Fieldbus

NI-FBUS™ Communications Manager Function Reference Manual

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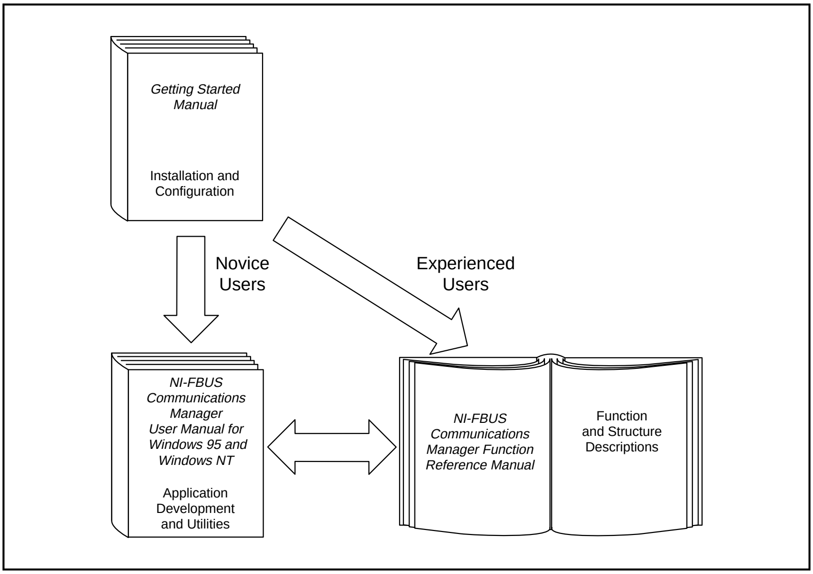
About This Manual

This manual describes the functions of the NI-FBUS Communications Manager software. The NI-FBUS Communications Manager software for Windows 95 is meant to be used with the Microsoft Windows 95 operating system. The NI-FBUS Communications Manager software for Windows NT is meant to be used with the Microsoft Windows NT (version 3.5.1 and later) operating system. This manual assumes that you are already familiar with the appropriate Microsoft operating system.

How to Use the Manual Set


Getting Started Manual
Installation and Configuration
Novice Users
Experienced Users
NI-FBUS Communications Manager User Manual for Windows 95 and Windows NT
Application Development and Utilities
NI-FBUS Communications Manager Function Reference Manual
Function and Structure Descriptions

Use this function reference manual to look up specific information about NI-FBUS functions, such as input and output parameters, syntax, and error messages.

Use the getting started manual to install and configure your fieldbus interface and the NI-FBUS Communications Manager software.

Use the *NI-FBUS Communications Manager User Manual for Windows 95 and Windows NT* to learn how to use the NI-FBUS Communications Manager interface for your application.

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Administrative Functions*, includes a list of available NI-FBUS administrative functions, and describes the purpose, format, input and output arguments, context, description, and return values for each function.
- Chapter 2, *Core Fieldbus Functions*, lists and describes the core NI-FBUS functions.
- Chapter 3, *Alert and Trend Functions*, lists and describes the NI-FBUS alert and trend functions.
- The Appendix, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.
- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.
- The *Index* contains an alphabetical list of key terms and topics in this manual, including the page where you can find each one.

Conventions Used in This Manual

This manual uses the following conventions:

bold italic Bold italic text denotes a note, caution, or warning.

`bold monospace` Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are unique.

italic Italic text denotes emphasis, a cross reference, or an introduction to a key concept. This font also denotes text for which you supply the appropriate word or value.

`italic monospace` Italic text in this font denotes that you must supply the appropriate words or values in the place of these items.

`monospace` Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and for statements and comments taken from programs.

Related Documentation

The following documents contain information that you might find helpful as you read this manual:

- *Function Block Application Process, Part 1*
- *Function Block Application Process, Part 2*
- *Device Description Services Specification, Fieldbus Foundation*
- *Fieldbus Message Specification, Fieldbus Foundation*

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in the Appendix, *Customer Communication*, at the end of this manual.

Chapter 1

Administrative Functions

This chapter includes a list of available NI-FBUS administrative functions, and describes the purpose, format, input and output arguments, context, description, and return values for each function.

For details on how NI-FBUS functions are classified and how to use them, refer to the *NI-FBUS Communications Manager User Manual for Windows 95 and Windows NT*.

Format of the Function Information

Function Names

The functions are in alphabetical order.

Purpose

The *Purpose* sections are brief statements of the purpose of each function.

Format

The *Format* sections show the format for calling each function.

Input

The *Input* sections show the input parameters for each function.

Output

The *Output* sections show the output parameters for each function.

Context

The *Context* sections tell you if you can use a function on a link, device, VFD, session, or physical device.

Description

The *Description* sections describe the purpose and workings of each function.

Return Values

The *Return Values* sections list all the return values for each function and explain what each one means.

Table 1-1. List of Administrative Functions

Function	Purpose
`nifClose`	Close an open descriptor
`nifGetBlockList`	Return a list of information for all blocks of the specified type present in the VFD
`nifGetDeviceList`	Return the list of information for all active devices on the network
`nifGetInterfaceList`	Read the list of interface names from the NI-FBUS Communications Manager configuration
`nifGetVFDList`	Gather VFD information on a specified physical device
`nifOpenBlock`	Return a descriptor representing a block
`nifOpenLink`	Return a descriptor representing a fieldbus link
`nifOpenPhysicalDevice`	Return a descriptor representing a physical device
`nifOpenSession`	Return a descriptor for an NI-FBUS session
`nifOpenVfd`	Return a descriptor representing a Virtual Field Device (VFD)

nifClose

Purpose

Close an open descriptor.

Format

```
nifError_t nifClose(nifDesc_t ud)
```

Input

`ud`	The descriptor from an `nifOpen` call.

Output

Not applicable.

Context

Block, VFD, physical device, link, session.

Description

`nifClose` closes the specified descriptor. The descriptor is invalid after it is closed. Be sure your application closes all the descriptors it opens. Your application should always close a descriptor if it no longer needs the descriptor.

If you close a descriptor with calls pending on it, the calls complete within the usual time with an error code indicating that you closed the descriptor prematurely. If you make more synchronous wait calls that wait on the closing descriptor, such as `nifWaitTrend`, `nifWaitAlert`, and `nifGetDeviceList`, the NI-FBUS Communications Manager aborts these functions and returns an error code indicating that you closed the descriptor. Because calls that wait on a closed descriptor return an error message, you should have a separate descriptor just for these synchronous wait calls.

☞ **Note:** ***A** session **is a connection between your application and an NI-FBUS entity. If you close a session, you close the communication channel between your application and the NI-FBUS entity associated with the session. Make sure you close all descriptors opened under this session before closing a session descriptor.***

nifClose

Continued

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The descriptor is invalid.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifGetBlockList

Purpose

Returns a list of information for all blocks of the specified type present in the VFD.

Format

```
nifError_t nifGetBlockList(nifDesc_t ud, uint8 whichTypes,
             nifBlockInfo_t *info, uint16 *numBlocks)
```

Input

`ud`	The descriptor of a VFD.
`whichTypes`	Specifies what types of blocks to return (function, transducer, or physical).
`numBlocks`	The number of buffers allocated in the `info` list.

Output

`info`	The list of information associated with each block.
`numBlocks`	The number of blocks actually in the VFD.

Context

VFD.

Description

`nifGetBlockList` returns information about all the blocks in the specified VFD. A *block* can be a resource block, transducer block, or function block residing within a VFD. Only blocks of the types specified by `whichTypes` are returned.

nifGetBlockList

Continued

nifBlockInfo_t is defined as follows:

```
typedef struct {
   char      fbTag[TAG_SIZE + 1];
   uint16    startIndex;
   uint32    ddName;
   uint32    ddItem;
   uint16    ddRev;
   uint16    profile;
   uint16    profileRev;
   uint32    executionTime;
   uint32    periodExecution;
   uint16    numParams;
   uint16    nextFb;
   uint16    startViewIndex;
   uint8     numView3;
   uint8     numView4;
   uint16    ordNum;
   uint8     blockType;
} nifBlockInfo_t;
```

The blockType field in nifBlockInfo_t can be FUNCTION_BLOCK, TRANSDUCER_BLOCK, or RESOURCE_BLOCK.

The whichTypes parameter must be a bit combination of FUNCTION_BLOCK, TRANSDUCER_BLOCK, and RESOURCE_BLOCK.

Return Values

E_OK
The call was successful.

E_INVALID_DESCRIPTOR
The descriptor was invalid or of the wrong type.

E_COMM_ERROR
The NI-FBUS Communications Manager failed to communicate with the device.

E_BUF_TOO_SMALL
The buffer does not contain enough entries to hold all the information for the blocks. If you receive this error, buffer entries that you allocated do not contain valid block information when the call returns.

nifGetBlockList

Continued

E_OBSOLETE_DESC
The input descriptor is no longer valid. It was closed before `nifGetBlockList` completed.

E_BAD_ARGUMENT
The `whichtypes` value is something other than `FUNCTION_BLOCK`, `TRANSDUCER_BLOCK`, or `RESOURCE_BLOCK`.

E_RESOURCES
A system resource problem occurred. The resource problem is usually a memory shortage.

E_BAD_DEVICE_DATA
The device returned some inconsistent information.

E_SERVER_CONNECTION_LOST
The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifGetDeviceList

Purpose

Return the list of information for all active devices on the network.

Format

```
nifError_t nifGetDeviceList(nifDesc_t link,
             nifDeviceInfo_t *devInfo, uint16 *numDevices,
             uint16 *revision)
```

Input

`link`	The link descriptor to return information for.
`numDevices`	The number of allocated list entries.
`revision`	The revision number from the last `nifGetDeviceList` call, or zero (see the *Description* for usage).

Output

`devInfo`	The list of device information.
`numDevices`	The number of devices present in the link.
`revision`	Current revision number of the live list that the NI-FBUS Communications Manager reads from the fieldbus interface to the specified link.

Context

Link.

Description

`nifGetDeviceList` returns a list of information describing each device on the link. A *link* is a group of fieldbus devices connected across a single wire pair with no intervening bridges. Before `nifGetDeviceList` returns the list of information, `nifGetDeviceList` waits until the revision argument passed in differs from the live list revision number the fieldbus interface keeps to the specified link. The revision numbers the fieldbus interface keeps start at one, so if you pass in a zero for `revision`, you can force `nifGetDeviceList` to immediately return the current device list. To use `nifGetDeviceList` most effectively, in subsequent calls to it, you should pass in the `revision` parameter output from the previous call to `nifGetDeviceList`. Using the

nifGetDeviceList

Continued

revision parameter output from the previous call forces `nifGetDeviceList` to wait until the device list has actually changed before returning the list of information.

If a device on the bus is unresponsive, its entry in the device information list has the tag and device ID `unknown device`, but its address field is correct. Also, the flag bit NIF_DEV_NO_RESPONSE is set.

The device list includes devices in the fixed, temporary, and visitor address ranges.

If there are too few input buffers, `nifGetDeviceList` returns an error code, but the `numDevices` parameter is set to the total number of devices available. In this case, the buffers you pass in do *not* contain valid data, but the revision number is set to the correct value. If a device is an interface device, then the flag bit NIF_DEV_INTERFACE is set. You can abort a pending `nifGetDeviceList` call by closing the link descriptor on which the call was made.

`nifDeviceInfo_t` is defined as follows:

```
typedef struct {
   char deviceID[DEV_ID_SIZE + 1];
   char pdTag[TAG_SIZE + 1];
   uint8 nodeAddress;
   uint32 flags;
} nifDeviceInfo_t;
```

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The link descriptor is invalid.
E_BUF_TOO_SMALL	There are not enough buffers allocated. If you receive this error, your input buffers do not contain valid data.
E_COMM_ERROR	The NI-FBUS Communications Manager failed to communicate with the device.

nifGetDeviceList

Continued

E_OBSOLETE_DESC — The input descriptor is no longer valid. It was closed before `nifGetDeviceList` completed.

E_SERVER_CONNECTION_LOST — The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifGetInterfaceList

Purpose

Read the list of interface names from the NI-FBUS Communications Manager configuration.

Format

```
nifError_t nifGetInterfaceList(nifDesc_t ud,
             int16 *numIntf, nifInterfaceInfo_t *info)
```

Input

`ud`	A valid session descriptor.
`numIntf`	The number of buffers for interface information reserved in `info.`

Output

`numIntf`	The actual number of names returned.
`info`	An array of structures containing the interface name and device ID for each interface.

Context

Not applicable.

Description

`nifGetInterfaceList` returns the interface name and device ID of each fieldbus interface in the NI-FBUS Communications Manager configuration. The `numIntf` parameter is an IN/OUT parameter. On input, it must contain the number of buffers that `info` allocates and points to, and on output it contains the total number of interface information entries available. If not enough buffers were allocated, or if the `info` buffer is NULL, the NI-FBUS Communications Manager returns an error and does not copy any data to the buffers. In this case, the `numIntf` parameter is still valid.

The `nifInterfaceInfo_t` structure is defined as follows:

```
typedef struct nifInterfaceInfo_t{
   char      interfaceName[NIF_NAME_LEN];
   char      deviceID[DEV_ID_SIZE +1];
} nifInterfaceInfo_t;
```

nifGetInterfaceList

Continued

☞ **Note:** `nifGetInterfaceList` ***is an internal function for the NI-FBUS Communications Manager and does not cause fieldbus activity.***

Return Values

E_OK	The call was successful.
E_BUF_TOO_SMALL	The buffer does not contain enough entries to hold all the interface information.
E_CONFIG_ERROR	Some configuration information, such as registry information or network configuration information, is incorrect.

nifGetVFDList

Purpose

Gather VFD information on a specified physical device.

Format

```
nifError_t nifGetVFDList(nifDesc_t ud, nifVFDInfo_t *info,
             uint16 *numBuffers)
```

Input

`ud`	The descriptor of the physical device to get the VFD list for.
`numBuffers`	The number of buffers allocated in the `info` list.

Output

`numBuffers`	The number of VFDs actually in the device.
`info`	The VFD information.

Context

Physical device.

Description

`nifGetVFDList` gathers function block application VFD information from the specified physical device. A *physical device* is a fieldbus entity residing at a single address on a link.

If there are too few input buffers, or if the input buffer pointer is NULL, an error code is returned, but the `numBuffers` parameter is set to the total number of VFDs in the device. In this case, no buffers contain valid data on output.

nifGetVFDList

Continued

The `info` parameter has the following format:

```
typedef struct {
   char      vfdTag[TAG_SIZE + 1];
   char      vendor[TAG_SIZE +1];
   char      model[TAG_SIZE +1];
   char      revision[TAG_SIZE +1];
   int16     ODVersion;
   uint16    numTransducerBlocks;
   uint16    numFunctionBlocks;
   uint16    numActionObjects;
   uint16    numLinkObjects;
   uint16    numAlertObjects;
   uint16    numTrendObjects;
   uint16    numDomainObjects;
   uint16    totalObjects;
   uint32    flags;
} nifVFDInfo_t;
```

Return Values

E_OK — The call was successful.

E_COMM_ERROR — The NI-FBUS Communications Manager failed to communicate with the device.

E_INVALID_DESCRIPTOR — The input descriptor does not correspond to a physical device.

E_BUF_TOO_SMALL — There were not enough allocated buffers. Your specified input buffers do *not* contain valid data.

E_SM_NOT_OPERATIONAL — The device is present, but cannot respond because it is at a default address.

E_OBSOLETE_DESC — The input descriptor is no longer valid. It was closed before `nifGetVFDList` completed.

nifGetVFDList

Continued

E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.
E_BAD_DEVICE_DATA	The device returned some inconsistent information.

nifOpenBlock

Purpose

Return a descriptor representing a block.

Format

```
nifError_t nifOpenBlock (nifDesc_t ud, char *blockTag,
             nifDesc_t *out_ud)

nifError_t nifOpenBlock (nifDesc_t ud, NIFB_ORDINAL(n),
             nifDesc_t *out_ud)
```

Input

`ud`	A valid session, link, physical device, or VFD descriptor.
`blockTag`	The tag of the block. To access a block by ordinal number within a VFD, use the `NIFB_ORDINAL` macro in the `nifbus.h` header file. You can only access a block by ordinal number for VFD descriptors.

Output

`out_ud`	A descriptor for the block you request.

Context

VFD, physical device, link, session.

Description

`nifOpenBlock` returns a descriptor for the block you specify. You must pass a valid session, link, physical device, or VFD descriptor to this function.

There are two ways to specify the block: by tag, and by ordinal number. To open the block by its tag, you must set `blockTag` to the current tag of the block. The NI-FBUS Communications Manager returns an error if it finds more than one block with the same tag. You can obtain the list of block tags within a specified VFD with a call to `nifGetBlockList`.

nifOpenBlock

Continued

To open the block by its ordinal number, use the `NIFB_ORDINAL` macro. This macro is only valid if `ud` is a VFD descriptor. The first block in a VFD has the ordinal number zero. Notice that the first block in a VFD is always the resource block.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The input descriptor is invalid.
E_MULTIPLE	There are identical block tags.
E_ORDINAL_NUM_OUT_OF _RANGE	The ordinal number is out of the device's range.
E_COMM_ERROR	An error occurred when the NI-FBUS Communications Manager communicated with the device.
E_NOT_FOUND	There is no such block in the device or VFD with the specified tag.
E_OBSOLETE_DESC	The input descriptor is no longer valid. It was closed before `nifOpenBlock` completed.
E_RESOURCES	A system resource problem occurred. The resource problem is usually a memory shortage.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.
E_BAD_DEVICE_DATA	The device returned some inconsistent information.

nifOpenLink

Purpose

Return a descriptor representing a fieldbus link.

Format

```
nifError_t nifOpenLink (nifDesc_t session, uint8 interfaceOrDevID,
             char *name, uint16 linkID, nifDesc_t *out_ud)
```

Input

`session`	A valid session descriptor on which to open the link.
`interfaceOrDevID`	How to specify the link: zero if by interface name, one if by local device ID.
`name`	The interface name or local device ID.
`linkID`	The link ID.

Output

`out_ud`	A descriptor for the link you request.

Context

Session.

Description

`nifOpenLink` returns a descriptor for the link you specify. You must pass a valid session descriptor to this function.

There are two ways you can specify the link. If the `interfaceOrDevID` parameter is zero, then `name` specifies the name of the interface the link is connected to. The list of valid interface names is contained in a configuration source which the NI-FBUS Communications Manager has access to, and can be obtained by a call to `nifGetInterfaceList`. If `interfaceOrDevID` is one, then the `name` specifies the device ID of an interface device to which the NI-FBUS Communications Manager is attached.

In both cases, `linkID` is the fieldbus link ID number for the specified link. For single-segment fieldbus networks, you can set `linkID` to zero.

nifOpenLink

Continued

Return Values

E_OK The call was successful.

E_INVALID_DESCRIPTOR The input descriptor is invalid.

E_CONFIG_ERROR Some configuration information, such as registry information or network configuration information, is incorrect.

E_NOT_FOUND The interface name, device ID or link ID you specified is not found.

E_RESOURCES A system resource problem occurred. The resource problem is usually a memory shortage.

E_BAD_ARGUMENT The `interfaceOrDevID` value is not valid.

E_OBSOLETE_DESC The input descriptor is no longer valid. It was closed before `nifOpenLink` completed.

E_SERVER_CONNECTION_LOST The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifOpenPhysicalDevice

Purpose

Return a descriptor representing a physical device.

Format

```
nifError_t nifOpenPhysicalDevice (nifDesc_t ud, uint8 tagOrDevID,
             char *name, nifDesc_t *out_ud)
```

Input

`ud`	A valid session or link descriptor on which to open the device.
`tagOrDevID`	How to specify the device: zero if by physical device tag, one if by device ID.
`name`	The tag or device ID.

Output

`out_ud`	A descriptor for the device you request

Context

Link, session.

Description

`nifOpenPhysicalDevice` returns a descriptor for the physical device you specify. You must pass a valid session or link descriptor to this function. If you pass a link descriptor, the NI-FBUS Communications Manager searches only that link for the specified device.

There are two ways you can specify the device. If the `tagOrDevID` parameter is zero, then the `name` specifies the tag of the physical device. If `tagOrDevID` is one, then `name` is the device ID of the device you specify. You can obtain the list of physical device tags and device IDs of devices on the network with a call to `nifGetDeviceList`.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The input descriptor is invalid.

nifOpenPhysicalDevice

Continued

E_BAD_ARGUMENT
The `tagOrDevID` value is not valid.

E_NOT_FOUND
No attached physical device has the specified device ID or physical device tag.

E_MULTIPLE
There is more than one device with the same tag or device ID on the same fieldbus network.

E_COMM_ERROR
An error occurred when the NI-FBUS Communications Manager communicated with the device.

E_RESOURCES
A system resource problem occurred. The resource problem is usually a memory shortage.

E_OBSOLETE_DESC
The input descriptor is no longer valid. It was closed before `nifOpenPhysicalDevice` completed.

E_SERVER_CONNECTION_LOST
The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifOpenSession

Purpose

Return a descriptor for an NI-FBUS Communications Manager session.

Format

```
nifError_t nifOpenSession (void *reserved, nifDesc_t *out_ud)
```

Input

`reserved`	Reserved for future use; you must set this value to NULL.

Output

`out_ud`	A descriptor for the NI-FBUS Communications Manager communications entity you request.

Context

Not applicable.

Description

`nifOpenSession` returns a descriptor for the NI-FBUS Communications Manager session. When you open a session, the NI-FBUS Communications Manager establishes a communication channel between your application and the NI-FBUS entity. All subsequent descriptors you open are associated with this session, and all the NI-FBUS calls on these descriptors communicate with the NI-FBUS entity through the communication channel established during the `nifOpenSession` call.

The `reserved` argument is reserved for future use; you must set `reserved` to NULL.

Return Values

E_OK	The call was successful.
E_SERVER_NOT_RESPONDING	Either the NI-FBUS Communications Manager server has not been started, or the server, in its current state, cannot respond to the request.

nifOpenSession

Continued

E_RESOURCES	A system resource problem occurred. The resource problem is usually a memory shortage, or a failure of file access functions.

nifOpenVfd

Purpose

Return a descriptor representing a Virtual Field Device (VFD).

Format

```
nifError_t nifOpenVfd (nifDesc_t ud, char *vfdTag,
             nifDesc_t *out_ud)

nifError_t nifOpenVfd (nifDesc_t ud, NIFB_ORDINAL(n),
             nifDesc_t *out_ud)
```

Input

ud A valid physical device descriptor.

vfdTag The tag of the VFD. To access by ordinal number within a physical device, use the ORDINAL macro in the nifbus.h header file.

Output

out_ud A descriptor for the VFD you request

Context

Physical device.

Description

nifOpenVfd returns a descriptor for the Virtual Field Device (VFD) you specify. A *VFD* is defined as a logical device within a physical device. More than one VFD can reside within a physical device. You must pass a valid physical device descriptor to this function.

There are two ways to specify the VFD: by tag, and by ordinal number. To open the VFD by its tag, you must set the vfdTag parameter to the current tag of the VFD. The NI-FBUS Communications Manager returns an error if it finds more than one VFD with the same tag. You can obtain the list of VFD tags within a specified physical device with a call to nifGetVFDList.

To open the VFD by its ordinal number, use the NIFB_ORDINAL macro. The first VFD of your application in a physical device has the ordinal number zero. Notice that the Management VFDs are not included in the ordinal numbering scheme.

nifOpenVfd

Continued

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The input descriptor is invalid.
E_MULTIPLE	There are identical VFD tags.
E_ORDINAL_NUM_OUT_OF_RANGE	The ordinal number is out of the device's range.
E_COMM_ERROR	An error occurred when the NI-FBUS Communications Manager communicated with the device.
E_NOT_FOUND	No VFD in the device has the specified VFD tag.
E_RESOURCES	A system resource problem occurred. The resource problem is usually a memory shortage.
E_SM_NOT_OPERATIONAL	The device is present, but cannot respond because it is at a default address.
E_OBSOLETE_DESC	The input descriptor is no longer valid. It was closed before `nifOpenVfd` completed.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.
E_BAD_DEVICE_DATA	The device returned some inconsistent information.

Chapter 2

Core Fieldbus Functions

This chapter lists and describes the core NI-FBUS functions.

You can use the NI-FBUS core functions to access fieldbus block parameters using any type of descriptor. Because there are several ways to identify the fieldbus block parameters, the NI-FBUS core functions accept special interface macros for the `name` argument, as well as the standard *`TAG.PARAM`* identifier format. Refer to the *Using Interface Macros* section at the end of this chapter for tips on using the interface macros.

Format of the Function Information

Function Names

The functions are in alphabetical order.

Purpose

The *Purpose* sections are brief statements of the purpose of each function.

Format

The *Format* sections show the format for calling each function.

Input

The *Input* sections show the input parameters for each function.

Output

The *Output* sections show the output parameters for each function.

Context

The *Context* sections tell you if you can use a function on a link, device, VFD, session, or physical device.

Description

The *Description* sections describe the purpose and workings of each function.

Return Values

The *Return Values* sections list all the return values for each function and explain what each one means.

Table 2-1. List of Core Functions

Function	Purpose
`nifFreeObjectAttributes`	Free an `nifAttributes_t` structure allocated during a previous call to `nifGetObjectAttributes`
`nifGetObjectAttributes`	Read a single set of object attributes from the Device Description (DD)
`nifGetObjectSize`	Return the size in bytes of an object's value
`nifGetObjectType`	Returns the Object Dictionary type of the specified object.
`nifReadObject`	Read an object's value from a device
`nifReadObjectList`	Read the values of several objects from a device or several devices.
`nifWriteObject`	Write a parameter value to a device

nifFreeObjectAttributes

Purpose

Free an `nifAttributes_t` structure allocated during a previous call to `nifGetObjectAttributes`.

Format

```
nifError_t nifFreeObjectAttributes(nifAttributes_t *attr)
```

Input

`attr`	Object attribute values your application reads using `nifGetObjectAttributes`.

Output

Not applicable.

Context

Session, block, VFD, physical device, link.

Description

`nifFreeObjectAttributes` frees up the memory associated with the `nifAttributes_t` structure specified by `attr`. `attr` must have been filled in by a successful call to `nifGetObjectAttributes`. Once this function has been called, the contents of `attr` are no longer valid.

If your application does not call this function after calling `nifGetObjectAttributes`, your application will not free up memory properly.

Return Values

E_OK	The call was successful.
E_BAD_ARGUMENT	`attr` was not a valid `nifAttributes_t` structure.

nifGetObjectAttributes

Purpose

Read a single set of object attributes from the Device Description (DD).

Format

```
nifError_t nifGetObjectAttributes(nifDesc_t ud, char *name,
             nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_INDEX(uint16 idx), nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_INDEX_SUBINDEX(uint16 idx, uint16 subidx),
             nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_ITEM(uint32 item), nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_ITEM_SUBINDEX(uint32 item, uint16 subidx),
             nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_BLOCK_ITEM(char *blocktag, uint32 item),
             nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_BLOCK_ITEM_SUBINDEX(char *blocktag, uint32 item,
             uint16 subidx), nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_BLOCK_INDEX(char *blocktag, uint16 idx),
             nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_BLOCK_INDEX_SUBINDEX(char *blocktag, uint16 idx,
             uint16 subidx), nifAttributes_t *attr)

nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_NAME_SUBINDEX(char *name, uint16 subidx),
             nifAttributes_t *attr)
```

nifGetObjectAttributes

Continued

```
nifError_t nifGetObjectAttributes(nifDesc_t ud,
             NIFB_BLOCK_NAME_SUBINDEX(char *blocktag, char *name,
             uint16 subidx), nifAttributes_t *attr)
```

Input

`ud` The descriptor (of any type if by name; VFD or block if by index).

`name` Name of the object you need the DD attributes of, in *BLOCKTAG.PARAM* form. To specify a structure element by name, specify the name in *BLOCKTAG.STRUCT.ELEMENT* format. Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the object.

Output

`attr` Object attribute values read from the DDOD (Device Description Object Dictionary). The type `nifAttributes_t` consists of a data structure including a type code which selects from a list of structures, one for each type of object. Other information, including whether individual attributes were successfully evaluated and whether individual attributes are dynamic (meaning they could change) is also provided. The structure is too long to be included in this manual, so you can find it in the NI-FBUS Communications Manager header files.

Context

Session, block, VFD, physical device, link.

nifGetObjectAttributes

Continued

Description

The NI-FBUS Communications Manager reads the DD object attributes identified in the call from the DDOD associated with `ud` and returned in `attr`. Notice that the object attributes describe certain characteristics of the object, but do not contain the object’s value. The DD object attributes also differ in content from the FMS OD Object Description of the object.

For block, VFD, physical device, or link descriptors, the object name may refer to a variable or a variable list. You would normally use `nifGetObjectAttributes` to read the type description of a certain data type.

Refer to Table 2-4, *Core Function Macros,* at the end of this chapter for an explanation of how to use macros to specify the object.

For more detailed information concerning the `nifAttributes_t` structure, refer to the *Fieldbus Foundation Device Description Services User Guide,* Chapter 3, *Using ddi_get_item.*

☞ **Note:** ***After a successful call to*** `nifGetObjectAttributes`***, your application must call*** `nifFreeObjectAttributes` ***when it is done using the*** `attr` ***structure. Your application will not free up memory correctly if it does not perform this operation.***

Return Values

E_OK	The call was successful.
E_CONFIG_ERROR	Some configuration information, such as registry information or network configuration information, is incorrect.
E_INVALID_DESCRIPTOR	The device descriptor does not correspond to a VFD or block
E_SYMBOL_FILE_NOT_FOUND	The NI-FBUS Communications Manager could not find the symbol file.

nifGetObjectAttributes

Continued

E_SM_NOT_OPERATIONAL — The device is present, but cannot respond because it is at a default address.

E_NOT_FOUND — The referred object does not exist, or it does not have object attributes.

E_MULTIPLE — The NI-FBUS Communications Manager found more than one identical tag; the function failed.

E_ORDINAL_NUM_OUT_OF_RANGE — The ordinal number is out of the device’s range.

E_OBSOLETE_DESC — The input descriptor is no longer valid. It was closed before `nifGetObjectAttributes` completed.

E_SERVER_CONNECTION_LOST — The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifGetObjectSize

Purpose

Return the size in bytes of an object's value.

Format

```
nifError_t nifGetObjectSize(nifDesc_t ud, char *name,
             int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud, NIFB_INDEX(uint16 idx),
             int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_INDEX_SUBINDEX(uint16 idx, uint16 subidx),
             int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_ITEM(uint32 item), int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_ITEM_SUBINDEX(uint32 item, uint16 subidx),
             int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_BLOCK_ITEM(char *blocktag, uint32 item),
             int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_BLOCK_ITEM_SUBINDEX(char *blocktag, uint32 item,
             uint16 subidx), int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_BLOCK_INDEX(char *blocktag, uint16 idx),
             int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_BLOCK_INDEX_SUBINDEX(char *blocktag, uint16 idx,
             uint16 subidx), int16 *size_in_bytes)

nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_NAME_SUBINDEX(char *name, uint16 subidx),
             int16 *size_in_bytes)
```

nifGetObjectSize

Continued

```
nifError_t nifGetObjectSize(nifDesc_t ud,
             NIFB_BLOCK_NAME_SUBINDEX(char *blocktag, char *name,
             uint16 subidx), int16 *size_in_bytes)
```

Input

`ud`	The descriptor (of any type if by name, or of a block or VFD if by index).
`name`	Character string name of the object you need the size of, in *`BLOCKTAG.PARAM`* form. To specify a structure element by name, specify the name in *`BLOCKTAG.STRUCT.ELEMENT`* format. Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the character string name.

Output

`size_in_bytes`	The size of the object.

Context

Session, block, VFD, physical device, link.

Description

This function returns the size of the specified Object Value. You have to pass a buffer of the returned size to `nifReadObject` to hold the value of the object.

Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the character string name.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The specified descriptor is invalid.
E_SYMBOL_FILE_NOT_FOUND	The NI-FBUS Communications Manager could not find the symbol file.

nifGetObjectSize

Continued

E_NOT_FOUND	The named object does not exist.
E_MULTIPLE	Multiple identical tags were found; the function failed.
E_OBSOLETE_DESC	The input descriptor is no longer valid. It was closed before `nifGetObjectSize` completed.
E_ORDINAL_NUM_OUT_OF_RANGE	The ordinal number is out of the device's range.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifGetObjectType

Purpose

Returns the Object Dictionary type of the specified object.

Format

```
nifError_t nifGetObjectType(nifDesc_t ud, char *objName,
             nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_INDEX(uint16 idx), nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_INDEX_SUBINDEX(uint16 idx, uint16 subidx),
             nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_ITEM(uint32 item), nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_ITEM_SUBINDEX(uint32 item, uint16 subidx),
             nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_BLOCK_ITEM(char *blocktag, uint32 item),
             nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_BLOCK_ITEM_SUBINDEX(char *blocktag, uint32 item,
             uint16 subidx), nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_BLOCK_INDEX(char *blocktag, uint16 idx),
             nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_BLOCK_INDEX_SUBINDEX(char *blocktag, uint16 idx,
             uint16 subidx), nifObjTypeList_t *typeData)

nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_NAME_SUBINDEX(char *name, uint16 subidx),
             nifObjTypeList_t *typeData)
```

nifGetObjectType

Continued

```
nifError_t nifGetObjectType(nifDesc_t ud,
             NIFB_BLOCK_NAME_SUBINDEX(char *blocktag, char *name,
             uint16 subidx), nifObjTypeList_t *typeData)
```

Input

`ud`

The descriptor of the session, link, physical device, VFD or block if you are accessing by name. If you are accessing by index, `ud` must be a VFD or block.

`objName`

The name of the parameter you want to read the OD type of, in ***`BLOCKTAG.PARAM`*** form. Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the parameter. To specify a named structure element, supply `name` in ***`BLOCKTAG.STRUCT.ELEMENT`*** format. To specify a type index returned by a previous call to `nifGetObjectType`, use the `NIFB_TYPE_INDEX` macro.

Output

`typeData`

Object Type value read from the object dictionary in the device. The `nifObjTypeList_t` data structure is a record consisting of an object type code, the number of elements, the `blocktag` to which this object belongs (if applicable), and a pointer to a list of elements of type `nifObjElem_t`. The `nifObjElem_t` type is a structure which consists of two elements: the OD `typeIndex` of the element and the OD length of the element.

Context

Session, block, VFD, DDOD, physical device, link.

nifGetObjectType

Continued

Description

`nifGetObjectType` is used to read the Object Dictionary type values of objects such as block parameters, MIB objects or communication parameters from devices.

- If `ud` is the descriptor of a link, then `objName` must be in *`BLOCKTAG.PARAM_NAME`* format.
- If `ud` is a session descriptor, then all links are searched for the given *`BLOCKTAG.PARAM_NAME`*. The call fails if identical *`BLOCKTAG.PARAM_NAME`* tags are found on the bus. Index access is not allowed for session descriptors.
- If `ud` is the descriptor of a general function block application VFD, and you use the `NIFB_INDEX` macro, the index specified is the index of the object in the VFD.
- If `ud` is the descriptor of a function block, `name` must be in *`PARAM_NAME`* format.
- If `ud` is the descriptor of a function block, and you use the `NIFB_INDEX` or `NIFB_INDEX_SUBINDEX` macro, the index specified is the relative index of the parameter within the block. Relative indices start at one for the first parameter. Index zero retrieves the OD type of the block itself.
- In all cases, you can expand *`PARAM_NAME`* to *`STRUCT.ELEMENT`* format to represent a named element of a named structure.

Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the parameter.

The `nifObjTypeList_t` data structure is defined as follows:

```
typedef struct {
   uint8        objectCode;
   uint16       numElems;
   char         blockTag[TAG_SIZE + 1];
   nifObjElem_t *allElems;
   } nifObjTypeList_t;
```

The `nifObjElem_t` data type is defined as follows:

```
typedef struct {
   uint16       objTypeIndex;
   uint16       objSize;
   } nifObjElem_t;
```

nifGetObjectType

Continued

The objectCode returned in the data structure nifObjTypeList_t is as specified in the *FMS Specifications* in the *Fieldbus Foundation Specifications,* and is listed in Table 2-2 for your convenience.

Table 2-2. Object Codes for the nifObjTypeList_t Data Structure

Object	Object Code in fbtypes.h
Domain	ODT_DOMAIN
Program Invocation	ODT_PI
Event	ODT_EVENT
Data Type	ODT_SIMPLETYPE
Data Type Structure Description	ODT_STRUCTTYPE
Simple Variable	ODT_SIMPLEVAR
Array	ODT_ARRAY
Record	ODT_RECORD
Variable List	ODT_VARLIST

For object codes ODT_STRUCTTYPE, ODT_SIMPLEVAR, ODT_ARRAY, and ODT_RECORD, the list of elements in allElements contains the typeIndex and the size of each component element. For example, the following fragment of pseudocode gets the type information for a structured object and does something with the type information for each element:

```
nifObjTypeList_t typeInfo;
nifDesc_t aiBlock;
int loop;

...
```

nifGetObjectType

Continued

```
nifGetObjectType(aiBlock, "OUT", &typeInfo);
for (loop=0; loop < typeInfo.numElems; loop++)
{
   doSomethingWithElement(typeInfo.allElems[loop]);
}
```

For variable list objects (type `ODT_VARLIST`), you must call `nifGetObjectType` for each element in the list of elements with the `typeIndex` of the element returned in the list with the first `nifGetObjectType` call. The `typeIndex` of the element returned in the list in this case is the relative index of the element within the block, whose name is returned by `blockTag. These` subsequent calls to `nifGetObjectType` should use the `NIFB_INDEX` macro to specify the `typeIndex` returned by the first call.

For example, the following fragment of pseudocode gets the type information for a variable list object and does something with the type information for each variable:

```
nifObjTypeList_t typeInfo, varTypeInfo;
nifDesc_t aiBlock;
int loop;

...

nifGetObjectType(aiBlock, "VIEW_1", &typeInfo);
if (typeinfo.objectCode == ODT_VARLIST)
{
   for (loop=0; loop < typeInfo.numElems; loop++)
   {
      nifGetObjectType(aiBlock,
         NIFB_INDEX(typeInfo.allElems[loop].objTypeIndex),
         &varTypeInfo);
      doSomethingWithVariable(varTypeInfo);
   }
}
```

For all successful calls to `nifGetObjectType`, you must call `nifFreeObjectType` to clean up memory allocated within these structures.

nifGetObjectType

Continued

For objects with the object codes `ODT_DOMAIN`, `ODT_PI`, `ODT_EVENT`, and `ODT_SIMPLETYPE`, only the object type is returned, and the list of elements `allElems` in the structure `nifObjTypeList_t` is empty. The list of standard data types for an object which has the object code `ODT_SIMPLETYPE` is also as specified in the *FMS Specifications* in the *Fieldbus Foundation Specifications* and is listed in Table 2-3 for your convenience.

Table 2-3. Standard Data Types for Objects with the Object Code ODT_SIMPLETYPE

Data Type	objTypeIndex in fbtypes.h	Number of Octets (Size)
`Boolean`	`FF_BOOLEAN`	1
`Integer8`	`FF_INTEGER8`	1
`Integer16`	`FF_INTEGER16`	2
`Integer32`	`FF_INTEGER32`	4
`Unsigned8`	`FF_UNSIGNED8`	1
`Unsigned16`	`FF_UNSIGNED16`	2
`Unsigned32`	`FF_UNSIGNED32`	4
`Floating Point`	`FF_FLOAT`	4
`Visible String`	`FF_VISIBLE_STRING`	1, 2, 3,...
`Octet String`	`FF_OCTET_STRING`	1, 2, 3,...
`Date`	`FF_DATE`	7
`Time of Day`	`FF_TIMEOFDAY`	4 or 6
`Time Difference`	`FF_TIME_DIFF`	4 or 6
`Bit String`	`FF_BIT_STRING`	1, 2, 3,...
`Time Value`	`FF_TIME_VALUE`	8

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The descriptor you specified is not valid.

nifGetObjectType

Continued

E_TIMEOUT The device containing the object is present but did not respond within the timeout period.

E_MULTIPLE More than one identical tag was found; the function failed.

E_NOT_FOUND The NI-FBUS Communications Manager could not find the specified object.

E_BAD_ARGUMENT The object specified by index was that of a simple data type, which must already be known to you.

E_RESOURCES The NI-FBUS Communications Manager is unable to allocate some system resource; this is usually a memory problem.

E_SERVER_CONNECTION_LOST The session established with the NI-FBUS Communications Manager, under which the descriptor was opened, has been lost or closed.

nifReadObject

Purpose

Read an object's value from a device.

Format

```
nifError_t nifReadObject(nifDesc_t ud, char *name, void *buffer,
             uint8 *length)

nifError_t nifReadObject(nifDesc_t ud, NIFB_INDEX(uint16 idx),
             void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_INDEX_SUBINDEX(uint16 idx, uint16 subidx),
             void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_ITEM(uint32 item), void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_ITEM_SUBINDEX(uint32 item, uint16 subidx),
             void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_BLOCK_ITEM(char *blocktag, uint32 item),
             void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_BLOCK_ITEM_SUBINDEX(char *blocktag, uint32 item,
             uint16 subidx), void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_BLOCK_INDEX(char *blocktag, uint16 idx),
             void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_BLOCK_INDEX_SUBINDEX(char *blocktag, uint16 idx,
             uint16 subidx), void *buffer, uint8 *length)

nifError_t nifReadObject(nifDesc_t ud,
             NIFB_NAME_SUBINDEX(char *name, uint16 subidx),
             void *buffer, uint8 *length)
```

nifReadObject

Continued

```
nifError_t nifReadObject(nifDesc_t ud,
             NIFB_BLOCK_NAME_SUBINDEX(char *blocktag, char *name,
             uint16 subidx), void *buffer, uint8 *length)
```

Input

`ud`	The descriptor of the session, link, physical device, VFD or block if reading by name. If reading by index, `ud` must be a VFD or block.
`name`	Name of the parameter your application reads, in *`BLOCKTAG.PARAM`* format. To specify a structure element by name, specify the name in *`BLOCKTAG.STRUCT.ELEMENT`* format. Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the parameter.
`length`	The size of the buffer to hold the result, in bytes.

Output

`buffer`	The value that the NI-FBUS Communications Manager reads.
`length`	The actual size of the resulting data, in bytes.

Context

Session, block, VFD, physical device, link.

Description

`nifReadObject` reads the values of objects such as block parameters or communications parameters from devices.

- If `ud` is the descriptor of a link, then `name` must be in the format *`BLOCKTAG.PARAM_NAME`*.
- If `ud` is a session descriptor, then all links are searched for the given *`BLOCKTAG.PARAM_NAME`*. The call fails if multiple identical *`BLOCKTAG.PARAM_NAME`* tags are located on the bus. Index access is not allowed for session descriptors.
- If `ud` is the descriptor of a general function block application VFD, then name must be in the format *`BLOCKTAG.PARAM_NAME`*.

nifReadObject

Continued

- If `ud` is the descriptor of a function block, `name` must be in the format *`PARAM_NAME`*.
- If `ud` is the descriptor of a function block, and the `NIFB_INDEX` or `NIFB_INDEX_SUBINDEX` macro is used, the index specified is the relative index of the parameter within the block. Relative indices start at 1 for the first parameter.
- In all descriptor cases, you can expand *`PARAM_NAME`* itself to *`STRUCT.ELEMENT`* format to represent a named element of a named structure.

In each case, `name` can represent either a variable or a variable list object. You should determine the size of the object beforehand, possibly with a call to `nifGetObjectSize`. If the object is larger than the buffer size specified in `length`, the NI-FBUS Communications Manager returns an error, and none of the data in the buffer is valid.

Refer to Table 2-4, *Core Function Macros,* at the end of this chapter for an explanation of how to use macros to specify the parameter.

The data `nifReadObject` returns is in Fieldbus Foundation FMS Application format. You must accomplish conversion of the data to the internal format of your processor and compiler.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The descriptor does not correspond to a VFD or function block; this descriptor is no longer valid.
E_NOT_FOUND	The referred object does not exist.
E_OBJECT_ACCESS_DENIED	The NI-FBUS Communications Manager interface does not have the required privileges. The access group you belong to is not allowed to acknowledge the event, or the password you used is wrong.
E_MULTIPLE	The NI-FBUS Communications Manager found more than one identical tag; the function failed.
E_BUF_TOO_SMALL	The object is larger than your buffer.
E_SM_NOT_OPERATIONAL	The device is present, but cannot respond because it is at a default address.

nifReadObject

Continued

E_SYMBOL_FILE_NOT_FOUND The NI-FBUS Communications Manager could not find the symbol file.

E_OBSOLETE_DESC The input descriptor is no longer valid. It was closed before `nifReadObject` completed.

E_COMM_ERROR The NI-FBUS Communications Manager failed to communicate with the device.

E_PARAMETER_CHECK The device reported a violation of parameter-specific checks.

E_SERVER_CONNECTION_LOST The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifReadObjectList

Purpose

Read the values of several objects from a device or several devices.

Format

```
nifError_t nifReadObjectList (nifDesc_t ud, char **blkParamList,
             uint16 numObjects, void *buffer, uint16 *length,
             nifError_t *errArray)
```

Input

`ud` The descriptor of the session, link, physical device, VFD, or block.

`blkParamList` The list of parameter names your application reads in the form of *`BLOCKTAG.PARAM`*. To specify any parameter by index use the `NIFB_INDEX` macro. To specify any parameter that is an array or structure element by index and subindex, use the `NIFB_INDEX_SUBINDEX` macro. To specify a named structure element, supply the parameter name in the form of *`BLOCKTAG.STRUCT.ELEMENT`*.

`numObjects` The number of parameter names specified in `blkParamList`. (The maximum number of objects that can be specified in `blkParamList` is given by the constant `MAX_LIST_ELEMS`.)

`length` The size of the buffer to hold the result of all the parameter reads, in bytes.

Output

`buffer` The values of all the parameters read, stored as a continuous string of bytes.

`length` The cumulative size of the actual resulting data in bytes.

`errArray` The error codes resulting from each parameter read. The error codes have a one to one correspondence with the order in which the parameters are specified in `blkParamList`.

nifReadObjectList

Continued

Context

Session, link, device, VFD, block.

Description

nifReadObjectList reads the values of objects specified in the list, which may include block parameters or communication parameters from devices.

- If ud is the descriptor of a link, each name in blkParamList must be in the format *BLOCKTAG.PARAM_NAME*.
- If ud is a session descriptor, then all links are searched for any given name specified by the blocktag.param format in blkParamList. The read of this particular object fails if identical *BLOCKTAG.PARAM_NAME* tags are located on the bus. Index access is not allowed for session descriptors.
- If ud is the descriptor of a general function block application VFD, any name in blkParamList must be in the format blocktag.param_name.
- If ud is the descriptor of a function block, any name in blkParamList must be in the format *PARAM_NAME*.
- If ud is the descriptor of a function block and the NIFB_INDEX or NIFB_INDEX_SUBINDEX macro is used to specify a name in blkParamList, the index specified is the relative index of the parameter within the block. Relative indices start at 1 for the first block parameter.
- In all descriptor cases, any PARAM_NAME specified in blkParamList can be expanded to *STRUCT.ELEMENT* format to represent a named element of a named structure.

For each name specified in blkParamList, the name can either represent a variable or a variable list object. You should determine the size of each object specified in blkParamList beforehand, possibly with a call to nifGetObjectSize. If the cumulative size of all the objects specified in the list is larger than the buffer size specified in length, the NI-FBUS Communications Manager returns an error. The data in the buffer is valid for however many objects were successfully read. The success or failure of the read for every object specified in blkParamList is indicated in errArray, the array in which error codes are returned. The error code in the first element of errArray is the error code indicating success or failure upon read of the first object specified in blkParamList, and so on.

nifReadObjectList

Continued

Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the parameters in `blkParamList`.

The data `nifReadObjectList` returns is in Fieldbus Foundation FMS Application format. You must accomplish conversion of the data to the internal format of your processor and compiler.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The descriptor is no longer valid.
E_BUF_TOO_SMALL	The size of the data resulting from the read of all objects specified in the list is larger than your buffer.
E_RESOURCES	A system resource problem occurred. The resource problem is usually a memory shortage.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifWriteObject

Purpose

Write a parameter value to a device.

Format

```
nifError_t nifWriteObject(nifDesc_t ud, char *name, void *buffer,
             uint8 length)

nifError_t nifWriteObject(nifDesc_t ud, NIFB_INDEX(uint16 idx),
             void *buffer, uint8 length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_INDEX_SUBINDEX(uint16 idx, uint16 subidx),
             void *buffer, uint8 length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_ITEM(uint32 item), void *buffer, uint8 *length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_ITEM_SUBINDEX(uint32 item, uint16 subidx),
             void *buffer, uint8 *length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_BLOCK_ITEM(char *blocktag, uint32 item),
             void *buffer, uint8 *length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_BLOCK_ITEM_SUBINDEX(char *blocktag, uint32 item,
             uint16 subidx), void *buffer, uint8 *length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_BLOCK_INDEX(char *blocktag, uint16 idx),
             void *buffer, uint8 *length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_BLOCK_INDEX_SUBINDEX(char *blocktag, uint16 idx,
             uint16 subidx), void *buffer, uint8 *length)

nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_NAME_SUBINDEX(char *name, uint16 subidx),
             void *buffer, uint8 *length)
```

nifWriteObject

Continued

```
nifError_t nifWriteObject(nifDesc_t ud,
             NIFB_BLOCK_NAME_SUBINDEX(char *blocktag, char *name,
             uint16 subidx), void *buffer, uint8 *length)
```

Input

`ud` The descriptor of the session, link, physical device, VFD or block if writing by name. If writing by index, `ud` must be a VFD or block.

`name` Name of the parameter you want the NI-FBUS Communications Manager to write, in *BLOCKTAG.PARAM* form. To specify a structure element by name, specify the name in *BLOCKTAG.STRUCT.ELEMENT* format. Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the parameter.

`buffer` The value you want the NI-FBUS Communications Manager to write.

`length` The size of the data buffer, in bytes.

Output

Not applicable.

Context

Block, VFD, physical device, link, session.

Description

`nifWriteObject` writes the values of a function block parameter to a device.

- If `ud` is the descriptor of a session or link, then `name` must be in the format *BLOCKTAG.PARAM_NAME*.
- If `ud` is a session descriptor, then all links are searched for the given *BLOCKTAG.PARAM_NAME*. The function fails if more than one identical *BLOCKTAG.PARAM_NAME* match is found.
- If `ud` is a physical device descriptor, a parameter is written by *BLOCKTAG.PARAM_NAME*.

nifWriteObject

Continued

- If `ud` is the descriptor of a general Virtual Field Device, then name must be in the format *`BLOCKTAG.PARAM_NAME`*.
- If `ud` is the descriptor of a function block, `name` must be in the format *`PARAM_NAME`*.
- If `ud` is the descriptor of a function block, and you use the `NIFB_INDEX` or `NIFB_INDEX_SUBINDEX` macro, the index specified is the relative index of the parameter within the block. Relative indices start at one for the first parameter.
- In all descriptor cases, you can expand *`PARAM_NAME`* itself to *`STRUCT.ELEMENT`* format to represent a named element of a named structure.

Refer to Table 2-4, *Core Function Macros*, at the end of this chapter for an explanation of how to use macros to specify the parameter.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The device descriptor does not correspond to a VFD.
E_SYMBOL_FILE_NOT_FOUND	The NI-FBUS Communications Manager could not find the symbol file.
E_ORDINAL_NUM_OUT_OF_RANGE	The parameter is out of the device's range.
E_OBJECT_ACCESS_UNSUPPORTED	The device does not support write access to this object.
E_MULTIPLE	The NI-FBUS Communications Manager found more than one identical tag; the function failed.
E_SM_NOT_OPERATIONAL	The device is present, but cannot respond because it is at a default address.
E_COMM_ERROR	The NI-FBUS Communications Manager failed to communicate with the device.
E_PARAMETER_CHECK	The device reported a violation of parameter-specific checks.

nifWriteObject

Continued

E_EXCEED_LIMIT
The device reported that the value exceeds the limit.

E_WRONG_MODE_FOR_REQUEST
The device reported that the current function block mode does not allow you to write to the parameter.

E_WRITE_IS_PROHIBITED
The device reported that the `WRITE_LOCK` parameter value is set. The `WRITE_LOCK` parameter prohibits writing to the `name` parameter.

E_DATA_NEVER_WRITABLE
The specified object is read-only.

E_SERVER_CONNECTION_LOST
The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

Using Interface Macros

This section contains tips for using the NI-FBUS Communications Manager interface macros. These macros are defined in the header file `nifbus.h`.

Table 2-4. Core Function Macros

Descriptor Type You Have	Parameter Information You Have	Macro to Use
Block Descriptor	Name	Normal Access by Name
Block Descriptor	Name and Subindex	`NIFB_NAME_SUBINDEX`
Block Descriptor	Relative Index within the Block	`NIFB_INDEX`
Block Descriptor	Relative Index and Subindex	`NIFB_INDEX_SUBINDEX`
Block Descriptor	DD Item ID	`NIFB_ITEM`
Block Descriptor	DD Item ID and Subindex	`NIFB_ITEM_SUBINDEX`
Non-Block Descriptor	Name	Normal Access Using *`BLOCKTAG.PARAM`* Format
Non-Block Descriptor	Name and Subindex	`NIFB_BLOCK_NAME_SUBINDEX`
Non-Block Descriptor	Relative Index within the Block	`NIFB_BLOCK_INDEX`
Non-Block Descriptor	Relative Index and Subindex	`NIFB_BLOCK_INDEX_SUBINDEX`
Non-Block Descriptor	DD Item ID	`NIFB_BLOCK_ITEM`
Non-Block Descriptor	DD Item ID and Subindex	`NIFB_BLOCK_ITEM_SUBINDEX`

As shown in Table 2-4, you can specify the parameter your application reads in the `name` parameter in the following ways:

- To specify an object by index, use the `NIFB_INDEX` macro in the `nifbus.h` header file.
- To specify an array or structure element by index and subindex, use the `NIFB_INDEX_SUBINDEX` macro.
- If you already have a block descriptor, you can specify an object by its item ID with the `NIFB_ITEM` macro, or you can specify a subelement by its item ID with the `NIFB_ITEM_SUBINDEX` macro.

- If you do not have a block descriptor, you have the following choices:
  - You can use the `NIFB_BLOCK_ITEM` macro to specify an item.
  - You can use the `NIFB_BLOCK_ITEM_SUBINDEX` macro to specify a subelement.
  - You can use the `NIFB_BLOCK_INDEX` macro specify an object by index.
  - You can use the `NIFB_BLOCK_INDEX_SUBINDEX` macro to specify a subindex.

You can find all these macros in the `nifbus.h` header file.

Chapter

3

Alert and Trend Functions

This chapter lists and describes the NI-FBUS alert and trend functions.

Format of the Function Information

Function Names

The functions are in alphabetical order.

Purpose

The *Purpose* sections are brief statements of the purpose of each function.

Format

The *Format* sections show the format for calling each function.

Input

The *Input* sections show the input parameters for each function.

Output

The *Output* sections show the output parameters for each function.

Context

The *Context* sections tell you if you can use a function on a link, device, VFD, session, or physical device.

Description

The *Description* sections describe the purpose and workings of each function.

Return Values

The *Return Values* sections list all the return values for each function and explain what each one means.

Table 3-1. Alert Functions

Function	Purpose
`nifAcknowledgeAlarm`	Acknowledge an alarm received
`nifWaitAlert`	Wait for an alert (an event or an alarm) from a specific device or from *any* device

Table 3-2. Trend Function

Function	Purpose
`nifWaitTrend`	Wait for a trend from a specific device or from any device

nifAcknowledgeAlarm

Purpose

Acknowledge an alarm received.

Format

```
nifError_t nifAcknowledgeAlarm(nifDesc_t ud, char *alarmName)
```

Input

ud	A session, link, physical device, VFD, or block descriptor for the alarm
alarmName	The name of the alarm object that you want the NI-FBUS Communications Manager to acknowledge. If ud is a block descriptor, alarmName should be the parameter name, otherwise alarmName should be in *BLOCKTAG.PARAMNAME* format.

Context

Block, VFD, physical device, link, session.

Description

nifAcknowledgeAlarm acknowledges an alarm notification from a device. The NI-FBUS Communications Manager clears the unacknowledged field associated with the alarm object alarmName.

If ud is a block descriptor, the alarmName is the same as the alarmOrEventName field of the alert data you get in the nifWaitAlert call. If ud is a session, link, VFD, or physical device descriptor, then alarmName is in *BLOCKTAG.PARAMNAME* format, where blockTag is the same as the blockTag field of the alert data in the nifWaitAlert function.

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The device descriptor is not a valid descriptor.

nifAcknowledgeAlarm

Continued

E_OBJECT_ACCESS_DENIED The NI-FBUS Communications Manager interface does not have the required privileges. The access group you belong to is not allowed to acknowledge the event, or the password you used is wrong.

E_COMM_ERROR An error occurred when the NI-FBUS Communications Manager tried to communicate with the device.

E_ALARM_ACKNOWLEDGED The alarm has already been acknowledged.

E_MULTIPLE There are identical block tags.

E_NOT_FOUND There is no such block in the device or VFD with the specified tag.

E_SYMBOL_FILE_NOT_FOUND The NI-FBUS Communications Manager could not find the symbol file.

E_SERVER_CONNECTION_LOST The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifWaitAlert

Purpose

Wait for an alert (an event or an alarm) from a specific device or from *any* device.

Format

```
nifError_t nifWaitAlert(nifDesc_t ud, nifAlertData_t *aldata,
            uint8 alertPriority)
```

Input

ud	The descriptor of the session, link, physical device, VFD, block, or link the alert comes from.
alertPriority	Lowest priority of the alert coming in that you want to wait on.

Output

aldata	The information about the specific alert.

Context

Block, VFD, physical device, link, session.

Description

ud represents a descriptor of a session, link, a physical device, a VFD, or a block. If ud is a VFD descriptor, then the NI-FBUS Communications Manager waits for an alert from any block in the Virtual Field Device. If ud is a block, the NI-FBUS Communications Manager waits for an alarm or event from the block ud refers to. If ud represents a link, nifWaitAlert completes when an event is received from any device connected to that link. If the descriptor is a session descriptor, the function waits on any event from any attached link.

nifWaitAlert waits indefinitely until the NI-FBUS Communications Manager receives an alert with a priority greater than or equal to the input alert priority. Your application can have a dedicated thread which does nifWaitAlert only.

When the NI-FBUS Communications Manager interface receives an alert, the aldata parameter is filled in with the information about the alert. The form of aldata->alertData depends on the value of aldata->alertType. alData->alarmOrEventName is the name of the alarm parameter or event parameter that

nifWaitAlert

Continued

caused the alert. alData->deviceTag and alData->blockTag are the tags of the device and the block of the alarm, respectively.

nifWaitAlert sends a confirmation to the device, informing the alerting device that the alert was received. Note that this is a separate step from alert acknowledgment, which must be carried out for alarms using nifAcknowledgeAlarm.

If you have multiple threads waiting to receive the same alert, the NI-FBUS Communications Manager sends a copy of the alert to all the waiting threads. Your application must ensure that only one thread acknowledges any one alarm with a call to nifAcknowledgeAlarm. You can abort a pending nifWaitAlert call by closing the descriptor on which the call was made.

The alertType parameter can be ALERT_ANALOG, ALERT_DISCRETE, or ALERT_UPDATE.

nifAlertData_t is defined as follows:

```
typedef struct nifAlertData_t{
   uint8        alertType;
   char         deviceTag[TAG_SIZE + 1];
   char         blockTag[TAG_SIZE + 1];
   char         alarmOrEventName [TAG_SIZE + 1];
   uint8        alertKey;
   uint8        standardType;
   uint8        mfrType;
   uint8        messageType;
   uint8        priority;
   nifTime_t    timeStamp;
   uint16       subCode;
   uint16       unitIndex;
   union {
      float     floatAlarmData;
      uint8     discreteAlarmData;
      uint16    staticRevision;
   } alertData;
} nifAlertData_t ;
```

nifWaitAlert

Continued

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The descriptor you gave is invalid.
E_OBSOLETE_DESC	The input descriptor is no longer valid. It was closed before `nifWaitAlert` completed.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

nifWaitTrend

Purpose

Wait for a trend from a specific device or from any device.

Format

```
nifError_t nifWaitTrend(nifDesc_t ud, nifTrendData_t *trend)
```

Input

ud	The descriptor of the session, physical device, VFD, block, or link that the trend comes from.

Output

trend	The information about the specific trend.

Context

Block, VFD, physical device, link, session.

Description

ud represents a descriptor of a session, link, physical device, VFD, or block. If ud is a VFD descriptor, then the NI-FBUS Communications Manager waits for a trend from any block in the Virtual Field Device. If ud is a block, the NI-FBUS Communications Manager waits for a trend from the block ud identifies. If ud represents a link, the call completes when a trend is received from any device connected to that link. If the descriptor is a session descriptor, nifWaitTrend waits on any trend from any attached link.

nifWaitTrend waits indefinitely until the NI-FBUS Communications Manager interface receives a trend. Your application can have a dedicated thread which does nifWaitTrend only.

When a trend comes in, the trend parameter is filled in with the information about the trend. The form of trend->trendData depends on the value of trend->trendType. There are three trend types: TREND_FLOAT, TREND_DISCRETE and TREND_BITSTRING. If the trend type is TREND_FLOAT, the trend->trendData is a 16-element array of floating point numbers. If the trend type is TREND_DISCRETE, the trend->trendData is a 16-element array of 1-byte integers. If the trend type is TREND_BITSTRING, the trend->trendData is a 16-element array of 2-byte bit strings, which is equivalent to a

nifWaitTrend

Continued

32-element array of 1-byte integers. deviceTag and blockTag are the device and block tags of the parameter that has the trend; paramName is the name of the parameter.

If you have multiple threads waiting to receive the same trend, the NI-FBUS Communications Manager sends a copy of the trend to all the waiting threads. You can abort a pending nifWaitTrend call by closing the descriptor on which the call was made.

The trend type can be TREND_FLOAT, TREND_DISCRETE, or TREND_BITSTRING. The sample type can be SAMPLE_INSTANT or SAMPLE_AVERAGE.

nifTrendData_t is defined as follows:

```
typedef struct nifTrendData_t {
   uint8 trendType;
   char deviceTag[TAG_SIZE + 1];
   char blockTag[TAG_SIZE + 1];
   char paramName[TAG_SIZE + 1];
   uint8 sampleType;
   uint32 sampleInterval;
   nifTime_t lastUpdate;
   uint8 status[16];
   union {
      float f[16];
      uint8 d[16];
      uint8 bs[32];
   } trendData;
} nifTrendData_t;
```

Return Values

E_OK	The call was successful.
E_INVALID_DESCRIPTOR	The descriptor you gave is not valid.
E_SERVER_CONNECTION_LOST	The session established with the NI-FBUS Communications Manager for this descriptor has been closed or lost.

Appendix

Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a Fax-on-Demand system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by application engineers.

Electronic Services

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National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call (512) 795-6990. You can access these services at:

United States: (512) 794-5422
Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 01 48 65 15 59
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as `anonymous` and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.

Fax-on-Demand Support

Fax-on-Demand is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access Fax-on-Demand from a touch-tone telephone at (512) 418-1111.

E-Mail Support (currently U.S. only)

You can submit technical support questions to the applications engineering team through e-mail at the Internet address listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

`support@natinst.com`

Telephone and Fax Support

National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.

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Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	905 785 0085	905 785 0086
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	09 725 725 11	09 725 725 55
France	01 48 14 24 24	01 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Israel	03 5734815	03 5734816
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	5 520 2635	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	01635 523545	01635 523154

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include additional pages if necessary.

Name ____

Title ____

Company ____

Address ____

____

Fax (____) ____________________ Phone (____) ____________________

Computer brand ________________ Model ____________ Processor ____________

Operating system (include version number) ____________________________

Clock Speed _______ MHz RAM _______ MB Display adapter ____________

Mouse ____ yes ____ no Other adapters installed ____________________

Hard disk capacity _______ MB Brand ____________________________

Instruments used ____

National Instruments hardware product model ________________ Revision __________

Configuration ____

National Instruments software product ____________________ Version __________

Configuration ____

The problem is ____

____

____

____

List any error messages ____________________________________

____

____

The following steps will reproduce the problem ________________________

____

____

Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

Hardware Revision ______________________________

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Base I/O Address of Hardware ______________________________

NI-FBUS Communications Manager Software Version ______________________________

Other Products

Computer Make and Model ______________________________

Microprocessor ______________________________

Clock Frequency ______________________________

Type of Video Board Installed ______________________________

Operating System ______________________________

Operating System Version ______________________________

Operating System Mode ______________________________

Programming Language ______________________________

Programming Language Version ______________________________

Other Boards in System ______________________________

Base I/O Address of Other Boards ______________________________

DMA Channels of Other Boards ______________________________

Interrupt Level of Other Boards ______________________________

Documentation Comment Form

National Instruments encourages you to comment on the documentation supplied with our products. This information helps us provide quality products to meet your needs.

Title: *NI-FBUS™ Communications Manager Function Reference Manual*

Edition Date: July 1997

Part Number: 321288B-01

Please comment on the completeness, clarity, and organization of the manual.

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If you find errors in the manual, please record the page numbers and describe the errors.

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Thank you for your help.

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Glossary

Prefix	Meaning	Value
n-	nano-	10^{-9}
μ-	micro-	10^{-6}
m-	milli-	10^{-3}

A

AI

Analog Input. A type of function block.

alarm

A notification the NI-FBUS Communications Manager software sends when it detects that a block leaves or returns to a particular state.

alert

An alarm or an event.

argument

A value you pass in a function call. Sometimes referred to as a parameter, but this documentation uses a different meaning for parameter, which is included in this glossary.

ASCII

American Standard Code for Information Interchange.

B

block

A logical software unit that makes up one named copy of a block and the associated parameters its block type specifies. The values of the parameters persist from one invocation of the block to the next. It can be a resource block, transducer block, or function block residing within a VFD.

block context

Describes a category of NI-FBUS functions that accept block descriptors.

block view objects

Variable list objects used to read multiple block parameters at once.

D

DDOD

Device Description Object Dictionary. The Device Description binary file.

descriptor

A number returned to the application by the NI-FBUS Communications Manager, used to specify a target for future NI-FBUS calls.

device ID

An identifier for a device that the manufacturer assigns. Device IDs must be unique to the device; no two devices can have the same device ID.

device tag

A name you assign to a fieldbus device.

E

entity

A certain thing, such as a process, object, device, or event.

event

An occurrence on a device that causes a fieldbus entity to send the fieldbus event message.

F

fieldbus

An all-digital, two-way communication system that connects control systems to instrumentation.

Fieldbus Messaging Specification (FMS)

The layer of the communication stack that defines a model for applications to interact over the fieldbus. The services FMS provides allow you to read and write information about the OD, read and write the data variables described in the OD, and perform other activities such as uploading/downloading data, and invoking programs inside a device.

function block

A named block consisting of one or more input, output, and contained parameters. The block performs some control function as its algorithm. function blocks are the core components you control a system with. The Fieldbus Foundation defines standard sets of function blocks. There are ten function blocks for the most basic control and I/O functions. Manufacturers can define their own function blocks.

function block execution schedule

A list of times in the macrocycle when the function block will begin to execute its algorithm.

I

index

An integer that the fieldbus specification assigns to a fieldbus object or a device that you can use to refer to the object.

L

link

A group of fieldbus devices connected across a single wire pair with no intervening bridges.

Link Active Schedule

A schedule of times in the macrocycle when devices must publish their output values on the fieldbus.

Link Active Scheduler (LAS)

A device that is responsible for keeping a link operational. The LAS executes the link schedule, circulates tokens, distributes time and probes for new devices.

link context

Describes a category of NI-FBUS calls that accept link descriptors.

link ID

See link identifier.

link identifier

A number that specifies a link.

Link Master device

A device that is capable of becoming the LAS.

M

macrocycle

One iteration of a the process control loop.

O

object attribute

A part of the machine-readable description of a fieldbus object.

Object Dictionary (OD)

A structure in a device that describes data that can be communicated on the fieldbus. The OD is a lookup table that gives information such as data type and units about a value that can be read from or written to a device.

Object Dictionary index
A value in the object dictionary used to refer to a single object.

object value
The actual data value associated with a fieldbus object.

P

parameter
One of a set of network-visible values that makes up a function block.

physical device
A single device residing at a unique address on the fieldbus.

physical device context
Describes a category of NI-FBUS functions that accept physical device descriptors.

process variable
A common fieldbus function block parameter representing some value in the process being controlled.

publisher
A device that has at least one function block with its output value connected to the input of another device.

R

resource block
A special block containing parameters that describe the operation of the device.

S

sample type
Specifies how trends are sampled on a device, whether by averaging data or by instantaneous sampling.

session
A connection between your application and an NI-FBUS entity.

session context
Describes a category of NI-FBUS functions that accept session descriptors.

stale
Data that has not been updated for `stale_limit` number of macrocycles, where the stale limit is a parameter of the connection.

subscriber
A device that has at least one function block with its input value connected to the output of another device.

symbol file

A Fieldbus Foundation or device manufacturer-supplied file that contains the ASCII names for all the objects in a device.

T

tag

A name you can define for a block, VFD, or device.

thread

An operating system object that consists of a flow of control within a process. In some operating systems, a single process can have multiple threads, each of which can access the same data space within the process. However, each thread has its own stack and all threads can execute concurrently with one another (either on multiple processors, or by time-sharing a single processor).

timeout

A period of time after which an error condition is raised if some event has not occurred.

transducer block

A block that is an interface to the physical, sensing hardware in the device. It also performs the digitizing, filtering, and scaling conversions needed to present input data to function blocks, and converts output data from function blocks. transducer blocks decouple the function blocks from the hardware details of a given device, allowing generic indication of function block input and output. Manufacturers can define their own transducer blocks.

trend

A fieldbus object that allows a device to sample a process variable periodically, then transmit a history of the values on the network.

V

variable list

A list of variables you can access with a single fieldbus transaction.

VFD context

Describes a category of NI-FBUS functions that accept VFD descriptors.

Virtual Field Device (VFD)

A model for remotely viewing data described in the object dictionary.

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