafString, since
    // the application created the event elsewhere.
    ZafString *myString = DynamicPtrCast(myString, ZafString);
    DoSomethingWithString(myString);
    }
    break;
  ...
  }
  return (ccode);
}
```

Event Definitions

ZAF 5 defines a set of portable messages that may be trapped and allow developers to take action in response to user and system events. Many of these events are designed for programmer use, but some are intended for internal library use only and these are documented as such. However, all messages are fully documented to allow maximum flexibility.

Events are separated into six broad categories:

- Notification Events
- System Events
- Logical Events
- Raw Events
- Device Requests
- Application Events

Detailed descriptions of each category follow later in this chapter.

Subcategories exist within some of these broad categories as well. When present, these subcategories generally separate portable events (intended for use by ZAF programmers) from non-portable events (intended for internal library use only).

To fully release the capabilities of Zinc Application Framework a developer should be familiar with all these events. In particular, the following aspects of each event are critical:

- *Sendability* refers to an event's ability to be sent by the programmer to trigger an action. Some events may be sent, others are expected to be generated only by the Operating System or by ZAF internally.
- *Portability* refers to the identical behavior of the event on all Operating Systems. Almost all ZAF events are fully portable, but some have been defined for the use in specific operating systems as part of ZAF's internal portable library implementation.
- *Guarantee* refers to the reliability of a particular event in an application context. To maximize ease-of-use for developers, many events are guaranteed. That is, they are generated internally by ZAF on Operating Systems that would not normally generate an event.

Notification Events

Notification events are normally generated by the Operating System. They notify the library that an OS internal operation has either been initiated or completed. Notification events are not requests to take action, and in general should be used only to synchronize ZAF with the changing state of the OS. However, some notification events indicate OS operations that may be canceled or reversed; In these cases, the library may intervene to reset the OS state. (Notification events are only defined in response to an OS / ZAF state discrepancy on a platform, and not for internal ZAF notifications.)

- Notification events should not be sent by the user. For simplicity, ZAF assumes these events to be generated only by the OS.
- Notification events are fully portable. They will be received at the same times, in response to the same actions on all platforms.
- Notification events are guaranteed. Where an OS does not generate a notification event on a particular platform, the library will emulate the behavior and generate the event internally. (This is the only time that a notification event should be sent by ZAF.)

Following is the set of notification events. *Note: where shown, class names refer to the indicated classes and all their subclasses.*

N_CHANGE_PAGE	Notifies ZafNotebook that the current notebook page has changed.
N_CLOSE	Notifies ZafWindow that it is about to be closed. If ZafWindow returns 0, it will be closed; otherwise it will not be closed. (Operation may not be cancellable on Motif.)
N_CURRENT	Notifies ZafWindowObject that it has received focus. Calls memberUserFunction(), if any.
N_EXIT	Notifies ZafWindowManager that the application is about to exit. ZafWindowManager responds by returning the result of exitFunction(), if any. If exitFunction() returns 0, it will exit; otherwise it will not exit. (Operation may not be cancellable on Motif.)
N_HSCROLL	Notifies ZafWindowObject that its corresponding horizontal ZafScrollBar has scrolled, if the scroll bar is SupportObject(). ZafWindowObject responds by scrolling its data. If the scroll bar is not SupportObject(), then memberUserFunction() is called.
N_MOUSE_ENTER	Notifies ZafWindowObject that the mouse has entered its region. windowManager::mouseObject already points to the object. Sends an initialization message to ZafHelpTips, if the object has a help tip or a quick tip.
N_MOUSE_LEAVE	Notifies ZafWindowObject that the mouse has left its region. Sends a deinitialization message to ZafHelpTips, if the object has a help tip or a quick tip.
N_MOVE	Notifies ZafWindowObject that it has been moved, and that its zafRegion reflects the new position. ZafWindowObject responds by updating its internal information to correspond with the operating system object.

N_NON_CURRENT	Notifies ZafWindowObject that it is about to lose focus. If ZafWindowObject returns 0, it will lose focus; otherwise it will not lose focus. Calls memberUserFunction(), if any. (Operation may not be cancellable on Motif.)
N_RESET_I18N	Notifies ZafWindowObjects that depend on internationalization (such as ZafBignum, ZafDate, and ZafTime) that the internationalization values have been reset, and such objects should redisplay their data according to the new values.
N_SIZE	Notifies ZafWindowObject that it has been sized, and that its zafRegion reflects the new size. ZafWindowObject responds by updating its internal information to correspond with the operating system object.
N_TIMER	Notifies ZafWindowObject that a timer event has occurred.
N_VSCROLL	Notifies ZafWindowObject that its corresponding vertical ZafScrollBar has scrolled, if the scroll bar is SupportObject(). ZafWindowObject responds by scrolling its data. If the scroll bar is not SupportObject(), then memberUserFunction() is called.

System Events

System events are normally generated internally by ZAF. They are requests for action to be taken, and generally should not be ignored.

- System events may be sent by the user. However, some system events are used internally by ZAF and are not safe to be sent by the casual user. System events that are specifically anticipated to be sent by users will be documented fully. All others will be documented briefly for those trapping the events, or deriving custom ZAF objects.
- System events are fully portable. They cause the same actions on all platforms.
- System events are guaranteed. ZAF will generate system events internally at the same times, in the same orders on all platforms.

The following is the set of system events that are designed to be sent by the user. *Note: where shown, class names refer to those classes and all their subclasses.*

S_ADD_OBJECT	Causes ZafWindow to add event.windowObject as a child.
S_CLOSE	Causes ZafWindowManager to close a window, and any temporary windows above it. If event.windowObject is null, ZafWindowManager closes its top-most non-temporary window; otherwise, it closes the window specified by event.windowObject.
S_CLOSE_-TEMPORARY	Causes ZafWindowManager to close its top-most window, if it is temporary.
S_CONTINUE	User hook. For example, may cause a latent thread to continue processing.

S_COPY	Causes ZafString or ZafText to copy its selected data to the clipboard.
S_COPY_DATA	Causes ZafWindowObject to copy event.windowObject's data values and update visually.
S_CUT	Causes ZafString or ZafText to cut its selected data to the clipboard.
S_DECREMENT	Causes ZafSpinControl to decrement its field object by the value of ZafSpin-Control::delta.
S_EXIT	Causes ZafWindowManager to receive an N_EXIT event.
S_HELP	Causes ZafWindowObject to display its help context by calling DisplayHelp(). Handled at the child-most level that has a help context.
S_HSCROLL	Causes a horizontally scrollable object to scroll itself horizontally event.scroll.delta units.
S_HSCROLL_CHECK	Causes a horizontally scrollable object to ensure its current child is visible. If it isn't, it is scrolled horizontally into view.
S_HSCROLL_-COMPUTE	Causes a horizontally scrollable object to compute its horizontal scrolling values, based on its current child and horizontal data. Its corresponding horizontal scroll bar's data is set accordingly.
S_HSCROLL_SET	Causes a horizontal ZafScrollBar to replace its data with event.scroll and update visually.
S_INCREMENT	Causes ZafSpinControl to increment its field object by the value of ZafSpin-Control::delta.
S_MAXIMIZE	Causes ZafWindowManager to maximize a window on the display. If event.windowObject is non-null, ZafWindowManager passes the event to event.windowObject; otherwise, it passes the event to its top-most window.
S_MDI_CASCADE_-WINDOWS	Causes a parent ZafMDIWindow to cascade all its MDI child windows beginning with the bottom-most window at the top-left corner and stepping each window down and right.
S_MDI_CLOSE	Causes a parent ZafMDIWindow to close the top-most MDI child window.
S_MDI_MAXIMIZE	Causes a child ZafMDIWindow to maximize itself within its parent.
S_MDI_MINIMIZE	Causes a child ZafMDIWindow to minimize itself within its parent.
S_MDI_MOVE_-MODE	Causes keyboard moving mode to begin on the current MDI child window, if supported by the native environment.
S_MDI_NEXT_-WINDOW	Causes a parent ZafMDIWindow to bring the next MDI child window to the top.

S_MDI_RESTORE	Causes a maximized or minimized child ZafMDIWindow to restore itself within its parent.
S_MDI_SIZE_MODE	Causes keyboard sizing mode to begin on the current MDI child window, if supported by the native environment.
S_MDI_TILE_-WINDOWS	Causes a parent ZafMDIWindow to tile all its MDI child windows so that all child windows are visible, taking up as much of the parent's client space as needed.
S_MINIMIZE	Causes ZafWindowManager to minimize a window on the display. If event.windowObject is non-null, ZafWindowManager passes the event to event.windowObject; otherwise, it passes the event to its top-most window.
S_MOVE_MODE	Causes keyboard moving mode to begin on the current window, if supported by the native environment.
S_NEXT_WINDOW	Causes ZafWindowManager to bring the next window to the top.
S_PASTE	Causes ZafString or ZafText to paste the clipboard's data to it at the current cursor position, replacing any selected data.
S_REDISPLAY	Causes ZafWindowObject to redraw itself. Higher-priority events (such as mouse or keyboard events) may be processed first.
S_REDISPLAY_DATA	Causes ZafWindowObject to immediately redraw only its data portions.
S_REDISPLAY_-REGION	Causes ZafWindowObject to redraw the portion of itself requested in event.region (specified as a region relative to the top left of the object). Higher-priority events (such as mouse or keyboard events) may be processed first.
S_RESTORE	Causes ZafWindowManager to restore a maximized or minimized window on the display. If event.windowObject is non-null, ZafWindowManager passes the event to event.windowObject; otherwise, it passes the event to its top-most window.
S_SET_DATA	Causes ZafWindowObject to reset its data pointers to share event.windowObject's data and update visually. The data manager updates its notification lists to reflect the change.
S_SIZE	Causes ZafWindowObject to set its zafRegion to event.region and update visually. May be used to size and/or move the object, since zafRegion is modified.
S_SIZE_MODE	Causes keyboard sizing mode to begin on the current window, if supported by the native environment.
S_SUBTRACT_-OBJECT	Causes ZafWindow to subtract event.windowObject as a child.

S_VSCROLL	Causes a vertically scrollable object to scroll itself vertically event.scroll.delta units.
S_VSCROLL_CHECK	Causes a vertically scrollable object to ensure its current child is visible. If it isn't, it is scrolled vertically into view.
S_VSCROLL_-COMPUTE	Causes a vertically scrollable object to compute its vertical scrolling values, based on its current child and vertical data. Its corresponding vertical scroll bar's data is set accordingly.
S_VSCROLL_SET	Causes a vertical ZafScrollBar to replace its data with event.scroll and update visually.

System Events (Internal)

The following is the set of system events that may be trapped, but are generally not sent by the user. These are generally "advanced" events used internally by ZAF, but they may be exploited by expert ZAF programmers. *Note: where shown, class names refer to those classes and all their subclasses.*

S_BEGIN_DRAG	Causes windowManager::dragObject to point to the object being dragged. Sent to the window object under the mouse when a drag operation is initiated, usually by moving the mouse several pixels after a down-click. Dragging begins only if windowManager::dragObject is set by this event.
S_COMPUTE_SIZE	Causes ZafWindowObject to recompute its region. Normally sent to an object when it is being created, or when its parent is being resized.
S_CREATE	Causes ZafWindowObject and its children to be created by processing the following events or functions in this order: SetVisible(false), S_INITIALIZE, S_REGISTER_OBJECT, S_COMPUTE_SIZE, OSSize(), SetVisible(oldVisible). Normally sent to an object when it is added to its parent (or ZafWindowManager), if the parent has already been created. The S_CREATE message itself is not propogated to the object's children, but the appropriate messages are sent to the children for creation.
S_CURRENT	Causes ZafWindowObject to complete the process of gaining focus by updating itself visually to indicate that it has focus, setting the focus member, and synchronizing the ZAF object with the operating system.
S_DEINITIALIZE	Causes ZafWindowObject to deinitialize itself and its children, by clearing screenID, clearing windowManager::mouseObject if appropriate, and doing anything else needed by the native environment. Normally sent to an object when it is being destroyed.
S_DESTROY	Causes ZafWindowObject to destroy itself and all its children, if any. Normally sent to an object when it is subtracted from its parent. Causes S_DEINITIALIZE to be sent to itself and all its children, if any.

S_DRAG_COPY	Received by ZafWindowObject being copy-dragged over.
S_DRAG_DEFAULT	Received by ZafWindowObject being default-dragged over.
S_DRAG_LINK	Received by ZafWindowObject being link-dragged over.
S_DRAG_MOVE	Received by ZafWindowObject being move-dragged over.
S_DROP_COPY	Received by ZafWindowObject that is copy-dropped on.
S_DROP_DEFAULT	Received by ZafWindowObject that is default-dropped on.
S_DROP_LINK	Received by ZafWindowObject that is link-dropped on. ZAF does not currently implement link-drop, but this message is provided as a hook for the user.
S_DROP_MOVE	Received by ZafWindowObject that is move-dropped on.
S_END_DRAG	Causes the object being dragged to clear windowManager::dragObject.
S_HLP_CLOSE	Used internally by ZafHelpSystem to close the window when the Close button is selected.
S_HLP_SELECT_-TOPIC	Used internally by ZafHelpSystem to display event.windowObject's help context, sent when an item in the list is double-clicked.
S_HLP_SHOW_-INDEX	Used internally by ZafHelpSystem to display the help context index when the Show Index button is selected.
S_HLP_SHOW_-TOPIC	Used internally by ZafHelpSystem to display the help context corresponding to the name displayed in the string field when the Show Topic button is selected.
S_HLP_UPDATE_-NAME	Used internally by ZafHelpSystem to set the string field corresponding to the list item that is selected.
S_HOT_KEY	Causes ZafWindowObject to perform an action appropriate to the hot key, if its hotKeyChar is the same as event.key.value. When a hot key is typed, the current window sends S_HOT_KEY to each of its children until a match is found, or all the objects have been checked.
S_INITIALIZE	Causes ZafWindowObject to initialize itself and its children, including converting its zafRegion to be in native coordinates, initializing oldRegion, and initializing its numberID and stringID to unique values (if they weren't already initialized). Normally sent to an object when it is being created.
S_NON_CURRENT	Causes ZafWindowObject to complete the process of losing focus by updating itself visually to indicate that it has lost focus, clearing the focus member, and synchronizing the ZAF object with the operating system.
S_REDISPLAY_-DEFAULT	Causes ZafButton to redisplay its border to indicate that it has gained or lost default status.

S_REGISTER_-OBJECT	Causes ZafWindowObject to register itself and its children with the operating system, including calling RegisterObject(). Normally sent to an object when it is being created.

System Events (Result Codes)

The following is the set of system event values that functions may return as result codes. These system event values are not used in actual events, but may be returned to indicate a status code or a user’s response. They are included here since they are processed in much the same way as “normal” events. *Note: where shown, class names refer to those classes and all their subclasses.*

S_DLG_ABORT	Returned by ZafDialogWindow after it is closed by the Abort button.
S_DLG_CANCEL	Returned by ZafDialogWindow after it is closed by the Cancel button.
S_DLG_HELP	Returned by ZafDialogWindow after it is closed by the Help button (Motif).
S_DLG_IGNORE	Returned by ZafDialogWindow after it is closed by the Ignore button.
S_DLG_NO	Returned by ZafDialogWindow after it is closed by the No button.
S_DLG_OK	Returned by ZafDialogWindow after it is closed by the OK button.
S_DLG_RETRY	Returned by ZafDialogWindow after it is closed by the Retry button.
S_DLG_YES	Returned by ZafDialogWindow after it is closed by the Yes button.
S_ERROR	Returned by some functions to indicate error status.
S_NO_OBJECT	Returned by ZafWindowManager::Event(), indicating that there are no windows open, and the application should exit.
S_UNKNOWN	Returned from an Event() function when the event passed in was unknown to the class, and thus not handled.

Logical Events

Logical events are portable mappings of OS events that represent raw end-user input. These events include mouse and keyboard events, for example, but do not include events triggered by ZAF objects or OS objects. (For example, a button press or menu selection should not send a logical event.)

- Logical events should not be sent by the user or ZAF. ZAF assumes these events are portable mappings of raw OS input events, and therefore do not need to be handled by ZAF library objects. (Typically, ZAF library objects will act on raw OS input events to optimize performance). A portable subset of possible logical mappings is documented below.

- Logical events may be portable. Logical events are normally returned by LogicalEvent() in response to raw OS events (or they may be natively available on some platforms). A subset of possible logical mappings will be documented as portable. By implication, a set of OS events that can be mapped to the documented logical event set must pass through the ZAF objects on all platforms. Other logical events are not portable and will be disclaimed by the documentation.
- Logical events are not guaranteed. However, the documented subset of OS Events that map to logical events are guaranteed to be generated, and therefore the logical mapping is guaranteed to be accessible. (In the future we may want to guarantee full user extensibility of the event map table.)

The following is the set of portable logical event mappings designed to be trapped by the user. Mappings on some systems are “soft” and may not correspond exactly to the keystrokes listed. *Note: where shown, class names refer to those classes and all their subclasses, and “list object” means ZafHzList, ZafVtList, or ZafTreeList.*

L_BACKSPACE	Mapped for ZafString or ZafText in response to a backspace event.
L_BEGIN_ESCAPE	Mapped for ZafWindowObject in response to a right mouse button down-click event.
	L_BEGIN_SELECTMapped for ZafWindowObject in response to a left mouse button down-click event.
L_BOL	Mapped for ZafString or ZafText in response to a home event.
L_CANCEL	Mapped for ZafWindowObject in response to an escape event.
L_CLOSE	Mapped for ZafWindowManager when a keystroke (such as <ALT>-<F4>) indicates that the top-most non-temporary window should be closed.
L_CLOSE_-TEMPORARY	Mapped for ZafWindowManager when a keystroke (such as escape) indicates that the top-most temporary window should be closed.
L_CONTINUE_-ESCAPE	Mapped for the ZafWindowObject under the mouse when the mouse moves while the right button is still depressed. In Motif, only mapped for ZafWindow if ZafRegisterMouse() was called for the window with true in the rightMouse parameter (see the header m_utils.hpp).
L_CONTINUE_-SELECT	Mapped for the ZafWindowObject under the mouse when the mouse moves while the left button is still depressed. In Motif, only mapped for ZafWindow if ZafRegisterMouse() was called for the window with true in the leftMouse parameter (see the header m_utils.hpp).
L_COPY	Mapped for ZafString or ZafText when a keystroke indicates a copy event.
L_CUT	Mapped for ZafString or ZafText when a keystroke indicates a cut event.

L_DELETE	Mapped for ZafString or ZafText in response to a delete event.
L_DOUBLE_CLICK	Mapped for ZafWindowObject when it is clicked on twice in a row quickly with the left mouse button. The maximum time between the first up-click and the second down-click is determined by the native environment, or ZafWindowObject::doubleClickRate.
L_DOWN	Mapped for ZafText or a list object in response to a down arrow event.
L_END_ESCAPE	Mapped for the ZafWindowObject under the mouse when the right mouse button is released.
L_END_SELECT	Mapped for the ZafWindowObject under the mouse when the left mouse button is released.
L_EXIT	Mapped for ZafWindowManager when a keystroke indicates that the application should exit.
L_EOL	Mapped for ZafString or ZafText in response to an end event.
L_FIRST	Mapped for a list object in response to a home event.
L_HELP	Mapped for ZafWindowObject in response to a help event.
L_LAST	Mapped for a list object in response to an end event.
L_LEFT	Mapped for ZafString, ZafText, or a list object in response to a left arrow event.
L_MDI_NEXT_WINDOW	Mapped for a parent ZafMDIWindow when a keystroke indicates that the top-most MDI child window should become bottom-most, and the next MDI child window should become top-most.
L_NEXT	Mapped for ZafWindow in response to a tab event. (Tabbing order of children is defined by the environment).
L_PASTE	Mapped for ZafString or ZafText when a keystroke indicates a paste event.
L_PGDN	Mapped for ZafText, ZafScrolledWindow, or a list object in response to a page down event.
L_PGUP	Mapped for ZafText, ZafScrolledWindow, or a list object in response to a page up event.
L_PREVIOUS	Mapped for ZafWindow in response to a shift-tab event. (Tabbing order of children is defined by the environment).
L_RIGHT	Mapped for ZafString, ZafText, or a list object in response to a right arrow event.

L_SELECT	Mapped for a selectable object (e.g. ZafButton, ZafIcon, or any object in a list) in response to an enter or return event.
L_UP	Mapped for ZafText or a list object in response to an up arrow event.
L_VIEW	Mapped for ZafWindowObject when the mouse moves over it. In Motif, only mapped for ZafWindow if ZafRegisterMouse() was called for the window with true in the view parameter (see the header m_utils.hpp).

Logical Events (Non-portable)

The following is the set of non-portable logical events that are platform-specific and unsafe for portable ZAF applications. These logical events are required by ZAF internally for some native environments' non-portable needs. Programmers may trap these events on the platforms indicated, but will not have access to them on others. *Note: where shown, class names refer to those classes and all their subclasses, and "list object" means ZafHzList, ZafVtList, or ZafTreeList.*

L_ALT_KEY	Causes focus to switch to or from the pull-down menu when <ALT> is pressed and released (DOS).
L_DELETE_EOL	Mapped for ZafString or ZafText when a keystroke indicates to delete the data from the beginning of the selected range to the end of the current line (DOS).
L_DELETE_WORD	Mapped for ZafString or ZafText when a keystroke indicates to delete the word that the cursor is positioned on (DOS).
L_EXTEND_FIRST	Mapped for an ExtendedSelection list object when a keystroke indicates to extend the selection through the first child (Motif).
L_EXTEND_LAST	Mapped for an ExtendedSelection list object when a keystroke indicates to extend the selection through the last child (Motif).
L_EXTEND_NEXT	Mapped for an ExtendedSelection list object when a keystroke indicates to extend the selection through the next unselected child (Motif).
L_EXTEND_-PREVIOUS	Mapped for an ExtendedSelection list object when a keystroke indicates to extend the selection through the previous unselected child (Motif).
L_INSERT_TOGGLE	Mapped for ZafString or ZafText when the insert key is typed (DOS).
L_MARK_BOL	Mapped for ZafString or ZafText when a keystroke indicates to extend the selection to the beginning of the current line (DOS).
L_MARK_DOWN	Mapped for ZafText when a keystroke indicates to extend the selection one line down (DOS).

L_MARK_EOL	Mapped for ZafString or ZafText when a keystroke indicates to extend the selection to the end of the current line (DOS).
L_MARK_LEFT	Mapped for ZafString or ZafText when a keystroke indicates to extend the selection one character to the left (DOS).
L_MARK_PGDN	Mapped for ZafText when a keystroke indicates to extend the selection one page down (DOS).
L_MARK_PGUP	Mapped for ZafText when a keystroke indicates to extend the selection one page up (DOS).
L_MARK_RIGHT	Mapped for ZafString or ZafText when a keystroke indicates to extend the selection one character to the right (DOS).
L_MARK_UP	Mapped for ZafText when a keystroke indicates to extend the selection one line up (DOS).
L_MARK_WORD_-LEFT	Mapped for ZafString or ZafText when a keystroke indicates to extend the selection one word to the left (DOS).
L_MARK_WORD_-RIGHT	Mapped for ZafString or ZafText when a keystroke indicates to extend the selection one word to the right (DOS).
L_MAXIMIZE	Mapped for ZafWindow when a keystroke indicates to maximize itself on the display (DOS).
L_MDI_MOVE_MODE	Mapped for ZafMDIWindow to cause keyboard moving mode to begin on the current MDI child window (DOS).
L_MDI_SIZE_MODE	Mapped for ZafMDIWindow to cause keyboard sizing mode to begin on the current MDI child window (DOS).
L_MINIMIZE	Mapped for ZafWindow when a keystroke indicates to minimize itself on the display (DOS).
L_MOVE_MODE	Mapped for ZafWindow to cause keyboard moving mode to begin on the current window (DOS).
L_NEXT_WINDOW	Mapped for ZafWindowManager when a keystroke indicates to make the next window top-most (Motif, DOS).
L_NONE	Not an event mapping. Used to denote the last entry of an event map table.
L_RESTORE	Mapped for a maximized ZafWindow when a keystroke indicates to restore itself on the display (DOS).
L_SIZE_MODE	Mapped for ZafWindow to cause keyboard sizing mode to begin on the current window (DOS).

L_SYSTEM_MENU	Mapped for ZafWindow when a keystroke (such as <ALT>-<space>) indicates to open the system menu (DOS).
L_TOGGLE_-EXPANDED	Mapped for ZafTreeList when a keystroke indicates to expand or close the current tree item (Motif).
L_WORD_LEFT	Mapped for ZafString or ZafText when a keystroke indicates to move the cursor one word to the left (Motif, DOS, Macintosh).
L_WORD_RIGHT	Mapped for ZafString or ZafText when a keystroke indicates to move the cursor one word to the right (Motif, DOS, Macintosh).

Raw Events

Raw events are OS specific raw input events including mouse and keyboard.

- Raw events should not be sent by the user or ZAF. These events are always placed on the event queue by a ZAF device. Because these events vary widely between systems, they will not be documented, except in the abstract.
- Raw events are not portable. However, these events can often be mapped to portable, logical events, and/or have their data made portable by calling LogicalEvent(). Data in mouse and keyboard events will be converted by LogicalEvent() to object specific position, and portable character format, respectively. Despite documented nonportability, the raw event structure itself is consistent across platforms. event.type should always be E_OSEVENT, and event.InputType() should return E_KEY, E_MOUSE, etc.
- Raw events are not guaranteed. These events are generally handled by the OS and are not guaranteed to be received, with the exception of those raw events required to yield documented portable logical event mappings.

The following is the set of raw event types that may be trapped by the user, based on the return value of event.InputType().

E_KEY	Indicates the ZafKeyboard device.
E_MOUSE	Indicates the ZafMouse device.
E_OSEVENT	Indicates a system event on any native environment, and is assigned to event.type. event.InputType() may return E_KEY or E_MOUSE, as appropriate. The value of this constant is also used for E_MACINTOSH, E_MOTIF, E_MSWINDOWS, E_OS2, and E_XT.

Raw Events (Event Types)

The following is the set of raw event types that are designed to pass to ZafEventManager in specifying a device object, such as when calling the DeviceState() method.

E_CURSOR	Indicates the ZafCursor device.
E_DEVICE	Indicates all devices.
E_HELPTIPS	Indicates the ZafHelpTips device.
E_TIMER	Indicates the ZafTimer device.

Device Requests

Device messages are messages sent to ZAF devices to request an action. They are similar in function to system events, but are sent only to devices. D_ messages apply to all devices. D?_ messages apply only to the device whose first character matches the ?.

- Device messages can be sent by the user. Portable device request messages will be documented.
- Device messages may be portable. However, due to OS differences, all device messages are not implemented on all platforms. Portable messages will be fully documented; others briefly.
- Device messages are not guaranteed. However, when possible ZAF UI objects attempt to use these messages to achieve desired results, rather than working around them with the native OS.

The following is the set of portable device request events designed to be sent by the user. Note: where shown, class names refer to those classes and all their Device Requests:subclasses.

D_STATE	Causes a device to return its state.
DH_SET_HELP_-OBJECT	Causes ZafHelpTips::helpObject to be set to event.windowObject.
DH_UPDATE_-HELP_OBJECT	Causes ZafHelpTips::helpObject to update with the help tip of event.windowObject, if event.windowObject is not nil.
DM_BOTTOM_-LEFT_CORNER	Causes ZafMouse to show the bottom-left corner image.
DM_BOTTOM_-RIGHT_CORNER	Causes ZafMouse to show the bottom-right corner image.
DM_BOTTOM_SIDE	Causes ZafMouse to show the bottom side image.
DM_CANCEL	Causes ZafMouse to show the cancel image.
DM_CROSS_HAIRS	Causes ZafMouse to show the cross-hairs image.
DM_EDIT	Causes ZafMouse to show the I-bar image.

DM_LEFT_SIDE	Causes ZafMouse to show the left side image.
DM_MOVE	Causes ZafMouse to show the move image.
DM_RIGHT_SIDE	Causes ZafMouse to show the right side image.
DM_SELECT	Causes ZafMouse to show the selection image.
DM_TOP_LEFT_-CORNER	Causes ZafMouse to show the top-left corner image.
DM_TOP_RIGHT_-CORNER	Causes ZafMouse to show the top-right corner image.
DM_TOP_SIDE	Causes ZafMouse to show the top side image.
DM_VIEW	Causes ZafMouse to show the default pointer image.
DM_WAIT	Causes ZafMouse to show the wait image.

Device Requests (Non-portable)

The following is the set of non-portable device request events that are platform-specific and unsafe for portable ZAF applications. These device events are used internally for some native environments’ non-portable needs. *Note: where shown, class names refer to those classes and all their subclasses.*

D_ACTIVATE	Causes a device to be activated (DOS, Macintosh).
D_DEACTIVATE	Causes a device to be deactivated (DOS, Macintosh).
D_DEINITIALIZE	Causes a device to deinitialize (MSWindows, Motif, DOS, OS/2, Macintosh).
D_HIDE	Causes ZafMouse to be hidden (MSWindows, DOS, OS/2, Macintosh).
D_INITIALIZE	Causes a device to initialize (MSWindows, Motif, DOS, OS/2, Macintosh).
D_OFF	Causes a device to stop putting events on the event queue (DOS).
D_ON	Causes a device to put events on the event queue as normal (DOS).
D_POSITION	Causes a device to change its position to event.position (DOS).
DC_INSERT	Causes ZafCursor to show the insert image (DOS).
DC_OVERSTRIKE	Causes ZafCursor to show the overstrike image (DOS).
DH_HELP_TIPS_-TIMER	Notifies ZafHelpTips that its timer has expired, meaning that it should display the help tip associated with the object that the mouse is over (Motif, Macintosh).

DM_DRAG	Causes ZafMouse to show the drag image (MSWindows, Motif, DOS, OS/2, Macintosh).
DM_DRAG_COPY	Causes ZafMouse to show the copy-drag image (MSWindows, Motif, DOS, OS/2, Macintosh).
DM_DRAG_COPY_-MULTIPLE	Causes ZafMouse to show the multiple-item-copy-drag image (MSWindows, Motif, DOS, OS/2, Macintosh).
DM_DRAG_LINK	Causes ZafMouse to show the link-drag image (MSWindows, Motif, DOS, OS/2, Macintosh).
DM_DRAG_LINK_-MULTIPLE	Causes ZafMouse to show the multiple-item-link-drag image (MSWindows, Motif, DOS, OS/2, Macintosh).
DM_DRAG_MOVE	Causes ZafMouse to show the move-drag image (MSWindows, Motif, DOS, OS/2, Macintosh).
DM_DRAG_MOVE_-MULTIPLE	Causes ZafMouse to show the multiple-item-move-drag image (MSWindows, Motif, DOS, OS/2, Macintosh).

Application Events

Application events are system wide events intended to be received and handled only by the ZAF Window Manager. As such, these events are usually used to implement macro level functionality such as loading a window, changing application language, etc. Among other possible functionality, application events allow Zinc Designer’s test mode to invoke more sophisticated application flows.

- Application events can be sent by the user. In fact, this is the source of most application events. All application events are fully documented.
- Application events are fully portable. In addition, the code required to implement an application event should, in most cases be portable ZAF code.
- Application events are not guaranteed. Because they are sent by the user, ZAF objects do not expect to receive these events at any specific time.

The following is the set of application events that may be sent by the user. *Note: where shown, class names refer to those classes and all their subclasses.*

A_CLOSE_WINDOW	Causes the application to close any window whose stringID matches event.text. (The object handling the event deletes event.text. If the window is Destroyable(), the object handling the event also deletes the window.)
A_HELP_CONTEXT	Causes ZafHelpManager to display the help context specified by event.text. (The object handling the event deletes event.text.)

A_MINIMIZE_-WINDOWS	Causes ZafWindowManager to minimize all the windows on the display.
A_OPEN_-DOCUMENT	User hook for opening the document whose file name is in event.text. If event.text is nil, the application is starting up, and a new “untitled” document should be opened. Some operating systems may send this event. (The object handling the event deletes event.text.)
A_OPEN_WINDOW	Causes the application to open the persistent window whose storage pathname is in event.text, or if it’s already on the screen, the window receives focus. (The object handling the event deletes event.text.)
A_PRINT_-DOCUMENT	User hook for printing the document whose file name is in event.text. Some operating systems may send this event. (The object handling the event deletes event.text.)
A_RESET_I18N	Causes the application to change its language and locale bases specified in event.text. (The object handling the event deletes event.text.)
A_RESTORE_-WINDOWS	Causes ZafWindowManager to restore all the minimized windows on the display.

ZAF 5 to 4 Class Comparisons

Zinc Application Framework 5 introduces a new API. Naming conventions and parameters have changed during this “once in a lifetime” rewrite. Core architectures and concepts remain largely unchanged from previous versions of ZAF, however.

Programmers using versions of ZAF prior to version 5 may find the following table useful when transitioning to version 5. In the table, each ZAF 5 class is listed along with an indication of similarity to a previous ZAF 4 class. All ZAF 5 classes are different from their previous incarnations, but differences vary significantly in degree.

- “Similar” indicates that the class is functionally very close to the ZAF 4 class.
- “Different” indicates that the class is functionally substantially different from the equivalent ZAF 4 class.
- “New” indicates that the class introduces entirely new functionality for ZAF 5.

Class	Similar	Different	New
`ZafApplication`	•		
`ZafAttachment`	•		
`ZafBignum`	•		
`ZafBignumData`		•	
`ZafBitmapData`		•	
`ZafBitmapStruct`			•
`ZafBorder`	•		
`ZafButton`		•	
`ZafChart`			•
`ZafCodeSetData`		•	
`ZafComboBox`	•		
`ZafConstraint`	•		
`ZafCoordinateStruct`			•
`ZafCursor`	•		
`ZafData`			•
`ZafDataManager`			•
`ZafDataPersistence`			•
`ZafDataRecord`			•
`ZafDate`	•		
`ZafDateData`		•	

Class	Similar	Different	New
ZafDevice	•		
ZafDialogWindow	•		
ZafDimensionConstraint	•		
ZafDiskFile			•
ZafDiskFileSystem			•
ZafDisplay	•		
ZafElement	•		
ZafEraStruct	•		
ZafErrorStub	•		
ZafErrorSystem	•		
ZafEventManager	•		
ZafEventMap	•		
ZafEventStruct	•		
ZafFile	•		
ZafFileDialog			•
ZafFileInfoStruct	•		
ZafFileSystem			•
ZafFormatData			•
ZafFormattedString	•		
ZafGeometryManager	•		
ZafGroup	•		
ZafHelpStub	•		
ZafHelpSystem	•		
ZafHelpTips			•
ZafHzList	•		
ZafI18nData			•
ZafIcon	•		
ZafIconData			•
ZafIconStruct			•
ZafImage	•		
ZafImageStruct			•
ZafInteger	•		
ZafIntegerData			•
ZafKeyboard	•		

Class	Similar	Different	New
ZafKeyStruct	•		
ZafLanguageData	•		
ZafLanguageStruct	•		
ZafList	•		
ZafListBlock	•		
ZafLocaleData			•
ZafLocaleStruct	•		
ZafMaximizeButton	•		
ZafMessageWindow	•		
ZafMDIWindow	•		
ZafMinimizeButton	•		
ZafMouse	•		
ZafMouseData			•
ZafMouseStruct			•
ZafNotebook	•		
ZafNotification			•
ZafObjectPersistence			•
ZafPaletteData			•
ZafPaletteMap	•		
ZafPaletteStruct		•	
ZafPath	•		
ZafPathElement	•		
ZafPopUpItem	•		
ZafPopUpMenu	•		
ZafPositionStruct	•		
ZafProgressBar			•
ZafPrompt	•		
ZafPullDownItem	•		
ZafPullDownMenu	•		
ZafQueueBlock	•		
ZafQueueElement	•		
ZafRegionStruct	•		
ZafReal	•		
ZafRealData			•

Class	Similar	Different	New
`ZafRelativeConstraint`	•		
`ZafScrollBar`	•		
`ZafScrollData`			•
`ZafScrollStruct`	•		
`ZafScrolledWindow`			•
`ZafSpinControl`	•		
`ZafStandardArg`			•
`ZafStatusBar`	•		
`ZafStorage`		•	
`ZafStorageFile`		•	
`ZafString`	•		
`ZafStringData`		•	
`ZafSystemButton`	•		
`ZafTable`		•	
`ZafTableHeader`		•	
`ZafTableRecord`		•	
`ZafText`	•		
`ZafTime`	•		
`ZafTimeData`		•	
`ZafTimer`	•		
`ZafTitle`	•		
`ZafToolBar`	•		
`ZafTreeItem`			•
`ZafTreeList`			•
`ZafUTime`			•
`ZafUTimeData`			•
`ZafVtList`	•		
`ZafWindow`	•		
`ZafWindowManager`	•		
`ZafWindowObject`	•		

Property Matrices

Zinc Application Framework 5 supports a very large number of individual "properties" or attributes that may be manipulated to change object appearance and behavior. These properties are actually data members of each class that are manipulated using accessor methods. Knowledge of these properties, their definitions and interrelationships is vital to full usage of ZAF. This Appendix provides a set of tables that may be used as a convenient reference to "object properties." In each table a matrix is presented. Each "cell" in the matrix indicates how a specific derived object (listed in the top row of the matrix) supports a single property inherited from its base class (listed in the left column of the matrix). Many possible types and degrees of support are possible.

Most properties are supported in one of several predictable ways. The following chart legend shows the symbols found on the property matrices and their corresponding meanings.

Symbol	For this derived class, the property is ...
" "	(blank) undefined
•	supported normally (may be inherited functionality)
Ø	initialized to zero
A	forced to "ZAF_AVAILABLE_REGION"
B	see base class for definition
C	initialized to "ZAF_CELL"
D	supported by DOS only (normally under end user control in other operating environments)
F	forced to "false"
I	forced to "ZAF_INSIDE_REGION"
M	forced to "ZAF_MULTIPLE_SELECTION"
N	forced to "NULL"
O	forced to "ZAF_OUTSIDE_REGION"
S	forced to "ZAF_SINGLE_SELECTION"
T	forced to "true"

In addition to properties and objects, the property matrices show two other pieces of information: support for "Dynamic" property manipulation, and contructor property initialization.

"Dynamic" property manipulation refers to a programmer's ability to change the state of a property at any time. Some properties may be changed without regard for an object's current state while others may only be changed when not being “managed” or displayed. Dynamic properties may be changed at any time and are indicated by the supported symbol (“•”) in the “Dynamic” column.

All ZAF user interface objects have at least three very different constructors. For ease of discussion, these are known as the “Normal” constructor, the “Copy” constructor, and the “Persistent” constructor. The Normal constructor is the one used in straight code—screen coordinates are specified and some properties while the remaining properties are defaulted. The Copy constructor duplicates an existing object—including all of its property states—and returns a pointer to the copy. The Persistent constructor loads an object from a ZAF binary data file and initializes many of its properties based on the contents of the file.

Each of these constructors is shown along with the value of each property as it is initialized by the constructor. “•” in these columns indicates that the property is being copied or read from elsewhere rather than being set to a known default value.

Base Classes

All ZAF user interface objects are ultimately derived from ZafWindow and/or ZafWindowObject. These two base classes therefore encapsulate the majority of the properties that may be manipulated using ZAF. The first two tables presented in this appendix detail these most important classes and will be the ones most commonly consulted.

The first table lists ZafWindowObject properties and indicates how each of its derived classes supports its many properties. The second table lists ZafWindow properties (including those inherited from ZafWindowObject) and indicates how classes derived from ZafWindow support these properties.

Many exceptional cases exist. These are detailed in the footnotes following the ZafWindow matrix.

Derived Classes

ZAF user interface subclasses contain far fewer properties since they inherit most of the functionality they need from their base classes. Unique properties are listed in separate “mini-matrices” for each object along with properties inherited from base classes other than ZafWindow and ZafWindowObject (since these properties are already covered in the base class matrices). Property inheritance, supported value, “Dynamic” property information, and default constructor initializations are shown.

A “B” in a matrix indicates that the base class matrix should be consulted. A “•” indicates that the class supports the property, although the property may be restricted by base class definition.

Derived class or “subclass” matrices follow the base class matrices. No footnotes are supplied or necessary for the derived classes.

Base Property Matrix—ZafWindowObject Classes

ZafWindowObject Property[1]	Dynamic[2]	Construc- tors			Derived ZafWindowObject																			
		Normal	Copy	Persistent	Prompt	String	FmtString	Bignum	Date	Integer	Real	Time	UTime	Button	Icon	Image	PrgressBar	PullDnItem	PopUpItem	Border	TitleBar	SysButton	MaxButton	MinButton
AcceptDrop	•	F	•	•	F	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F	F
AutomaticUpdate[4]	•	T	T	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BackgroundColor	•		•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	•	•	D	D	D	D	D	D	D
Bordered		F	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F
Changed	•	F	•	F	F	•	•	•	•	•	•	•	•	•					•					
CoordinateType		C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
CopyDraggable	•	F	•	•	F	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F	F
Disabled	•	F	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F
EditMode		F	•	F	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•
Error	•	N	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Focus	•	F	F	F	F	•	•	•	•	•	•	•	•	•	•	F	F	•	•	F	F	F	F	F
Font	•		•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	N	•	D	D	N	D			
HelpContext	•	N	•	•	N	•	•	•	•	•	•	•	•	•	•	N	N	•	•	N	N	N	N	N
HelpObjectTip	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	N	•	•	•	N	N	N	N	N
LinkDraggable	•	F	•	•	F	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F	F
MoveDraggable	•	F	•	•	F	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F	F
Noncurrent	•	F	•	•	T	•	•	•	•	•	•	•	•	•	•	T	T	•	•	T	T	T	T	T
OSDraw		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Parent		N	N	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
ParentDrawBorder[7]		F	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F
ParentDrawFocus[8]		F	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F
ParentPalette		F	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F
QuickTip	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	N	N	N	N	N
Region	•	Ø	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
RegionType		I	•	•	I	•	•	•	•	•	•	•	•	•	I	•	•	I	I	O	A	A	A	A
Selected	•	F	•	•	F	•	•	•	•	•	•	•	•	•	•	•	F	F	•	F	F	F	F	F
SupportObject		F	•	•											•			F	F	T	T	T	T	T
SystemObject		T	•	T																				
Text[9]	•				•	•	•	•	•	•	•	•	•	•	•		•	•	•		•			
TextColor	•		•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	N	•	D	D	N	D			
UserFunction	•	N	•	•	N	•	•	•	•	•	•	•	•	•	•	•	N		•	N	N	N	N	N
UserPaletteData	•	N	•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	•	•	D	D	D	D	D	D	D
Visible	•	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Legend to footnotes follows the ZafWindow matrix.

Base Property Matrix—ZafWindow Classes

ZafWindowObject or ZafWindow Property[1]		Con- structor			Derived ZafWindow																							
	Dynamic[2]	Normal	Copy	Persistent	Window	DialogWindow	MessageWin	ScrolledWin	MDI Parent Win	MDI Child Win	HzList	VtList	TreeList	TreeItem	Table	TableHeader	TableRecord	Notebook	ToolBar	StatusBar	Group	Text	ComboBox	SpinControl	ScrollBar	PullDownMenu	PopUpMenu	WindowMgr
AcceptDrop	•	F	•	•	•	F	F	•	F	•	•	•	•[3]	F[3]	F	F	F	F	F	F	F	•	•	F	F	F	F	F
AutomaticUpdate[4]	•	T	T	T	•	•	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	T
BackgroundColor	•		•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	D	D	D	D
Bordered		F	•	•	•	F	F	•	F	F	•	•	•	F	•	T	F	•	•	•	•	•	T	•	F	T	T	F
Changed	•	F	•	F	•	•		•	•	•	•	•	•				•					•	•	•	•			
CoordinateType		C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
CopyDraggable	•	F	•	•	F						•	•	•									•	•					
Disabled	•	F	•	•	•[6]	F	F	•[6]	F	F	•	•	•	•	•	•	F	•	•	•	•	•	•	•	•	F	F	
EditMode		F	•	F	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
Error	•	N	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Focus	•	F	F	F	•	•		•	•	•	•	•	•	•	•	F	•	•	•	F	•	•	•	•	•	•	•	
Font	•		•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		D	D	D
HelpContext	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	N	•	•	•	•	•	•	•	•	•	•	•	
HelpObjectTip	•	N	•	•	•	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
LinkDraggable	•	F	•	•	F						•	•	•									•	•					
MoveDraggable	•	F	•	•	F						•	•	•									•	•					
Noncurrent	•	F	•	•	•[6]	F	F	•[6]	F	F	•	•	•	•	•	T	F	•	•	T	•	•	•	•	•	F	F	
OSDraw		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	T
Parent		N	N	N	•[6]	N	N	•[6]	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	N
ParentDrawBorder[7]		F	•	•	F																	•						F
ParentDrawFocus[8]		F	•	•	F									•			T											F
ParentPalette		F	•	•	•[6]	F		•[6]			•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	F	F	F
QuickTip	•	N	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Region	•	Ø	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
RegionType		I	•	•	•	I	I	•	I	I	•	•	•	I	•	A	I	•	A	A	•	•	•	•	•	A	I	A
Selected	•	F	•	•	F									•														
SupportObject		F	•	•												T	F		•	T					•	T		
SystemObject		T	•	T																								
Text[9]	•				•[6]	•[6]	•[6]	•[6]	•	•				•							•	•	•	•				
TextColor	•		•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		D	D	D
UserFunction	•	N	•	•										•		N	•			N				•	•			
UserPaletteData	•	N	•[5]	•[5]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	D	D	D	D
Visible	•	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
DefaultButton	•	N	N	N	•	•	•	•		•																		
Destroyable	•	T	•	•	•	•	F	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Locked		F	•	•	•	•	F	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Maximized	•	F	•	•	•	•	F	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Minimized	•	F	•	•	•	•	F	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Modal		F	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Moveable		T	•	•	•	•	T	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
NormalHotKeys	•	F	•	•	•	•	•	•	•	•	F	F	F	F	F	F	F	•	F	F	•	F	F	F	F	T	T	F
SelectionType		S	•	•	•	•	S	•	S	•	•	•	•[3]	•[3]	•	M	•	S	•	S	•	S	S	S	S	S	•	S
Sizeable		T	•	•	•	F	F	•	•	•	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Temporary		F	•	•	•	F	F	•	F	F	F	F[10]	F	F	F	F	F	F	F	F	F	F	F	F	F	F	T	F

1. "Property" refers to accessor functions inside ZafWindowObject and ZafWindow that manipulate private data members. Each accessor has both a "Get" and a "Set" variant. For example, "SetAcceptDrop(true)" sets a property, while "if (AcceptDrop())" checks the status of the property.

2. "Dynamic" indicates the property may be changed dynamically, i.e. after the object has been initialized and has a screenID. If the property cannot be changed dynamically then "SetProperty" functions must be called prior to adding the object to a managed parent or to the ZafWindowManager. Alternatively, the object may be subtracted, properties changed, and then re-added to its parent.

3. Property is set on ZafTreeList only, and affects the entire tree including all ZafTreeItems.

4. "AutomaticUpdate" is defined only for palette manipulation functions (BackgroundColor, TextColor, Font, UserPaletteData) plus Add and Subtract. When "AutomaticUpdate()==false" the display is not refreshed when these functions are called. This allows the programmer to fully manipulate the palette, or add or subtract many items on a parent without slow and distracting screen updates. "SetAutomaticUpdate(true)" restores the normal display behavior and immediately redisplays the changes made while AutomaticUpdate was false.

   Note: AutomaticUpdate is not defined for other contexts and is therefore not portable outside of palette functions, Add and Subtract. It may result in unpredictable and/or non-portable behavior under other conditions and should therefore never be left in the "false" state. In general, "SetAutomaticUpdate(false)" and "SetAutomaticUpdate(true)" should immediately precede and follow the functions it is intended to affect.

5. This accessor function manipulates the UserPaletteData member which is an instance of ZafPaletteData—a separate class. Initialization, duplication and persistence are handled by ZafPaletteData rather than the user interface class.

6. Property is valid in some contexts for this class, but not others. For example, "SetDisabled(true)" is valid for proper child window only (i.e. windows without decorations).

7. By default, this property applies only to children of a ZafStatusBar. However, it may be exploited for other purposes.

8. By default, this property applies only to children of ZafHzList, ZafVtList, ZafTreeList, and ZafTreeItem. However, it may be exploited for other purposes.

9. Proper child windows cannot have decorations (e.g. TitleBar, Border, etc.) therefore, Text is undefined is this case. MDI child windows do have decorations.

10. Instances of this class are forced to "SetTemporary(true)" by ZafComboBox when they are the ZafComboBox::list member.

Property Matrices—Derived Classes

Bignum

ZafBignum Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
BignumData	•	•	•	N	•	•
HzJustify	String	•	B	B	B	B
InputFormatData	String	•	B	B	B	B
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	•	B	B	B	B
Password	String	F		B	B	B
RangeData	String	•	B	B	B	B
StringData	String	INVALID		B	B	B
Unanswered	String	•	B	B	B	B
UpperCase	String	F		B	B	B
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

Border

ZafBorder Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
Width (static member)	•	varies				

Button

ZafButton Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
AllowDefault	•	•		F	•	•
AllowToggling	•	•		F	•	•
AutoRepeatSelection	•	•		F	•	•
AutoSize	•	•		T	•	•
BitmapData	•	•	•	N	•	•
ButtonType	•	•		NATIVE	•	•
Depressed	•	internal		F	F	F
Depth	•	•		2	•	•
HotKeyChar	•	•		Ø	•	•
HotKeyIndex	•	•		-1	•	•
HzJustify	•	•		CENTER	•	•
SelectOnDoubleClick	•	•		F	•	•
SelectOnDownClick	•	•		F	•	•
SendMessageText	•	•	•	N	•	•
SendMessageWhenSelected	•	•		F	•	•
StringData	•	•	•	N	•	•
Value	•	•	•	Ø	•	•
VtJustify	•	•		CENTER	•	•

ComboBox

ZafComboBox Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSortData	•	•	•	list	list	list
ViewOnly	•	•		F	•	•

Date

ZafDate Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
DateData	•	•	•	N	•	•
HzJustify	String	•	B	B	B	B
InputFormatData	String	•	B	B	B	B
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	•	B	B	B	B
Password	String	F		B	B	B
RangeData	String	•	B	B	B	B
StringData	String	INVALID		B	B	B
Unanswered	String	•	B	B	B	B
UpperCase	String	F		B	B	B
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

Formatted String

ZafFormattedString Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
CompressedData	•	•		N	•	•
DeleteData	•	•		N	•	•
ExpandedData	•	•		StringData	StringData	StringData
FormatData	•	•		InputFormatData	InputFormatData	InputFormatData
HzJustify	String	•	B	B	B	B
InputFormatData	String	INVALID		B	B	B
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	INVALID		B	B	B
Password	String	F		B	B	B
RangeData	String	INVALID		B	B	B
StringData	String	INVALID		B	B	B
Unanswered	String	•	•	B	B	B
UpperCase	String	F		B	B	B
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

Group

ZafGroup Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSelect	•	•		F	•	•
HotKeyChar	•	•		Ø	•	•
HotKeyIndex	•	•		-1	•	•
StringData	•	•	•	N	•	•

HzList

ZafHzList Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSortData	•	•	•	F	•	•
CellHeight	•	•		parameter	•	•
CellWidth	•	•		parameter	•	•

Icon

ZafIcon Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	F		B	B	B
AutoRepeatSelection	Button	F		F	F	F
AutoSize	Button	•	B	B	B	B
BitmapData	Button	N		B	B	B
ButtonType	Button	FLAT		FLAT	B	B
Depressed	Button	•	B	B	B	B
Depth	Button	varies		B	B	B
HotKeyChar	Button	Ø		B	B	B
HotKeyIndex	Button	-1		B	B	B
HzJustify	Button	•	B	B	B	B
IconData	•	•	•	N	•	•
IconType	•	•		NATIVE	•	•
SelectOnDoubleClick	Button	•	B	T	B	B
SelectOnDownClick	Button	•	B	B	B	B
SendMessageText	Button	•	B	B	B	B
SendMessageWhenSelected	Button	•	B	B	B	B
StringData	Button	•	B	B	B	B
Value	Button	•	B	B	B	B
VtJustify	Button	•	B	B	B	B

Image

ZafImage Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSize	•	•		F	•	•
PathID	•	•	•	-1	•	•
PathName	•	•	•	N	•	•
Scaled	•	•		F	•	•

ZafImage Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
Tiled	•	•		F	•	•
Wallpaper	•	•		F	•	•

Integer

ZafInteger Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
HzJustify	String	•	B	B	B	B
InputFormatData	String	•	B	B	B	B
IntegerData	•	•	•	N	•	•
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	•	B	B	B	B
Password	String	F		B	B	B
RangeData	String	•	B	B	B	B
StringData	String	INVALID		B	B	B
Unanswered	String	•	B	B	B	B
UpperCase	String	F		B	B	B
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

Maximize Button

ZafMaximizeButton Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	F		B	B	B
AutoRepeatSelection	Button	F		B	B	B
AutoSize	Button	T		B	B	B
BitmapData	Button	internal		B	B	B
ButtonType	Button	3D		3D	B	B
Depressed	Button	internal		B	B	B
Depth	Button	1		1	B	B
HotKeyChar	Button	Ø		B	B	B
HotKeyIndex	Button	-1		B	B	B
HzJustify	Button	CENTER		B	B	B
SelectOnDoubleClick	Button	F		B	B	B
SelectOnDownClick	Button	F		B	B	B
SendMessageText	Button	N		B	B	B
SendMessageWhenSelected	Button	T		T	B	B
StringData	Button	internal		B	B	B
Value	Button	internal		S_MAX-IMIZE	B	B
VtJustify	Button	CENTER		B	B	B

MDIWindow

ZafMDIWindow Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
MDIType	•	•		parameter	•	•

Minimize Button

ZafMinimizeButton Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	F		B	B	B
AutoRepeatSelection	Button	F		B	B	B
AutoSize	Button	T		B	B	B
BitmapData	Button	internal		B	B	B
ButtonType	Button	3D		3D	B	B
Depressed	Button	internal		B	B	B
Depth	Button	1		1	B	B
HotKeyChar	Button	ø		B	B	B
HotKeyIndex	Button	-1		B	B	B
HzJustify	Button	CENTER		B	B	B
SelectOnDoubleClick	Button	F		B	B	B
SelectOnDownClick	Button	F		B	B	B
SendMessageText	Button	N		B	B	B
SendMessageWhenSelected	Button	T		T	B	B
StringData	Button	internal		B	B	B
Value	Button	internal		S_MIN-IMIZE	B	B
VtJustify	Button	CENTER		B	B	B

Notebook

ZafNotebook Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
CurrentPage	•	•	•	-1	•	-1
TabHeight	•	•		ø	•	•
TabText	•	•	•			
TabWidth	•	•		ø	•	•

PopUpItem

ZafPopUpItem Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	•		B	B	B
AutoRepeatSelection	Button	F		F	F	F
AutoSize	Button	F		B	B	B
BitmapData	Button	N		B	B	B
ButtonType	Button	FLAT		FLAT	B	B
Depressed	Button	internal		B	B	B

ZafPopUpItem Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
Depth	Button	Ø		Ø	B	B
HotKeyChar	Button	•	B	B	B	B
HotKeyIndex	Button	•	B	B	B	B
HzJustify	Button	LEFT		LEFT	B	B
ItemType	•	•		B	•	•
SelectOnDoubleClick	Button	F		B	B	B
SelectOnDownClick	Button	F		B	B	B
SendMessageText	Button	•	B	B	B	B
SendMessageWhenSelected	Button	•	B	B	B	B
StringData	Button	•	B	B	B	B
Value	Button	•	B	B	B	B
VtJustify	Button	CENTER		B	B	B

ProgressBar

ZafProgressBar Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
ProgressData	•	•	•	N	•	•
ProgressStyle	•	•		NATIVE	•	•
ProgressType	•	•		HORIZON-TAL	•	•
TextStyle	•	•		TEXT_-VALUE	•	•

Prompt

ZafPrompt Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSize	•	•		T	•	•
HotKeyChar	•	•		Ø	•	•
HotKeyIndex	•	•		-1	•	•
HzJustify	•	•		LEFT	•	•
StringData	•	•	•	N	•	•
TransparentBackground	•	•		F	•	
VtJustify	•	•		TOP	•	•

PullDownItem

ZafPullDownItem Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	F		B	B	B
AutoRepeatSelection	Button	F		F	F	F
AutoSize	Button	F		B	B	B
BitmapData	Button	N		B	B	B
ButtonType	Button	FLAT		FLAT	B	B
Depressed	Button	internal		B	B	B
Depth	Button	Ø		Ø	B	B

ZafPullDownItem Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
HotKeyChar	Button	•	B	B	B	B
HotKeyIndex	Button	•	B	B	B	B
HzJustify	Button	LEFT		LEFT	B	B
SelectOnDoubleClick	Button	F		B	B	B
SelectOnDownClick	Button	F		B	B	B
SendMessageText	Button	N		B	B	B
SendMessageWhenSelected	Button	F		B	B	B
StringData	Button	•	B	B	B	B
Value	Button	Ø		B	B	B
VtJustify	Button	CENTER		B	B	B

Real

ZafReal Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
HzJustify	String	•	B	B	B	B
InputFormatData	String	•	B	B	B	B
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	•	B	B	B	B
Password	String	F		B	B	B
RangeData	String	•	B	B	B	B
RealData	•	•	•	N	•	•
StringData	String	INVALID		B	B	B
Unanswered	String	•	B	B	B	B
UpperCase	String	F		B	B	B
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

ScrollBar

ZafScrollBar Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
AutoSize	•	•		T	•	•
ScrollData	•	•	•	N	•	•
ScrollType	•	•		VERTICAL	•	•

Scrolled Window

ZafScrolledWindow Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
HzScrollPos	•	•	•	parameter	•	•
ScrollHeight	•	•	•	parameter	•	•
ScrollWidth	•	•	•	parameter	•	•
VtScrollPos	•	•	•	parameter	•	•

SpinControl

ZafSpinControl Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
Delta	•	•	•	parameter	•	•
ViewOnly	•	•		F	•	•
WrappedData	•	•	•	T	•	•

String

ZafString Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
AutoClear	•	•	•	T	•	•
HzJustify	•	•		LEFT	•	•
InputFormatData	•	•		N	•	•
Invalid	•	•	•	F	•	•
LowerCase	•	•		F	•	•
OutputFormatData	•	•		N	•	•
Password	•	•		F	•	•
RangeData	•	•	•	N	•	•
StringData	•	•	•	N	•	•
Unanswered	•	•	•	F	•	•
UpperCase	•	•		F	•	•
VariableName	•	•		F	•	•
ViewOnly	•	•		F	•	•

SystemButton

ZafSystemButton Property	**Inherited From**	**Value**	**Dynamic**	**Constructor** Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	F		B	B	B
AutoRepeatSelection	Button	F		B	B	B
AutoSize	Button	T		B	B	B
BitmapData	Button	internal		B	B	B
ButtonType	Button	3D		3D	B	B
Depressed	Button	internal		B	B	B
Depth	Button	1		1	B	B
HotKeyChar	Button	Ø		B	B	B
HotKeyIndex	Button	-1		B	B	B
HzJustify	Button	CENTER		B	B	B
SelectOnDoubleClick	Button	F		B	B	B
SelectOnDownClick	Button	F		B	B	B
SendMessageText	Button	N		B	B	B
SendMessageWhenSelected	Button	F		T	B	B
StringData	Button	internal		B	B	B
SystemButtonType	•	•		NATIVE	•	•
Value	Button	Ø		B	B	B
VtJustify	Button	CENTER		B	B	B

Table

ZafTable Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
CurrentOffset	•	internal	user read-able	-1	-1	-1
Grid	•	•		T	•	•
HeaderHeight	•	•	•	parameter	ZafTable-Header	ZafTable-Header
HeaderWidth	•	•	•	parameter	ZafTable-Header	ZafTable-Header
MaxOffset	•	•	•	-1	•	•
ReadFunction	•	•	•	Read-Record	•	Read-Record
RowHeight	•	•		parameter	ZafTable-Record	ZafTable-Record
VirtualRecord	•	•		N	•	•
WriteFunction	•	•	•	Write-Record	•	Write-Record

TableHeader

ZafTableHeader Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
HeaderType	•	•		ROW	•	•
VirtualField	•	•		N	•	•

TableRecord

ZafTableRecord Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
Offset	•	internal	user read-able	-1	-1	-1

Text

ZafText Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoClear	•	•	•	F	•	•
HzJustify	•	•		LEFT	•	•
Invalid	•	•	•	F	•	•
StringData	•	•	•	N	•	•
Unanswered	•	•	•	F	•	•
ViewOnly	•	•		F	•	•
WordWrap	•	•	•	T	•	•

Time

ZafTime Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
HzJustify	String	•	B	B	B	B
InputFormatData	String	•	B	B	B	B

ZafTime Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	•	B	B	B	B
Password	String	F		B	B	B
RangeData	String	•	B	B	B	B
StringData	String	INVALID		B	B	B
TimeData	•	•	•	N	•	•
Unanswered	String	•	B	B	B	B
UpperCase	String	F		B	B	B
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

Title

ZafTitle Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AllowDefault	Button	F		B	B	B
AllowToggling	Button	F		B	B	B
AutoRepeatSelection	Button	F		B	B	B
AutoSize	Button	T		B	B	B
BitmapData	Button	N		B	B	B
ButtonType	Button	FLAT		FLAT	B	B
Depressed	Button	internal		B	B	B
Depth	Button	Ø		Ø	B	B
HotKeyChar	Button	Ø		B	B	B
HotKeyIndex	Button	-1		B	B	B
HzJustify	Button	CENTER		B	B	B
SelectOnDoubleClick	Button	T		T	B	B
SelectOnDownClick	Button	T		T	B	B
SendMessageText	Button	N		B	B	B
SendMessageWhenSelected	Button	T		T	B	B
StringData	Button	•	B	B	B	B
Value	Button	internal		B	B	B
VtJustify	Button	CENTER		B	B	B

ToolBar

ZafToolBar Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
DockType	•	•		TOP	•	•
WrapChildren	•	•		T	•	•

TreeItem

ZafTreeItem Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSortData	•	•	•	F	•	•
Expandable	•	•		F	•	•

ZafTreeItem Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
Expanded	•	•	•	F	•	•
NormalBitmap	•	•		N	•	•
SelectedBitmap	•	•		N	•	•
StringData	•	•	•	N	•	•

TreeList

ZafTreeList Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSortData	•	•	•	F	•	•
DrawLines	•	•		T	•	•

UTime

ZafUTime Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoClear	String	•	B	B	B	B
HzJustify	String	•	B	B	B	B
InputFormatData	String	•	B	B	B	B
Invalid	String	•	B	B	B	B
LowerCase	String	F		B	B	B
OutputFormatData	String	•	B	B	B	B
Password	String	F		B	B	B
RangeData	String	•	B	B	B	B
StringData	String	INVALID		B	B	B
Unanswered	String	•	B	B	B	B
UpperCase	String	F		B	B	B
UTimeData	•	•	•	N	•	•
VariableName	String	F		B	B	B
ViewOnly	String	•	B	B	B	B

VtList

ZafVtList Property	**Inherited From**	**Value**	**Dynamic**	**Constructor**		
				Normal	Copy	Persistent
AutoSortData	•	•	•	F	•	•

X Resources

As part of the internal implementation of Zinc Application Framework 5 for Motif, ZAF derives from Motif "xm*" classes and registers its own versions. Knowledge of this internal implementation may be useful for programmers who wish to change colors, fonts, etc. in Motif resource files rather than hard-coding them into an application.

In general, a Motif application that wants to use resources should do so as defined in the O'Reilly & Associates Motif manuals:

- Vol IV, Chapter 2.3.3—The App-defaults file
- Vol IV, Chapter 10—Resource Management

These chapters describe the types of operations and files that can be overriden, and from what class. This information is also available in various end-user Motif or system administration manuals.

The table below lists ZAF 5 window object class names and the corresponding Motif or custom class names that are registered with Motif. These names may be used as resource tags when overriding default widget operations. Also listed are Motif classes used as an immediate base class by ZAF.

Sample usage is presented following the table.

ZAF Class Name	**Motif Class Name**	**ZAF class derives from**
`ZafWindowObject`	"ZafWindowObject"	xmPrimitiveClassRec
`ZafWindow`	"ZafWindowShell" (shell)	topLevelShellClassRec
	"ZafWindowFrame" (frame)	xmBulletinBoardClassRec
	"ZafWindow" (client)	xmBulletinBoardClassRec
`ZafButton`	"ZafButton"	xmPushButtonClassRec
`ZafComboBox`	"ZafComboBox"	xmBulletinBoardClassRec
`ZafDialogWindow`	see ZafWindow	
`ZafFileDialog`	"ZafWindowShell"	xmFileSelectionBoxWidget
`ZafFormattedString`	"ZafFormattedString"	xmTextFieldClassRec
`ZafGroup`	see ZafString	
`ZafHzList`	see ZafVtList	
`ZafIcon`	uses Icon registration	
`ZafMDIWindow`	see ZafWindow	
`ZafNotebook`	"ZafNotebook"	xmBulletinBoardClassRec

ZAF Class Name	Motif Class Name	ZAF class derives from
ZafPullDownMenu	"xmRowColumn"	xmRowColumnClassRec
ZafPullDownItem	"xmCascadeButton"	xmCascadeButtonClassRec
ZafPopUpMenu	"popupShell"	xmRowColumnWidget-ClassRec
ZafPopUpItem	"ZafToggleItem" (no children)	xmToggleButtonClassRec
	"ZafCascadeItem" (with children)	xmCascadeButtonClassRec
ZafPrompt	"ZafPrompt"	xmLabelClassRec
ZafScrolledWindow	two "ZafWindow"s	
ZafScrollBar	"ZafScrollBar" (scroll-bar)	xmScrollBarClassRec
	"ZafSlider" (slider)	xmScaleClassRec
ZafSpinControl	"ZafSpinControl"	xmBulletinBoardClassRec
ZafStatusBar	see ZafWindow	
ZafString	"ZafString"	xmTextFieldClassRec
ZafTable	see ZafWindow	
ZafTableHeader	see ZafWindow	
ZafTableRecord	see ZafWindow	
ZafToolBar	see ZafWindow	
ZafText	"ZafText"	xmTextClassRec
ZafTreeList	"ZafTreeList"	xmListClassRec
ZafVtList	"ZafList"	xmListClassRec

When overriding operations for a program named "hello", for example, a resource file named "Hello" or "XHello" should be created. In this file a user might include overrides such as:

```
*ZafPrompt.fontList: -*-helvetica-bold-r-*-140-*-*-*-*-*-*
*ZafPrompt.foreground: blue
*ZafString.background: yellow
*ZafWindow.background: green
```

When adding definitions to resource files, note that Motif allows resources to affect derived classes. Therefore, overrides for a base xmBulletinBoardClass-Rec can affect ZAF classes that use the xmBulletinBoardClassRec definition. For example:

```
*xmLabel.foreground: black
*xmBulletinBoard.fontlist: -*-times-normal-r-*-140-*-*-*-*-*-*
```

Index

A

AcceptDrop
  WindowObject 575

ActivateObject
  TableRecord 487

ActiveModel
  Chart 68

Add
  List 282
  PopUpItem 361
  PullDownItem 384
  SystemButton 464
  Timer 503
  Window 548

AddColor
  Display 142

AddCompareFunction
  ObjectPersistence 343

AddDataConstructor
  DataPersistence 106

AddDataGroup
  Chart 68

AddDataPoint
  Chart 68

AddDepthItem
  TreeList 523

AddFileSystem
  DataPersistence 106

AddFont
  Display 143

AddGenericObjects
  Window 549

AddNotification
  Notification 333

AddObjectConstructor
  ObjectPersistence 343

AddPalette
  PaletteData 349

AddStaticModule
  I18nData 241

AddUserCallback
  ObjectPersistence 343

AddUserObject
  ObjectPersistence 344

AllocateData
  DataManager 102

AllocateFile
  DataPersistence 107

AllowDefault
  Button 54

AllowToggling
  Button 55

altDigits
  LocaleStruct 289

AltPressed
  Keyboard 273

Append
  StringData 454

Application 20

argc
  Application 21

argv
  Application 21

Array
  BitmapData 44
  IconData 251
  MouseData 316

array
  ImageStruct 262

Assign
  PositionStruct 369
  RegionStruct 401

Attachment 24

attributes
  FileInfoStruct 201

AutoClear
  String 444
  Text 490

AutomaticUpdate
  Window 550
  WindowObject 578

AutoRepeatSelection
  Button 55

AutoSelect
  Group 223

AutoSize
  Button 56
  Image 257
  Prompt 379
  ScrollBar 413

AutoSortData
  ComboBox 84
  HzList 237
  TreeItem 516
  TreeList 524
  VtList 543

available3D
  ZafMSWindowsApp . . 322

AxisColor
  Chart 69

B

Background
  Display 144

BackgroundColor
  WindowObject 580

BasisYear
UTimeData 536

Beep
ErrorSystem 172

BeginDraw
Display 144
WindowObject 581

beginGregorian
LocaleStruct 289

Bignum 29
Property Matrix E-725

BignumData 33
Bignum 31

BinaryMode
File 191

Bitmap
Display 145

BitmapData 43
Button 56

BitmapStruct 46

blankString
LanguageData 277

BlinkRate
Cursor 93

Blocked
EventManager 177

Border 48
Property Matrix E-725
Window 550

Bordered
WindowObject 582

bottom
RegionStruct 402

BottomOffset
Table 473

BroadcastEvent
Window 551

Button 51
Property Matrix E-725

ButtonType
Button 57

C

canonicalLocale
LocaleData 287

CellHeight
HzList 238

cellHeight
CoordinateStruct 90

CellWidth
HzList 238

cellWidth
CoordinateStruct 90

Center
RelativeConstraint 407
WindowManager 567

Changed
StorageFile 439
Window 552
WindowObject 583

ChangeExtension
DiskFileSystem 135

Char
StringData 454

Chart 65

ChartStub 74

ChartType
Chart 69

ChDir
DiskFileSystem 135
FileSystem 204
Storage 435

ClassID
Element 162
WindowObject 584

classID
WindowObject 584

ClassName
Element 162
WindowObject 584

className
WindowObject 584

Clear
BignumData 35
BitmapData 44
CodeSetData 77
Data 97
DataRecord 113
DateData 121
IconData 252
IntegerData 268
LanguageData 277
LocaleData 287
MouseData 316
PaletteData 349
RealData 398
ScrollData 416
TimeData 501
UTimeData 536

ClearCompareFunctions
ObjectPersistence 344

ClearDataAll
Chart 69

ClearDataConstructors
DataPersistence 107

ClearDataGroup
Chart 70

ClearFileSystems
DataPersistence 107

ClearImage
Button 57

ClearMessageFlags
MessageWindow 300

ClearNotifications
Notification 333

ClearObjectConstructors
ObjectPersistence 344

ClearText
Button 58

ClearUserCallbacks
ObjectPersistence 344

ClearUserObjects
ObjectPersistence 344

ClientRegion
Window 552

ClipRegion
Display 145

Close
DiskFileSystem 136
FileSystem 204
Storage 435

CodeSetAllocate
CodeSetData 77

CodeSetData 75

CodeSetFree
CodeSetData 77

CodeSetName
CodeSetData 77

colorBackground
PaletteStruct 352

colorForeground
PaletteStruct 352

colorTable
Display 146

column
PositionStruct 369

columns
Display 146

ComboBox 82

Property Matrix E-726

commonControlsAvailable
ZafMSWindowsApp . .322

Compare
StringData 455

CompareAscending
Window 553

CompareDescending
Window 553

CompareFunction
List 282

CompressedData
FormattedString 213

Constraint 87

Control
Application 22
DialogWindow 128

Convert 665

Convert Utility
ZAF 4 665

ConvertCoordinates
PositionStruct 369
RegionStruct 401
WindowObject 584

converted
EventStruct 185

ConvertRegion
WindowObject 584

convertText
ZafMSWindowsApp . . 322

ConvertToDrawRegion
WindowObject 585

ConvertToObjectPosition
WindowObject 585

ConvertToOSBitmap
Display 146

ConvertToOSChar
CodeSetData 78

ConvertToOSIcon
Display 146

ConvertToOSMouse
Display 146

ConvertToOSPosition
WindowObject 586

ConvertToOSRegion
WindowObject 586

ConvertToOSString
CodeSetData 78

ConvertToOSWChar
CodeSetData 78

ConvertToOSWString
CodeSetData 78

ConvertToScreenPosition
WindowObject 585

ConvertToZafBitmap
Display 147

ConvertToZafChar
CodeSetData 79

ConvertToZafEvent
WindowObject 586

ConvertToZafIcon
Display 147

ConvertToZafMouse

Display 147

ConvertToZafPosition
WindowObject 586

ConvertToZafRegion
WindowObject 586

ConvertToZafString
CodeSetData 79

ConvertXValue
CoordinateStruct 91

ConvertYValue
CoordinateStruct 91

CoordinateStruct 90

CoordinateType
WindowObject 588

coordinateType
CoordinateStruct 91

CopyDraggable
WindowObject 595

CornerScrollBar
Window 553

Count
List 283
PopUpItem 362
PullDownItem 385
SystemButton 465

CountryCodeToZafLocale
I18nData 242

Create
File 192
Storage 435

CreateSubclassedWindow
ZafMSWindowsApp . . 322

creditLeftParen
LocaleStruct 289

creditRightParen
LocaleStruct 290

Ctl3dAutoSubclass
ZafMSWindowsApp . . 323

Ctl3dEnabled
ZafMSWindowsApp . . 322

ctl3dModule
ZafMSWindowsApp . . 322

Ctl3dRegister
ZafMSWindowsApp . . 322

Ctl3dSubclassCtl
ZafMSWindowsApp . . 323

Ctl3dUnregister
ZafMSWindowsApp . . 323

CtrlPressed
Keyboard 273

currencySymbol
LocaleStruct 290

Current
List 283
PopUpItem 362
ProgressBar 373
PullDownItem 385
ScrollData 416
SystemButton 465

current
ScrollStruct 418

CurrentClassID
DataPersistence 107

CurrentClassName
DataPersistence 107

currentDirectoryName
FileSystem 204

CurrentFile
DataPersistence 108

CurrentFileSystem
DataPersistence 108

CurrentLanguage
DataPersistence 108

CurrentOffset
Table 473

CurrentPage
Notebook 329

Cursor 92

CursorOffset
String 444
Text 491

CursorPosition
Text 491

D

Data 95
StorageFile 439

data
EventStruct 185

DataGroup
Chart 70

DataGroupBackgroundColor
Chart 70

DataGroupFillPattern
Chart 70

DataGroupFont
Chart 70

DataGroupForegroundColor
Chart 71

DataGroupLineStyle
Chart 71

DataManager 101

DataPersistence 103

DataPoint
Chart 71

DataRecord 112

Date 114
  Property Matrix E-726

DateData 119
  Date 117

dateSeparator
  LocaleStruct 290

dateStringInputFormat
  LocaleStruct 290

dateStringOutputFormat
  LocaleStruct 290

dateTimeStringInputFormat
  LocaleStruct 290

dateTimeStringOutputFormat
  LocaleStruct 290

Day
  UTimeData 536

DayName
  UTimeData 536

DayOfWeek
  UTimeData 536

DaysInMonth
  UTimeData 536

DaysInYear
  UTimeData 536

DeactivateObject
  TableRecord 487

decimalSeparator
  LocaleStruct 290

Decrement
  ProgressBar 373
  ScrollData 416
  String 444

DefaultButton
  Window 554

DefaultLeadByte
  CodeSetData 80

DefaultMessageFlag
  MessageWindow 301

DefaultUserFunction
  WindowObject 591

DefaultValidateFunction
  String 444

defDigits
  LocaleStruct 291

DeleteData
  FormattedString 214

DeleteDriveNames
  DiskFileSystem 136

DeleteRecord
  Table 473

Delta
  ProgressBar 373
  ScrollData 416
  SpinControl 426

delta
  ScrollStruct 418

Depressed
  Button 58

Depth
  Button 58

DepthCurrent
  TreeItem 516
  TreeList 524

DepthFirst
  TreeItem 516
  TreeList 524

DepthLast
  TreeItem 517
  TreeList 525

DepthNext
  TreeItem 517

DepthPrevious
  TreeItem 517

DerivedAccess
  File 192

Destroy
  List 283
  PopUpItem 362
  PullDownItem 385
  SystemButton 465
  Window 554

Destroyable
  Data 98
  Window 554

DestroyColor
  ZafDisplay 142

DestroyEvent
  EventManager 177

DestroyFont
  ZafDisplay 143

DestroyOSBitmap
  Display 148

DestroyOSIcon
  Display 148

DestroyOSMouse
  Display 148

DestroyZafBitmap
  Display 148

DestroyZafIcon
  Display 148

DestroyZafMouse
  Display 148

Device 122

DeviceState
  Device 123

DeviceType

Device 124

DialogWindow 126

DimensionConstraint 129

direction
EraStruct 170

Directory
FileDialog 198
FileInfoStruct 201

dirSepStr
CodeSetData 80

Disabled
WindowObject 592

DiskFile 133

DiskFileSystem 135

Display 140
EventStruct 186

display
Device 123
WindowObject 593

DisplayContext
Display 148

DisplayHelp
HelpStub 225
HelpSystem 228

DisplayMode
Display 149

DockType
ToolBar 511

double
BignumData 37
RealData 399

DragDropEvent
WindowObject 594

Draggable
WindowObject 595

dragObject
WindowManager 567

dragStartPosition
ZafMSWindowsApp . .323

dragTest
ZafMSWindowsApp . .323

Draw
WindowObject 596

DrawBackground
WindowObject 596

DrawBorder
WindowObject 596

DrawContext
Display 148

DrawFocus
WindowObject 597

DrawLines
TreeList 525

DrawShadow
WindowObject 597

dropDownCombo
ZafMSWindowsApp . .323

Duplicate
Data 98
WindowObject 599

Dynamic Properties
Property Matrices . . .E-720

DynamicOSText
StringData 454

DynamicOSWText
StringData 454

DynamicPtrCast B-698

DynamicText
StringData 454

E

EditMode
WindowObject 600

Element 160

Ellipse
Display 149

Encompassed
RegionStruct 401

endDate
EraStruct 170

EndDraw
WindowObject 581

eraFormat
EraStruct 170

eraName
EraStruct 170

EraStruct 170

eraTable
LocaleStruct 291

eraTableLength
LocaleStruct 291

Error
Data 98
File 192
FileSystem 204
WindowObject 600

ErrorMessage
ErrorStub 172
ErrorSystem 175

errorString
LanguageData 277

ErrorStub 172

ErrorSystem 174

EvaluateIsA

Element 163

Event
Attachment 26
Bignum 32
Button 58
Constraint 89
Cursor 93
Data 100
Date 118
DimensionConstraint . 131
EventManager 177
GeometryManager 219
HelpSystem 228
HelpTips 232
Integer 265
Keyboard 273
Mouse 311
PopUpItem 362
PullDownItem 385
Real 395
RelativeConstraint 407
String 445
Text 491
Time 498
Timer 504
UTime 532
Window 555
WindowManager 567
WindowObject 602

event
QueueElement 392

EventManager 176
EventStruct 186

eventManager
WindowObject 607

EventMap 181

Events
A_CLOSE_WINDOW . C-714
A_HELP_CONTEXT C-714
A_MINIMIZE_WINDOWS C-715
A_OPEN_DOCUMENT C-715
A_OPEN_WINDOW C-715
A_PRINT_DOCUMENT C-715
A_RESET_I18N C-715
A_RESTORE_WINDOWS C-715
D_ACTIVATE C-713
D_DEACTIVATE . . C-713
D_DEINITIALIZE . . C-713
D_HIDE C-713
D_INITIALIZE C-713
D_OFF C-713
D_ON C-713
D_POSITION C-713
D_STATE C-712
DC_INSERT C-713
DC_OVERSTRIKE . C-713
DH_HELP_TIPS_TIMER C-713
DH_SET_HELP_OBJECT C-712
DH_UPDATE_HELP_OBJECT C-712
DM_BOTTOM_LEFT_CORNER C-712
DM_BOTTOM_RIGHT_CORNER C-712
DM_BOTTOM_SIDE . . C-712
DM_CANCEL C-712
DM_CROSS_HAIRS C-712
DM_DRAG C-714
DM_DRAG_COPY . C-714
DM_DRAG_COPY_MULTIPLE C-714
DM_DRAG_LINK . . C-714
DM_DRAG_LINK_MULTIPLE C-714
DM_DRAG_MOVE C-714
DM_DRAG_MOVE_MULTIPLE C-714
DM_EDIT C-712
DM_LEFT_SIDE . . . C-713
DM_MOVE C-713
DM_RIGHT_SIDE . . C-713
DM_SELECT C-713
DM_TOP_LEFT_CORNER C-713
DM_TOP_RIGHT_CORNER C-713
DM_TOP_SIDE C-713
DM_VIEW C-713
DM_WAIT C-713
E_CURSOR C-712
E_DEVICE C-712
E_HELPTIPS C-712
E_KEY C-711
E_MOUSE C-711
E_OSEVENT C-711
E_TIMER C-712
L_ALT_KEY C-709
L_BACKSPACE . . . C-707
L_BEGIN_ESCAPE C-707
L_BOL C-707
L_CANCEL C-707
L_CLOSE C-707
L_CLOSE_TEMPORARY C-707
L_CONTINUE_ESCAPE . C-707
L_CONTINUE_SELECT . C-707
L_COPY C-707
L_CUT C-707
L_DELETE C-708
L_DELETE_EOL . . C-709
L_DELETE_WORD C-709
L_DOUBLE_CLICK C-708
L_DOWN C-708
L_END_ESCAPE . . C-708
L_END_SELECT . . C-708
L_EOL C-708
L_EXIT C-708
L_EXTEND_FIRST C-709
L_EXTEND_LAST . C-709
L_EXTEND_NEXT C-709
L_EXTEND_PREVIOUS . C-709
L_FIRST C-708
L_HELP C-708
L_INSERT_TOGGLE . . C-709
L_LAST C-708
L_LEFT C-708
L_MARK_BOL C-709
L_MARK_DOWN . . C-709
L_MARK_EOL C-710
L_MARK_LEFT . . . C-710

L_MARK_PGDN . . C-710
L_MARK_PGUP . . . C-710
L_MARK_RIGHT . C-710
L_MARK_UP C-710
L_MARK_WORD_LEFT . C-710
L_MARK_WORD_RIGHT C-710
L_MAXIMIZE C-710
L_MDI_MOVE_MODE C-710
L_MDI_NEXT_WINDOW C-708
L_MDI_SIZE_MODE . C-710
L_MINIMIZE C-710
L_MOVE_MODE . . C-710
L_NEXT C-708
L_NEXT_WINDOW C-710
L_NONE C-710
L_PASTE C-708
L_PGDN C-708
L_PGUP C-708
L_PREVIOUS C-708
L_RESTORE C-710
L_RIGHT C-708
L_SELECT C-709
L_SIZE_MODE C-710
L_SYSTEM_MENU C-711
L_TOGGLE_EXPANDED C-711
L_UP C-709
L_VIEW C-709
L_WORD_LEFT . . . C-711
L_WORD_RIGHT . C-711
N_CHANGE_PAGE C-700
N_CLOSE C-700
N_CURRENT C-700
N_EXIT C-700
N_HSCROLL C-700
N_MOUSE_ENTER C-700
N_MOUSE_LEAVE C-700
N_MOVE C-700
N_NON_CURRENT C-701
N_RESET_I18N . . . C-701
N_SIZE C-701
N_TIMER C-701
N_VSCROLL C-701
S_ADD_OBJECT . . C-701
S_BEGIN_DRAG . . . C-704
S_CLOSE C-701
S_CLOSE_TEMPORARY C-701
S_COMPUTE_SIZE C-704
S_CONTINUE C-701
S_COPY C-702
S_COPY_DATA C-702
S_CREATE C-704
S_CURRENT C-704
S_CUT C-702
S_DECREMENT . . . C-702
S_DEINITIALIZE . . C-704
S_DESTROY C-704
S_DLG_ABORT C-706
S_DLG_CANCEL . . C-706
S_DLG_HELP C-706
S_DLG_IGNORE . . . C-706
S_DLG_NO C-706
S_DLG_OK C-706
S_DLG_RETRY C-706
S_DLG_YES C-706
S_DRAG_COPY . . . C-705
S_DRAG_DEFAULT C-705
S_DRAG_LINK C-705
S_DRAG_MOVE . . . C-705
S_DROP_COPY C-705
S_DROP_DEFAULT C-705
S_DROP_LINK C-705
S_DROP_MOVE . . . C-705
S_END_DRAG C-705
S_ERROR C-706
S_EXIT C-702
S_HELP C-702
S_HLP_CLOSE C-705
S_HLP_SELECT_TOPIC C-705
S_HLP_SHOW_INDEX C-705
S_HLP_SHOW_TOPIC C-705
S_HLP_UPDATE_NAME C-705
S_HOT_KEY C-705
S_HSCROLL C-702
S_HSCROLL_CHECK . C-702
S_HSCROLL_COMPUTE C-702
S_HSCROLL_SET . C-702
S_INCREMENT . . . C-702
S_INITIALIZE C-705
S_MAXIMIZE C-702
S_MDI_CASCADE_WINDOWS C-702
S_MDI_CLOSE C-702
S_MDI_MAXIMIZE C-702
S_MDI_MINIMIZE C-702
S_MDI_MOVE_MODE C-702
S_MDI_NEXT_WINDOW C-702
S_MDI_RESTORE . C-703
S_MDI_SIZE_MODE . . C-703
S_MDI_TILE_WINDOWS C-703
S_MINIMIZE C-703
S_MOVE_MODE . . C-703
S_NEXT_WINDOW C-703
S_NO_OBJECT C-706
S_NON_CURRENT C-705
S_PASTE C-703
S_REDISPLAY C-703
S_REDISPLAY_DATA C-703
S_REDISPLAY_DEFAULT C-705
S_REDISPLAY_REGION C-703
S_REGISTER_OBJECT C-706
S_RESTORE C-703
S_SET_DATA C-703
S_SIZE C-703
S_SIZE_MODE C-703
S_SUBTRACT_OBJECT C-703
S_UNKNOWN C-706
S_VSCROLL C-704
S_VSCROLL_CHECK . C-704
S_VSCROLL_COMPUTE C-704
S_VSCROLL_SET . C-704

EventStruct 183

eventType

EventMap 181

ExitFunction
WindowManager 568

Expandable
TreeItem 517

Expanded
TreeItem 517

ExpandedData
FormattedString 214

Export
PositionStruct 369

ExportPixel
RegionStruct 401

ExportPoint
RegionStruct 401

F

File 190
FileDialog 199

fileCreator
DiskFile 133

FileDialog 197

FileInfoStruct 201

FileSystem 203

fileType
DiskFile 133

FillPattern
Display 150

fillPattern
PaletteStruct 353

Filter
FileDialog 199

Find
Element 164
List 283

FindClose
DiskFileSystem 136
FileSystem 205
Storage 435

FindFirst
DiskFileSystem 136
FileSystem 205
Storage 436

FindNext
DiskFileSystem 136
FileSystem 205
Storage 436

First
List 283
PopUpItem 363
PullDownItem 385
SystemButton 465

FirstFileSystem
DataPersistence 108

FirstPage
Notebook 329

Flush
Table 474

Focus
WindowObject 608

FocusObject
PopUpItem 363
PullDownItem 386
Window 555
WindowObject 609

FocusOffset
Table 474

Font
Display 150
WindowObject 610

font
PaletteStruct 354

fontList
X Resources F-737

fontTable
Display 151

Foreground
Display 151

FormatData 208
FormattedString 215

Formatted String
Property Matrix E-726

FormattedString 211

FormattedText
BignumData 36
DateData 121
FormatData 209
IntegerData 269
RealData 399
TimeData 501
UTimeData 537

fractionDigits
LocaleStruct 291

FrameJumpProc
ZafMSWindowsApp . . 324

FrameProc
ZafMSWindowsApp . . 324

Full
ListBlock 285

FullPath
FileDialog 199

G

GeometryManager 217
Window 555

Get

EventManager 177
List 284
PopUpItem 363
PullDownItem 386
SystemButton 465

GetClassName
ObjectPersistence 344

GetCompareFunction
ObjectPersistence 345

GetCompareFunctionName
ObjectPersistence 345

GetCWD
DiskFileSystem 136
FileSystem 206
Storage 436

GetDataConstructor
DataPersistence 109

GetDriveNames
DiskFileSystem 137

GetFile
FileDialog 199

GetMessage
LanguageData 277

GetObject
Data 100
DataRecord 113
EventManager 178
PopUpItem 363
PullDownItem 386
WindowObject 611

GetObjectConstructor
ObjectPersistence 345

GetPalette
PaletteData 350

GetUserCallback
ObjectPersistence 345

GetUserCallbackName
ObjectPersistence 345

GetUserObject
ObjectPersistence 346

GetUserObjectName
ObjectPersistence 346

Grid
Table 474

Group 221
Property Matrix E-727

grouping
LocaleStruct 291

H

HeaderBackgroundColor
Table 474

HeaderHeight
Table 474

HeaderTextColor
Table 476

HeaderType
TableHeader 483

HeaderWidth
Table 476

Height
BitmapData 45
IconData 252
MouseData 316
RegionStruct 402

height
ImageStruct 262

HelpContext
EventStruct 186
WindowObject 612

HelpObject
HelpTips 232

helpObject
WindowManager 569

HelpObjectTip
WindowObject 613

HelpStub 225

HelpSystem 226

HelpTips 230

HelpTipsType
HelpTips 233

hInstance
ZafMSWindowsApp . . 323

HorizontalScrollBar
Window 556

HotKeyChar
Button 59
Group 224
Prompt 380

hotKeyChar
LanguageStruct 280

HotKeyIndex
Button 59
Group 224
Prompt 380

hotKeyIndex
LanguageStruct 280

HotKeyText
ZafMSWindowsApp . . 323

HotSpotX
MouseData 316

hotSpotX
MouseStruct 319

HotSpotY
MouseData 316

hotSpotY
MouseStruct 319

Hour
UTimeData 537

HzJustify
Button 59
Prompt 381
String 445
Text 492

HzList 235
Property Matrix E-727

HzScrollPos
ScrolledWindow 422

HzShift
PositionStruct 370
RegionStruct 402

I

I18nAllocate
I18nData 243

I18nData 240

I18nFree
I18nData 243

I18nName
I18nData 243

Icon 245
Display 151
Property Matrix E-727

IconData 250
Icon 248

IconImage
MessageWindow 301

IconStruct 253

IconType
Icon 248

Image 255
Property Matrix E-727

ImageData 260

ImageStruct 262

ImageType
Cursor 94
Mouse 311

Import
PositionStruct 370

ImportPixel
RegionStruct 401

ImportPoint
RegionStruct 401

Increment
ProgressBar 374
ScrollData 416
String 446

Index
List 284
PopUpItem 363
PullDownItem 386
SystemButton 466

IndexMethod
Chart 71

InitialDelay
HelpTips 233
WindowObject 614

InitializeOSBitmap
Display 151

InitializeOSIcon
Display 151

InitializeOSMouse
Display 151

InitializeWrappers
ZafMSWindowsApp . .324

InputFormatData
String 446

InputType
EventStruct 186

Insert
StringData 455

InsertRecord
Table 476

Installed
Device 124

intCurrencySymbol
LocaleStruct 291

Integer 263
Property Matrix E-728

IntegerData 267
Integer 266

integerStringInputFormat
LocaleStruct 291

integerStringOutputFormat
LocaleStruct 291

internalHandle
FileInfoStruct 201

Interval
Timer 504

intFractionDigits
LocaleStruct 292

Invalid
String 447
Text 492

IsA
Element 164
WindowObject 615

IsoToUnicode
CodeSetData 80

ItemType
PopUpItem 363

IValue
BignumData 36

J

JumpProc
ZafMSWindowsApp . . 324

K

Key
EventStruct 186

Keyboard 272

KeyStruct 275

L

LanguageAllocate
LanguageData 278

LanguageData 276

LanguageFree
LanguageData 278

LanguageName
LanguageData 278

LanguageStruct 280

Last
List 284
PopUpItem 364
PullDownItem 386
SystemButton 466

LastFileSystem
DataPersistence 109

LastPage
Notebook 329

LeapYear
UTimeData 537

left
RegionStruct 402

Length
DiskFile 133
File 193
StorageFile 439
StringData 456

length
FileInfoStruct 201

Line
Display 152

line
PositionStruct 369

lines
Display 146

LineStyle
Display 152

lineStyle
PaletteStruct 353

lineTable
Display 152

LinkDraggable
WindowObject 595

LinkMain
Application 22

List 281

list
ComboBox 85

ListBlock 285

ListIndex
Element 165

Load
Path 356

LocaleAllocate
LocaleData 288

LocaleData 286

LocaleFree
LocaleData 288

LocaleName
LocaleData 288

LocaleStruct 289

Locked
Window 556

LogicalEvent
WindowObject 616

LogicalPalette
WindowObject 620

logicalValue
EventMap 181

long
BignumData 36
IntegerData 269
UTimeData 537, 538

LowerCase
String 447

M

Main
Application 23

MakeFullPath
DiskFileSystem 137

MapTable
PaletteData 350

MarksXAxis
Chart 72

MarksYAxis
Chart 72

Maximize Button
Property Matrix E-728

MaximizeButton 295

Window 556

Maximized
Window 557

Maximum
DimensionConstraint . 131
ProgressBar 374
ScrollData 416

maximum
ScrollStruct 418

MaxLength
StringData 456

MaxOffset
Table 476

mblen
CodeSetData 80

mbstowcs
CodeSetData 80

MDIChildJumpProc
ZafMSWindowsApp . . 324

MDIFrameJumpProc
ZafMSWindowsApp . . 325

MDIType
MDIWindow 306

MDIWindow 303
Property Matrix E-729

MemberUserFunction
WindowObject 624

memberUserFunction
WindowObject 624

menu
PopUpItem 365
PullDownItem 386
SystemButton 466

Merge
DataPersistence 109
ObjectPersistence 346

Message
MessageWindow 301

MessageFlags
MessageWindow 302

MessageWindow 298

MilliSecond
UTimeData 537

miniDenominatorX
CoordinateStruct 90

miniDenominatorY
CoordinateStruct 90

Minimize Button
Property Matrix E-729

MinimizeButton 307
Window 557

Minimized
Window 557

MinimizeIcon
Window 558

Minimum
DimensionConstraint . .132
ProgressBar 374
ScrollData 416

minimum
ScrollStruct 418

miniNumeratorX
CoordinateStruct 90

miniNumeratorY
CoordinateStruct 90

Minute
UTimeData 537

MkDir
DiskFileSystem 137
FileSystem 206
Storage 436

Modal
Window 558

Mode
Display 152

modeTable
Display 153

modifiers
EventMap 182
EventStruct 187

monDecimalSeparator
LocaleStruct 292

monGrouping
LocaleStruct 292

MonoBackground
Display 153

monoBackground
PaletteStruct 354

MonoForeground
Display 153

monoForeground
PaletteStruct 354

monoTable
Display 153

Month
UTimeData 537

MonthName
UTimeData 537

monThousandsSeparator
LocaleStruct 292

Motif class names
X Resources F-736

Mouse 310
Display 154

MouseData 314

mouseObject
WindowManager 569

MouseStruct 318

mouseTimerID
  ZafMSWindowsApp . . 325

Moveable
  Window 558

MoveDraggable
  WindowObject 595

MoveEvent
  WindowObject 626

N

name
  FileInfoStruct 202

native3D
  ZafMSWindowsApp . . 325

NativeMapping
  CodeSetData 80

negativeSign
  LocaleStruct 292

negCurrencyPrecedes
  LocaleStruct 292

negSignPrecedes
  LocaleStruct 292

negSpaceSeparation
  LocaleStruct 293

NewHelpTipDelay
  HelpTips 233

Next
  Device 124
  Element 166
  WindowObject 626

Noncurrent
  WindowObject 627

NormalBitmap
  TreeItem 518

NormalHotKeys
  Window 559

Notebook 327
  Property Matrix E-729

Notification 331

NotifyCount
  Notification 335
  Timer 504

NotifyFocus
  WindowObject 628

NotifyMessage
  Timer 505

NotifySelection
  WindowObject 631

NumberID
  Element 167

numberID
  FileInfoStruct 202
  LanguageStruct 280

O

Object
  Constraint 89

ObjectFromHandle
  ZafMSWindowsApp . .325

objectHighWord
  ZafMSWindowsApp . .325

objectLowWord
  ZafMSWindowsApp . .325

ObjectPersistence 339

Offset
  Attachment 26
  TableRecord 487

offset
  EraStruct 170

Open
  DiskFileSystem 137
  FileSystem 206
  Storage 437

OpenCreate
  File 193
  Storage 437

operator 195, 540, 540
  List 284

operator -
  BignumData 38
  List 284
  PopUpItem 365
  PullDownItem 387
  StringData 458
  SystemButton 466
  Timer 505
  UTimeData 538
  Window 560, 564

operator --
  BignumData 38
  IntegerData 270
  RealData 400
  RegionStruct 404
  UTimeData 539

operator !=
  BignumData 41
  PositionStruct 370
  RegionStruct 403
  ScrollStruct 419
  StringData 458
  UTimeData 540

operator %
  BignumData 39

operator %=
  BignumData 41
  IntegerData 270
  RealData 400

operator ()

Window 564

operator *
BignumData 39
PaletteData 350

operator *=
BignumData 40
IntegerData 270
RealData 400

operator +
BignumData 38
List 282
PopUpItem 361
PullDownItem 384
StringData 459
SystemButton 465
Timer 504
UTimeData 539
Window 548, 564

operator ++
BignumData 39
IntegerData 270
RealData 400
RegionStruct 403
UTimeData 539

operator +=
IntegerData 270
RealData 400
RegionStruct 404
StringData 459
UTimeData 539

operator /
BignumData 39

operator /=
BignumData 41
IntegerData 270
RealData 400

operator <
BignumData 41
StringData 459

operator <=
BignumData 42
StringData 460

operator -=
BignumData 40
IntegerData 270
RealData 400
RegionStruct 404
StringData 458
UTimeData 539

operator =
BitmapData 45
IconData 252
IntegerData 270
MouseData 317
RealData 400
ScrollData 417
StringData 460
UTimeData 539

operator ==
BignumData 41
PositionStruct 370
RegionStruct 403
ScrollStruct 419
StringData 460
UTimeData 540

operator >
BignumData 42
StringData 460
UTimeData 540

operator >=
BignumData 42
StringData 460
UTimeData 540

operator >>
File 193

operator []
StringData 461

OppositeSide
Attachment 26
RelativeConstraint 408

OSDraw
WindowObject 633

osEvent
EventStruct 187

OSI18nName
I18nData 242

OSLanguageToZafLanguage
I18nData 242

osPalette
PaletteStruct 355

OSScreenID
WindowObject 634

OutputFormatData
String 447

OutputFormatText
String 447

Overlap
RegionStruct 402

Owner
Window 559

P

Palette
Display 154

palette
PaletteMap 351

PaletteData 348

PaletteMap 351

PaletteState
WindowObject 635

PaletteStruct 352

Parent
WindowObject 636

parentDirectoryName
FileSystem 206

ParentDrawBorder
  WindowObject 637

ParentDrawFocus
  WindowObject 637

Password
  String 448

Path 356
  PathElement 357

PathElement 357

PathID
  Image 257

PathName
  Image 258

patternTable
  Display 154

Pixel
  Display 155

pixelsPerInchX
  CoordinateStruct 90

pixelsPerInchY
  CoordinateStruct 90

Poll
  Cursor 94
  Device 125
  HelpTips 234
  Keyboard 273
  Mouse 313
  Timer 505

PollDevices
  EventManager 178

Polygon
  Display 155

PopLanguage
  DataPersistence 109

PopLevel
  DataPersistence 110

PopUpItem 359
  Property Matrix E-729

PopUpMenu 366

posCurrencyPrecedes
  LocaleStruct 293

Position
  EventStruct 187
  PositionStruct 370

PositionStruct 369

positiveSign
  LocaleStruct 293

posSignPrecedes
  LocaleStruct 293

posSpaceSeparation
  LocaleStruct 293

postSpace
  Display 156

preSpace
  Display 156

Previous
  Device 124
  Element 166
  WindowObject 638

ProgressBar 371
  Property Matrix E-730

ProgressData
  ProgressBar 374

ProgressStyle
  ProgressBar 375

ProgressType
  ProgressBar 375

Prompt 377
  Property Matrix E-730

Properties E-720

Property Matrices E-720
  Bignum E-725
  Border E-725
  ComboBox E-726
  Date E-726
  Formatted String E-726
  Group E-727
  HzList E-727
  Icon E-727
  Integer E-728
  Maximize Button . . . E-728
  MDIWindow E-729
  Minimize Button E-729
  Notebook E-729
  PopUpItem E-729
  ProgressBar E-730
  Prompt E-730
  PullDownItem E-730
  Real E-731
  ScrollBar E-731
  Scrolled Window . . . E-731
  SpinControl E-732
  String E-732
  SystemButton E-732
  Table E-733
  TableHeader E-733
  TableRecord E-733
  Text E-733
  Time E-733
  Title E-734
  ToolBar E-734
  TreeItem E-734
  TreeList E-735
  UTime E-735
  VtList E-735
  Window E-723
  WindowObject E-722

PullDownItem 382
  Property Matrix E-730

PullDownMenu 388
  Window 559

PushLanguage
  DataPersistence 109

PushLevel
  DataPersistence 110

Put

EventManager 178

Q

QueueBlock 391

QueueElement 392

QueueEvents
  Timer 505

QuickTip
  WindowObject 638

R

RangeData
  String 448

RangeText
  String 448

Ratio
  RelativeConstraint 408

rawCode
  EventMap 181
  EventStruct 187

Read
  File 193

ReadData
  DiskFile 134
  File 194
  StorageFile 440

ReadFromBeginning
  EventManager 178

ReadFromEnd
  EventManager 179

ReadOnly
  File 194

  FileInfoStruct 202
  Storage 437

ReadRecord
  Table 477

ReadWrite
  File 194
  Storage 437

Real 393
  Property Matrix E-731

RealData 397
  Real 396

realStringInputFormat
  LocaleStruct 293

realStringOutputFormat
  LocaleStruct 293

RearrangeArgs
  StandardArg 428

Record
  Table 477

Rectangle
  Display 156

RectangleXORDiff
  Display 156

Redisplay
  WindowObject 640

RedisplayData
  WindowObject 640

Reference
  Attachment 27

Region
  Button 60
  EventStruct 187
  RegionStruct 403
  WindowObject 640

RegionCopy
  Display 158

RegionStruct 401

RegionType
  WindowObject 641

RelativeConstraint 405

Remove
  DiskFileSystem 137
  FileSystem 207
  Storage 437
  StringData 456

Rename
  DiskFileSystem 138
  FileSystem 207
  Storage 437

Rep 666

Rep Utility
  ZAF 4 666

Rep4to5 667

Rep4to5 Utility
  ZAF 4 667

RepeatDelay
  WindowObject 614

Repopulate
  Table 477

ReportError
  ErrorStub 172

ResetI18n
  I18nData 243

ResetOSBitmap
  Display 158

ResetOSIcon
  Display 158

ResetOSMouse
  Display 158

ResetStorage
  HelpSystem 229

RestoreDisplayContext
  Display 148

RestoreDrawContext
  Display 148

right
  RegionStruct 402

RmDir
  DiskFileSystem 138
  FileSystem 207
  Storage 438

rootDirectoryName
  FileSystem 207

RootObject
  WindowObject 644

route
  EventStruct 188

RowHeight
  Table 477

RValue
  BignumData 37

S

Save
  Storage 438

SaveAs
  Storage 438

Scaled
  Image 258

ScreenID
  EventStruct 188

screenID
  WindowObject 644

Scroll
  EventStruct 188

ScrollBar 410
  Property Matrix E-731

ScrollData 414
  ScrollBar 413

Scrolled Window
  Property Matrix E-731

ScrolledWindow 420

ScrollEvent
  WindowObject 646

ScrollHeight
  ScrolledWindow 422

ScrollStruct 418

ScrollType
  ScrollBar 413

ScrollWidth
  ScrolledWindow 422

Second
  UTimeData 538

Seek
  DiskFile 134
  File 194
  StorageFile 440

SeekNextRecord
  Table 477

SeekPreviousRecord
  Table 478

SeekRandomRecord
  Table 478

Selected
  WindowObject 647

SelectedBitmap
  TreeItem 518

SelectionType
  HzList 238
  TreeList 525
  VtList 544

  Window 559

SelectOnDoubleClick
  Button 60

SelectOnDownClick
  Button 61

SendMessage
  Button 61

SendMessageText
  Button 62

SendMessageWhenSelected
  Button 61

SetAcceptDrop
  WindowObject 575

SetAllowDefault
  Button 54

SetAllowToggling
  Button 55

SetAutoClear
  String 444
  Text 490

SetAutomaticUpdate
  Window 550
  WindowObject 578

SetAutoRepeatSelection
  Button 55

SetAutoSelect
  Group 223

SetAutoSize
  Button 56
  Image 257
  Prompt 379
  ScrollBar 413

SetAutoSortData
  ComboBox 84
  HzList 237
  TreeItem 516
  TreeList 524

VtList 543

SetAxisColor
Chart 69

SetBackground
Display 144

SetBackgroundColor
ComboBox 85
HzList 238
TreeList 526
VtList 543
WindowObject 580

SetBasisYear
UTimeData 536

SetBignum
BignumData 37

SetBignumData
Bignum 31

SetBitmap
BitmapData 45

SetBitmapData
Button 56

SetBlinkRate
Cursor 93

SetBordered
WindowObject 582

SetBottomOffset
Table 473

SetButtonType
Button 57

SetCellHeight
HzList 238

SetCellWidth
HzList 238

SetCenter
RelativeConstraint 407

SetChanged
Window 552
WindowObject 583

SetChar
StringData 454

SetChartType
Chart 69

SetClipRegion
Display 145

SetCodeSetName
CodeSetData 77

SetColumnText
Table 473

SetCompareFunction
List 282

SetCompareFunctions
ObjectPersistence 346

SetCompressedData
FormattedString 213

SetCompressedText
FormattedString 213

SetCoordinateType
Table 473
WindowObject 588

SetCopyDraggable
WindowObject 595

SetCurrent
List 283
ProgressBar 373
ScrollData 416

SetCurrentOffset
Table 473

SetCurrentPage
Notebook 329

SetCursorOffset
String 444
Text 491

SetCursorPosition
Text 491

SetDataConstructors
DataPersistence 111

SetDataGroupBackground-Color
Chart 70

SetDataGroupFillPattern
Chart 70

SetDataGroupFont
Chart 71

SetDataGroupForegroundCol-or
Chart 71

SetDataGroupLineStyle
Chart 71

SetDate
DateData 121

SetDateData
Date 117

SetDefaultButton
Window 554

SetDefaultLeadByte
CodeSetData 80

SetDefaultMessageFlag
MessageWindow 301

SetDeleteData
FormattedString 214

SetDeleteText
FormattedString 214

SetDelta
ProgressBar 373
ScrollData 416
SpinControl 426

SetDepressed
Button 58

SetDepth
  Button 58

SetDestroyable
  Data 98
  Window 554

SetDevice
  EventStruct 185

SetDeviceImage
  EventManager 179

SetDevicePosition
  EventManager 179

SetDeviceState
  Device 123
  EventManager 179

SetDirectory
  FileDialog 198

SetDisabled
  WindowObject 592

SetDisplay
  EventStruct 186

SetDisplayContext
  Display 148

SetDockType
  ToolBar 511

SetDrawContext
  Display 148

SetDrawLines
  TreeList 525

SetDrive
  DiskFileSystem 138

SetEditMode
  WindowObject 600

SetError
  Data 98
  DataPersistence 108
  File 192
  FileSystem 204
  WindowObject 600

SetEventManager
  EventStruct 186

SetExitFunction
  WindowManager 568

SetExpandable
  TreeItem 517

SetExpanded
  TreeItem 517

SetExpandedData
  FormattedString 214

SetExpandedText
  FormattedString 215

SetFile
  FileDialog 199

SetFillPattern
  Display 150

SetFilter
  FileDialog 199

SetFocus
  WindowObject 608

SetFocusOffset
  Table 474

SetFont
  ComboBox 85
  Display 150
  HzList 239
  VtList 544
  WindowObject 610

SetForeground
  Display 151

SetFormatData
  FormattedString 215

SetFormatText
  FormattedString 215

SetGrid
  Table 474

SetHeaderBackgroundColor
  Table 474

SetHeaderHeight
  Table 474

SetHeaderTextColor
  Table 476

SetHeaderType
  TableHeader 483

SetHeaderWidth
  Table 476

SetHelpContext
  EventStruct 186
  WindowObject 612

SetHelpObject
  HelpTips 232

SetHelpObjectTip
  WindowObject 613

SetHelpTipsType
  HelpTips 233

SetHotKey
  Button 59
  Group 224
  Prompt 380

SetHotSpot
  MouseData 316

SetHzJustify
  Button 59
  Prompt 381
  String 445
  Text 492

SetHzScrollPos
  ScrolledWindow 422

SetI18nName
  I18nData 243

SetIcon
IconData 252

SetIconData
Icon 248

SetIconImage
Icon 248
MessageWindow 301

SetIconType
Icon 248

SetImageType
Cursor 94
Mouse 311

SetIndexMethod
Chart 72

SetInitialDelay
HelpTips 233
WindowObject 614

SetInputFormat
String 446

SetInputFormatData
String 446

SetInteger
IntegerData 269

SetIntegerData
Integer 266

SetInterval
Timer 504

SetInvalid
String 447
Text 492

SetItemType
PopUpItem 363

SetKey
EventStruct 186

SetLanguage
LanguageData 278

SetLanguageName
LanguageData 278

SetLineStyle
Display 152

SetLinkDraggable
WindowObject 595

SetLocale
LocaleData 287

SetLocaleName
LocaleData 288

SetLocked
Window 556

SetLowerCase
String 447

SetMapTable
PaletteData 350

SetMarksXAxis
Chart 72

SetMarksYAxis
Chart 72

SetMaximized
Window 557

SetMaximum
DimensionConstraint . . 131
ProgressBar 374
ScrollData 416

SetMaxLength
StringData 456

SetMaxOffset
Table 476

SetMessage
LanguageData 279
MessageWindow 301

SetMessageFlags
MessageWindow 302

SetMinimized
Window 557

SetMinimum
DimensionConstraint . . 132
ProgressBar 374
ScrollData 416

SetModal
Window 558

SetMode
Display 152

SetMonoBackground
Display 153

SetMonoForeground
Display 153

SetMouse
MouseData 316

SetMoveable
Window 558

SetMoveDraggable
WindowObject 595

SetNativeMapping
CodeSetData 80

SetNewHelpTipDelay
HelpTips 233

SetNoncurrent
WindowObject 627

SetNormalBitmap
TreeItem 518

SetNormalHotKeys
Window 559

SetNotifyMessage
Timer 505

SetNumberID
Element 167

SetObjectConstructors
ObjectPersistence 346

SetOffset
Attachment 26
TableRecord 487

SetOppositeSide
Attachment 26
RelativeConstraint 408

SetOSDraw
WindowObject 633

SetOSText
StringData 457

SetOSWText
StringData 457

SetOutputFormat
String 447

SetOutputFormatData
String 447

SetOwner
Window 559

SetPalette
Display 154

SetParent
WindowObject 636

SetParentDrawBorder
WindowObject 637

SetParentDrawFocus
WindowObject 637

SetParentPalette
WindowObject 637

SetPassword
String 448

SetPath
PathElement 357

SetPathID
Image 257

SetPathName
Image 258

SetPosition
EventStruct 187

SetProgressData
ProgressBar 374

SetProgressStyle
ProgressBar 375

SetProgressType
ProgressBar 375

SetQueueEvents
Timer 505

SetQuickTip
WindowObject 638

SetRange
String 448

SetRangeData
String 448

SetRatio
RelativeConstraint 408

SetReadFunction
Table 476

SetReal
RealData 399

SetRealData
Real 396

SetReference
Attachment 27

SetReferenceNumberID
Attachment 27

SetRegion
Button 60
EventStruct 187
WindowObject 640

SetRegionType
WindowObject 641

SetRepeatDelay
WindowObject 614

SetRowHeight
Table 477

SetScaled
Image 258

SetScreenID
EventStruct 188

SetScroll
EventStruct 188
ScrollData 417

SetScrollData
ScrollBar 413

SetScrollHeight
ScrolledWindow 422

SetScrollType
ScrollBar 413

SetScrollWidth
ScrolledWindow 422

SetSelected
String 449
WindowObject 647

SetSelectedBitmap
TreeItem 518

SetSelectionType
HzList 238
TreeItem 518
TreeList 525
VtList 544
Window 559

SetSelectOnDoubleClick
Button 60

SetSelectOnDownClick
Button 61

SetSendMessageText
Button 62

SetSendMessageWhenSelect-
ed
Button 61

SetShowing
 ScrollData 417

SetSizeable
 Window 560

SetSprintf
 StandardArg 429

SetSscanf
 StandardArg 429

SetStaticArray
 ImageStruct 262

SetStaticData
 LanguageData 279
 PaletteData 350
 StringData 457

SetStaticHandle
 BitmapStruct 47
 IconStruct 254
 MouseStruct 320

SetStep
 ProgressBar 375
 ScrollData 417

SetStretch
 Attachment 27
 RelativeConstraint 408

SetStringData
 Button 63
 Group 224
 Prompt 381
 String 449
 Text 492
 TreeItem 519

SetStringID
 Element 168

SetSystemButtonType
 SystemButton 466

SetTabHeight
 Notebook 330

SetTabHotKey
 Notebook 330

SetTabText
 Notebook 330

SetTabWidth
 Notebook 330

SetTemporary
 Window 563

SetText
 Button 63
 String 450
 StringData 457
 Text 493
 TreeItem 519
 Window 563
 WindowObject 648

SetTextColor
 ComboBox 85
 HzList 239
 TreeList 526
 VtList 544
 WindowObject 649

SetTextStyle
 ProgressBar 376

SetTextTitle
 Chart 72

SetTextXAxis
 Chart 72

SetTextYAxis
 Chart 73

SetTiled
 Image 258

SetTime
 TimeData 501

SetTimeData
 Time 498

SetTopOffset
 Table 478

SetTransparentBackground
 Prompt 381

SetType
 Attachment 27
 DimensionConstraint . . 132
 RelativeConstraint 408

SetUnanswered
 String 450
 Text 493

SetUpdate
 Notification 335

SetUpperCase
 String 450

SetUserCallbacks
 ObjectPersistence 346

SetUserFunction
 WindowObject 651

SetUserObjects
 ObjectPersistence 347

SetUserPalette
 HelpTips 234

SetUserPaletteData
 WindowObject 654

SetUTime
 UTimeData 538

SetUTimeData
 UTime 532

SetValue
 Button 63

SetVariableName
 String 451

SetVersion
 Storage 438

SetViewCurrent
 TreeList 526

SetViewOnly

ComboBox 85
String 451
Text 493

SetVirtualField
TableHeader 484

SetVirtualRecord
Table 478

SetVisible
WindowObject 659

SetVoidData
EventStruct 188

SetVtJustify
Button 59
Prompt 381

SetVtScrollPos
ScrolledWindow 422

SetWallpaper
Image 258

SetWidth
Border 50

SetWindow
EventStruct 189

SetWindowManager
EventStruct 189

SetWindowObject
EventStruct 189

SetWordWrap
Text 494

SetWrapChildren
ToolBar 511

SetWrappedData
SpinControl 427

SetWriteFunction
Table 479

SetZoneOffset
UTimeData 538

ShiftPressed
Keyboard 274

shiftState
KeyStruct 275

Showing
ScrollData 417

showing
ScrollStruct 418

Sizeable
Window 560

skipGregorian
LocaleStruct 293

Sort
List 284
PopUpItem 365
PullDownItem 387
SystemButton 466

SpinControl 424
Property Matrix E-732

StandardArg 428

startDate
EraStruct 171

state
PaletteMap 351

StaticArray
ImageStruct 262

StaticData
LanguageData 279
PaletteData 350
StringData 457

StaticHandle
BitmapStruct 47
IconStruct 254
MouseStruct 320

StatusBar 431

Step
ProgressBar 375
ScrollData 417

Storage 434

StorageFile 439

Stretch
Attachment 27
RelativeConstraint 408

String 441
Property Matrix E-732

StringData 452
Button 63
Group 224
Prompt 381
String 449
Text 492
TreeItem 519

StringID
Element 168

stringID
FileInfoStruct 202
LanguageStruct 280

StripFullPath
DiskFileSystem 138

Subtract
List 284
PopUpItem 365
PullDownItem 387
SystemButton 466
Timer 505
Window 560

SubtractCompareFunction
ObjectPersistence 347

SubtractDataConstructor
DataPersistence 111

SubtractFileSystem
DataPersistence 111

SubtractNotification
Notification 333

SubtractObjectConstructor
  ObjectPersistence 347

SubtractStaticModule
  I18nData 241

SubtractUserCallback
  ObjectPersistence 347

SubtractUserObject
  ObjectPersistence 347

support
  Window 561

SupportCurrent
  Window 561

SupportDestroy
  Window 561

SupportFirst
  Window 561

SupportLast
  Window 561

SystemButton 462
  Property Matrix E-732
  Window 562

SystemButtonMenu
  Window 562

SystemButtonType
  SystemButton 466

T

TabHeight
  Notebook 330

TabHotKeyChar
  Notebook 330

TabHotKeyIndex
  Notebook 330

Table 468
  Property Matrix E-733
  TableHeader 484
  TableRecord 487

TableHeader 480
  Property Matrix E-733

TableRecord 485
  Property Matrix E-733

TabText
  Notebook 330

TabWidth
  Notebook 330

Tell
  DiskFile 134
  File 195
  StorageFile 440
  Table 473

TempName
  DiskFileSystem 138

Temporary
  File 195
  Window 563

Text 488
  Button 63
  Display 158
  Property Matrix E-733
  String 450
  StringData 457
  Text 493
  TreeItem 519
  Window 563
  WindowObject 648

text
  EventStruct 188
  LanguageStruct 280

TextColor
  WindowObject 649

TextMode
  File 195

TextSize
  Display 159

TextStyle
  ProgressBar 376

TextTitle
  Chart 72

TextXAxis
  Chart 72

TextYAxis
  Chart 73

thousandsSeparator
  LocaleStruct 294

Tiled
  Image 258

Time 495
  Property Matrix E-733

time12StringOutputFormat
  LocaleStruct 294

TimeData 499
  Time 498

TimeName
  UTimeData 538

Timer 502

timeSeparator
  LocaleStruct 294

TimeStamp
  LocaleData 288

timeStringInputFormat
  LocaleStruct 294

timeStringOutputFormat
  LocaleStruct 294

Title 506
  Property Matrix E-734
  Window 563

ToggleExpanded
  TreeItem 517

ToggleSelected
  WindowObject 647

ToolBar 509
  Property Matrix E-734

top
  RegionStruct 402

topLevelShellClassRec
  X Resources F-736

TopOffset
  Table 478

Touching
  RegionStruct 403

TransparentBackground
  Prompt 381

TreeItem 513
  Property Matrix E-734

TreeList 521
  Property Matrix E-735
  TreeItem 519

Type
  Attachment 27
  DimensionConstraint . 132
  RelativeConstraint 408

type
  EventStruct 188
  PaletteMap 351

U

Unanswered
  String 450
  Text 493

UnicodeToIso
  CodeSetData 81

Update
  Notification 335

UpdateData
  Notification 337

UpdateObjects
  Notification 337

UpperCase
  String 450

userFlags
  WindowObject 651

UserFunction
  WindowObject 651

userFunction
  WindowObject 651

UserInformation
  WindowObject 653

userObject
  WindowObject 653

UserPaletteData
  WindowObject 654

userPaletteData
  WindowObject 654

userStatus
  WindowObject 659

UTime 528
  Property Matrix E-735

UTimeData 533
  UTime 532

V

Validate
  String 451

ValidName
  DiskFileSystem 139

Value
  Button 63
  IntegerData 269
  RealData 399
  UTimeData 538

value
  KeyStruct 275

VariableName
  String 451

Version
  Storage 438

VerticalScrollBar
  Window 564

ViewCount
  TreeList 526

ViewCurrent
  TreeItem 519
  TreeList 526

ViewFirst
  TreeItem 519
  TreeList 527

ViewLast
  TreeItem 520
  TreeList 527

ViewLevel
  TreeItem 520

ViewNext
  TreeItem 520

ViewOnly
  ComboBox 85
  String 451
  Text 493

ViewPrevious
  TreeItem 520

VirtualField
  TableHeader 484

VirtualRecord
  Table 478

Visible

WindowObject 659

VoidData
EventStruct 188

vsprintf
StandardArg 429

vsscanf
StandardArg 430

VtJustify
Button 59
Prompt 381

VtList 541
Property Matrix E-735

VtScrollPos
ScrolledWindow 422

VtShift
PositionStruct 370
RegionStruct 403

W

Wallpaper
Image 258

wcstombs
CodeSetData 81

Width
BitmapData 45
Border 50
IconData 252
MouseData 317
RegionStruct 403

width
ImageStruct 262

Window 545
EventStruct 189
Property Matrix E-723

WindowManager 565
EventStruct 189

windowManager
WindowObject 661

WindowObject 570
EventStruct 189
Property Matrix E-722

windowsPlatform
ZafMSWindowsApp . .326

windowsVersion
ZafMSWindowsApp . .326

WordWrap
Text 494

WrapChildren
ToolBar 511

WrappedData
SpinControl 427

Write
File 195
WindowObject 661

WriteData
DiskFile 134
File 196
StorageFile 440

WriteRecord
Table 479

X

X Resources F-736

xmBulletinBoardClassRec
X Resources F-736

xmCascadeButtonClassRec
X Resources F-737

xmFileSelectionBoxWidget
X Resources F-736

xmLabelClassRec
X Resources F-737

xmPrimitiveClassRec
X Resources F-736

xmPushButtonClassRec
X Resources F-736

xmRowColumnClassRec
X Resources F-737

xmRowColumnWidgetClass-Rec
X Resources F-737

xmScaleClassRec
X Resources F-737

xmScrollBarClassRec
X Resources F-737

xmTextFieldClassRec
X Resources F-736

Y

Year
UTimeData 538

Z

ZAF 5 to 4 Class Comparisons D-716
ZAF 4 . . . . D-716

ZafIChar
StringData 458

ZafLanguageStruct
LanguageData 279

ZafLanguageToZafLocale
I18nData 242

ZafLocaleToZafLanguage
  I18nData 242

ZafMSWindowsApp 321

zafRegion
  WindowObject 640

ZMake 682

ZoneOffset
  UTimeData 538