



# FieldPoint Optomux Programming Reference Help

This document contains information about using the FieldPoint Optomux commands.

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## **FieldPoint Commands Overview**

FieldPoint commands are based on and compatible with the Optomux protocol, so that FieldPoint banks and Optomux devices can communicate with each other over networks.

FieldPoint commands are of two types, standard and extended. The standard commands are a subset of Optomux commands that provide maximum compatibility with existing Optomux servers and host software. After you configure a FieldPoint module or bank, you can use any generic Optomux server to communicate with it.

FieldPoint extended commands support all the features of FieldPoint, and National Instruments recommends that you use the extended commands whenever possible. The standard command descriptions include lists of the recommended extended commands.

If you are using FieldPoint software on a host, you do not need the detailed information in this help file because the FieldPoint server builds commands and parses responses for you.

## Command Fields

All FieldPoint commands have the syntax described in this section and contain the following five fields in the order shown:

[*start*][*address*][*command*][*checksum*][*end*]

- [*start*] Each command starts with the ">" character (ASCII value 62).
- [*address*] Two ASCII-hex characters specify the address of the module that the command is intended for. The value of this field can be between 00 and F9 for networks built with the FP-1000 and FP-1001 FieldPoint network modules. The cFP-180x does not recognize addresses higher than 08.
- [*command*] This field is the body of the command. It is composed of the following four subfields, some of which may not be required for all FieldPoint commands:

[*cmdchars*] One, two, or four ASCII-hex characters. All FieldPoint commands must contain this subfield.

Standard commands have a single command character in the range "A""Z" or "a""i".

Extended commands have two characters and always begin with the "!" character (ASCII value 33). The second command character is in the range "A""Z" or "a""z".

Some extended commands support 32 channels. If you want to send one of those commands to a 32-channel module, you must precede the two command characters with "!o".

[*position*] Zero to four, or eight, ASCII-hex characters. Some FieldPoint commands do not contain this subfield.

This field specifies the FieldPoint module channels that the command targets. Each bit in this field represents one channel. Standard and extended commands can target up to 16 channels, and some extended commands can target up to 32 channels. Bit 31 represents channel 31, and bit 0 represents channel 0. Standard commands can contain zero to four characters in this field. Extended commands standardize this field to either no characters (when the command does not specify individual

channels), four characters (when the command targets up to 16 channels), or eight characters (when the command supports 32 channels and the command characters in *[cmdchars]* are preceded by "!o").

Try to ensure that the *[positions]* field matches the number of channels on the module. Addressing channels that do not exist on the module can cause errors and unexpected behavior, especially when you are using analog commands.

*[modifier]* Zero or more ASCII-hex characters. Some FieldPoint commands do not contain this subfield. This field is used by commands that support multiple execution features.

*[data]* Zero or more ASCII-hex characters. Some FieldPoint commands do not contain this subfield. This field contains command-specific characters.

*[checksum]* Two ASCII-hex characters. This field enables error checking for the command. Calculate the value of this field by adding the numeric values of all the characters in the *[address]* and *[command]* fields and determining the modulo-256 of the sum. Convert the modulus (remainder) of the division to two ASCII-hex characters to form the *[checksum]* field.

*[end]* One ASCII-hex character. This field indicates the end of the command. You can use either a carriage return (ASCII value 13) or a "." (ASCII value 46) for this field.

In the description of the individual commands later in this manual, only the fields that are relevant to the command are described. The *[start]* field, the *[address]* field, the *[checksum]* field, and the *[end]* field are not described for each command because they have the same syntax for all commands. The individual command descriptions include their use of the *[command]* field and its subfields.

## Syntax Examples

The following example uses the standard command Write Analog Outputs. Consider the following command:

```
>34J0011456[checksum].
```

This command writes the value 0x456 to channels 0 and 4 of the FieldPoint module at address 0x34.

The ">" character is the [*start*] field, 34 is the [*address*] field, and J0011456 is the [*command*] field.

In the [*command*] field, J is the [*cmdchar*] subfield, 0011 is the [*position*] subfield, and 456 is the [*data*] subfield. Note that this command does not use a [*modifier*] subfield.

Calculate the checksum as follows:

<b>Characters</b>	3	4	J	0	0	1	1	4	5	6
<b>Numeric Values</b>	51	52	74	48	48	49	49	52	53	54
<b>Numeric Sum</b>	530									
<b>Modulus</b>	18 (hex 12)									
<b>Checksum</b>	12									

The complete command with checksum is as follows:

```
>34J001145612.
```

In this example, the "." character is the [*end*] field.

The following example uses the extended command Write Discrete with the !o prefix:

```
>32!o!L00020080FFFF[checksum].
```

This command turns channels 7 and 17 ON on the FieldPoint digital output module at address 0x32.

The ">" character is the [*start*] field, 32 is the [*address*] field, and !o!L00020080FFFF is the [*command*] field.

Within the [*command*] field, !o!L is the [*cmdchar*] subfield, 00020080 is the [*position*] subfield, and FFFF is the [*data*] subfield. Note that this command does not use a [*modifier*] subfield.

Calculate the checksum as follows:

<b>Characters</b>	3	2	!	o	!	L	0	0	0	2	0	0	8	0	F	F	F	F
<b>Numeric Values</b>	51	50	33	111	33	76	48	48	48	50	48	48	56	48	70	70	70	70
<b>Numeric Sum</b>	1028																	
<b>Modulus</b>	4 (hex 4)																	
<b>Checksum</b>	04																	

The complete command with checksum is as follows:

```
>32!o!L00020080FFFF04.
```

In this example, the "." character is the *[end]* field.

# FieldPoint Responses

## FieldPoint Success Responses

The success response to a FieldPoint standard or extended command can take either of the following two forms:

A[*cr*]                    This response indicates that the command was executed successfully, and no other information is required in the response. This type of response does not contain a checksum.

A[*response data*]  
[*checksum*][*cr*]        Some commands require more information in the success response. This type of success response contains a [*response data*] field and a [*checksum*] field. The [*checksum*] field is calculated by adding the numeric values of all the characters in the [*response data*] field and determining the modulo-256 of the sum. The modulus (remainder) of the division is converted to two ASCII-hex characters to form the [*checksum*] field. Refer to the [FieldPoint Commands Overview](#) topic for more information about FieldPoint command syntax.



## FieldPoint Error Responses

A FieldPoint module returns an error response when an erroneous condition is detected during the reception or execution of a command. FieldPoint modules return only the standard errors (N00 through N07) in response to standard commands, enabling FieldPoint modules to work with host software that is written for the Optomux protocol. In response to the extended commands, FieldPoint modules return either standard or extended errors, depending on which error response is most appropriate.

The error response to a FieldPoint standard or extended command has the following form: N[*error number*][*cr*], where [*error number*] is two ASCII-hex characters. The error numbers are listed and described in this chapter.

FieldPoint error responses do not contain a [*checksum*] field.

### Standard Error Responses

The following table lists the FieldPoint standard error responses. They can be returned in response to standard or extended FieldPoint commands.

Error Number (Hex)	Error Tag	Description
00	E_PUCLR_EXP	Power Up Clear expected. The command was ignored. A command other than Power Up Clear was attempted after power-up or power failure. Once the error is received by the host, it is unnecessary to send the Power Up Clear command, because the next command is executed normally.  If this error message is received, the FieldPoint network module has gone through its power-up sequence and has reset all characteristics to defaults. If SnapShot is enabled, the module is configured in accordance with the stored SnapShot information.  The cFP-180x does not return this error.
01	E_INVALID_CMD	Undefined command. The command character was not a legal command character, or the addressed module does not support this command. The command was ignored.
02	E_BAD_CHECKSUM	Checksum error. The checksum received in the command did not match the calculated checksum of the characters in the command. The command was ignored.
03	E_INBUF_OVRFLO	Input buffer overrun. The received command was too long. The command was ignored.
04	E_ILLEGAL_CHAR	Unprintable ASCII character received. Only characters from ASCII value 33 to 127 are permitted within commands. The command was ignored.
05	E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the specified command.

06	E_WATCHDOG_TMO	Communications link network watchdog timed out. The command was ignored.  The cFP-180x does not return this error.
07	E_INV_LIMS_GOT	Specified limits invalid for the command. This includes notification that an invalid digit (hex or decimal) was received.

## Extended Error Responses

The following table lists the FieldPoint extended error responses, which can be returned in response only to extended FieldPoint commands.

Error Number (Hex)	Error Tag	Description
80	E_ILLEGAL_DIGIT	One or more characters sent in the command could not be correctly converted to a digit (hex or decimal).
81	E_BAD_ADDRESS	The command is valid, but the addressed module does not support the command received.
82	E_INBUF_FRMERR	The FieldPoint network module detected a serial framing error in the command. The command was ignored.
83	E_NO_MODULE	The addressed module does not exist.
84	E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the operation specified. The command was ignored.
85	E_INV_RANGE	One or more ranges specified in the command either do not exist or do not support the setting specified. The command was ignored.
86	E_INV_ATTR	One or more attributes specified in the command either do not exist or do not support the setting specified. The command was ignored.
88	E_HOTSWAP	The module has been hot-swapped since it was last sent a command. This response is sent only if the network module is enabled to report hot-swaps, and if the hot-swap occurred after hot-swap reporting mode was enabled. The command was ignored. This error number can be sent in response to a standard command if you have enabled hot-swap reporting for the bank.
89	E_ADDR_NOT_SAME	The module addressed by the Resend Last Response is not the same as the module addressed by the previous command.
8A	E_NO_RESEND_BUF	The response to the last command is unavailable.
8B	E_HW_FAILURE	An irrecoverable fault has occurred.
8C	E_UNKNOWN	An unidentifiable error condition has occurred.

## FieldPoint Extended Commands (Recommended)

National Instruments recommends using the FieldPoint extended commands whenever possible. The cFP-180x supports only the extended commands and the [Power Up Clear](#) command.

Extended commands do not accept [*positions*] masks that do not address any channels.

Command Name	Command Syntax	Success Response
<b>Utility Commands</b>		
<a href="#">Execute Channel Command</a>	!n[ <i>positions</i> ]{[ <i>command type</i> ][ <i>command pairs</i> ]}	A
<a href="#">Hotswap Reporting Mode</a>	!b[ <i>flag</i> ]	A
<a href="#">Read All Module IDs</a>	!B	A[ <i>number</i> ][ <i>modarray</i> ]
<a href="#">Read Bank Status</a>	!P	A[ <i>bank_status</i> ]
<a href="#">Read Channel Status</a>	!O[ <i>positions</i> ]	A[ <i>chnl_status</i> ]
<a href="#">Read Firmware Revision</a>	!e	
<a href="#">Read Module ID</a>	!A	A[ <i>modID</i> ]
<a href="#">Read Module Status</a>	!N	A[ <i>mod_status</i> ]
<a href="#">Resend Last Response</a>	!c	A
<a href="#">Reset Module</a>	!Z	A
<b>Configuration Commands</b>		
<a href="#">Get Attributes</a>	!E[ <i>positions</i> ]{[ <i>attrMask</i> ][ <i>rangeMask</i> ] <i>pairs</i> }	A{[ <i>settings</i> ] <i>array</i> }
<a href="#">Set Attributes</a>	!D[ <i>positions</i> ]{[ <i>attrMask</i> ][ <i>rangeMask</i> ] [ <i>settings</i> ] <i>triplets</i> }	A
<b>Discrete Commands</b>		
<a href="#">Read Discrete</a>	!J	A[ <i>data</i> ]
<a href="#">Read Discrete with Status</a>	!K	A[ <i>status</i> ][ <i>data</i> ]
<a href="#">Write Discrete</a>	!L[ <i>positions</i> ][ <i>data</i> ]	A
<a href="#">Write Discrete with Status</a>	!M[ <i>positions</i> ][ <i>data</i> ]	A[ <i>status</i> ]
<b>Analog Commands</b>		
<a href="#">Read 16-Bit Data</a>	!F[ <i>positions</i> ]	A[ <i>data</i> ]
<a href="#">Read 16-Bit Data with Status</a>	!G[ <i>positions</i> ]	A[ <i>status</i> ][ <i>data</i> ]
<a href="#">Write 16-Bit Data</a>	!H[ <i>positions</i> ][ <i>data</i> ]	A[ <i>positions</i> ][ <i>data</i> ]
<a href="#">Write 16-Bit Data with Status</a>	!I[ <i>positions</i> ][ <i>data</i> ]	A[ <i>status</i> ]
<b>Watchdog Commands</b>		
<a href="#">Get Watchdog Info</a>	!U	A[ <i>moduleInfo</i> ][ <i>chnlEnable</i> ][ <i>chnlWdgData</i> ]

<a href="#">Set 16-Bit Watchdog Data</a>	!S[positions][wdgData]	A
<a href="#">Set Discrete Watchdog Data</a>	!R[positions][wdgData]	A
<a href="#">Set Watchdog Data Status</a>	!T[positions][mask]	A
<a href="#">Set Watchdog Delay</a>	!Q[wdgTmo]	A[wdgTmo]
<b>Snapshot/Programmable Power-Up Commands</b>		
<a href="#">Read Snapshot Status</a>	!Y	A[status]
<a href="#">Store 16-Bit Data</a>	!g[positions][data]	A
<a href="#">Store 16-Bit Watchdog Data</a>	!j[positions][wdgData]	A
<a href="#">Store Attributes</a>	!f[positions]{[attrMask] [rangeMask] [settings] triplets}	A
<a href="#">Store Discrete</a>	!h[positions][data]	A
<a href="#">Store Discrete Watchdog Data</a>	!i[positions][wdgData]	A
<a href="#">Store Snapshot</a>	!W	A
<a href="#">Store Watchdog Data Status</a>	!k[positions][mask]	A
<a href="#">Store Watchdog Delay</a>	!V[wdgTmo]	A
<a href="#">Store Watchdog Enable</a>	!l[wdgTmo]	A
<a href="#">Use Snapshot</a>	!X[flag]	A[flag]

# **Execute Channel Command**

**[cmdchars] = !n**

## **Description**

**Execute Channel Command** executes commands specific to certain types of channels on some FieldPoint modules.

## Syntax

!n[positions]{[command type][command] pairs}

[positions] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the corresponding channel is targeted by a channel command. A zero in any bit means that the corresponding channel is not targeted.

{[command type][command] pairs}

For each "1" bit in the [positions] field, there must be a [command type][command] pair. The first pair corresponds to the most significant "1" in the [positions] field, and so on. This command can contain up to 16 pairs, one for each channel represented by a "1" in the [positions] field.

[command type] Four ASCII-hex characters form a 16-bit mask. A "1" in any bit means that the corresponding channel command is to be executed. Setting this field to 0000 causes no command to be executed.

[command] Two ASCII-hex characters form each command ID entry. This field must contain one such entry for each "1" bit in the preceding [command type] field. Each entry specifies the command of the corresponding typ to be executed.

The following topics contain definitions of command types and command IDs for FieldPoint I/O modules that support commands:

[\[c\]FP-CTR-500](#)

[\[c\]FP-CTR-502](#)

[\[c\]FP-PG-522](#)

[\[c\]FP-QUAD-510](#)

## Success Response

A

## Error Responses

E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_INV_ATTR	One or more [ <i>command type</i> ][ <i>command</i> ] pairs specified in the command either do not exist or are not valid for the targeted channels.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## Example

```
>01!n0008000102[checksum][cr]
```

In this example, the FieldPoint module at address 1 is an FP-CTR-500. The command executes the control command (0x0001) Increment Counter (0x02) on counter channel 3 (0x0008).

# **Get Attributes**

**[cmdchars] = !E**

## **Description**

The **Get Attributes** command reads specified attribute settings and ranges for specified channels of the addressed module.

## Syntax

!E[*positions*]{[*attrMask*][*rangeMask*] pairs}

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that attributes and/or range are to be set for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

{[*attrMask*][*rangeMask*][*settings*] triplets}

For each "1" bit in the [*positions*] field, there must be an [*attrMask*][*rangeMask*] pair. The first pair corresponds to the most significant "1" in the [*positions*] field, and so on. This command can contain up to 16 pairs, one for each channel represented by a "1" in the [*positions*] field.

[*attrMask*] Four ASCII-hex characters specify attributes to be read. The most significant bit corresponds to attribute 15, and the least significant bit corresponds to attribute 0. A "1" in any bit means that the corresponding attribute is targeted. A zero in any bit means that the corresponding attribute is not targeted.

[*rangeMask*] One ASCII-hex character indicates whether or not the command reads the range. A "1" means that the range is targeted. A zero means that the range is not targeted.

## Success Response

### A{[settings] array}

{[settings] array} The response contains one [settings] array for each "1" in the [positions] field. The first array corresponds to the most significant "1" in the [positions] field, and so on. The response can contain up to 16 [settings] arrays, one for each channel targeted by the [positions] field.

[settings] Two ASCII-hex characters correspond to each "1" in the preceding [attrMask] field. If the value in the [rangeMask] field is a "1," this field contains an additional two-character entry for the range. The first (most significant) entry in this field corresponds to the first "1" in the [attrMask] field, and so on. If this field includes a range entry, the range entry is the last in the field.

Each two-character entry represents a setting ID for a channel attribute or range. The following topics contain definitions of attribute and range IDs for all FieldPoint I/O modules:

[\[c\]FP-AI-100](#)

[\[c\]FP-AI-102](#)

[\[c\]FP-AI-110](#)

[\[c\]FP-AI-111](#)

[cFP-AI-112](#)

[cFP-AI-118](#)

[\[c\]FP-AIO-600](#)

[\[c\]FP-AIO-610](#)

[\[c\]FP-AO-200](#)

[\[c\]FP-AO-210](#)

[\[c\]FP-CTR-500](#)

[\[c\]FP-CTR-502](#)

[\[c\]FP-DI-300](#)

[\[c\]FP-DI-301](#)

[\[c\]FP-DI-304](#)

[\[c\]FP-DI-330](#)

[\[c\]FP-DIO-550](#)

[\[c\]FP-DO-400](#)

[\[c\]FP-DO-401](#)

[\[c\]FP-DO-403](#)

[\[c\]FP-DO-410](#)

[\[c\]FP-PG-522](#)

[\[c\]FP-PWM-520](#)

[\[c\]FP-QUAD-510](#)

[FP-RLY-420](#)

[cFP-RLY-421](#)

[FP-RLY-422](#)

[\[c\]FP-RTD-122](#)

[cFP-RLY-423](#)

[cFP-RLY-425](#)

[\[c\]FP-RTD-124](#)

[\[c\]FP-SG-140](#)

[\[c\]FP-TC-120](#)

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_INV_ATTR	One or more attributes specified in the command either do not exist or do not support the specified setting.
E_INV_RANGE	One or more ranges specified in the command either do not exist or do not support the specified setting.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!E00110000100001[checksum][cr]
```

This command reads the range settings for channels 4 and 0 of the FieldPoint module at address 51 (0x33). The response is as follows:

```
A4411[checksum][cr]
```

The response indicates that channel 4 is set to range 0x44, and channel 0 is set to range 0x11.

## Get Watchdog Info

[cmdchars] = !U

### Description

The **Get Watchdog Info** command returns all watchdog configuration information for the addressed FieldPoint module.

Each FieldPoint module can be configured to respond to or ignore watchdog timeouts. Also, each output channel can be configured to output a specified value in case of watchdog timeouts. If the watchdog is disabled for a module, none of the channels on the module respond to watchdog timeouts.

**Syntax**

!U



## Success Response

A

A[*moduleInfo*][*chnlEnable*][*chnlWdgData*]

[*moduleInfo*] 10 ASCII-hex characters contain the following information:

[*wdgEnabled*] Two ASCII-hex characters form an unsigned byte. A zero indicates that the watchdog is disabled for the module. A "1" indicates that the watchdog is enabled for the module.

[*wdgOccured*] Two ASCII-hex characters form an unsigned byte. A zero indicates that no watchdog timeout has occurred since the watchdog was enabled for the module. A "1" indicates that a watchdog timeout has occurred since the watchdog was enabled for the module.

[*wdgTmo*] Four ASCII-hex characters specify the watchdog timeout value. The timeout value in ms is equal to 10 times the value of [*wdgTmo*].

[*numChnls*] Two ASCII-hex characters specify the number of channels on the module. The command returns one [*chnlWdgData*] for each module channel.

[*chnlEnable*] Four ASCII-hex characters specify the enabled or disabled status of the watchdog for all channels. A "1" in any bit means that the watchdog is enabled for the corresponding channel. A zero in any bit means that the watchdog is disabled for the corresponding channel, that the channel is not an output channel, or that the channel does not exist.

If you send !o!U, [*chnlEnable*] contains eight ASCII-hex characters.

[*chnlWdgData*] Four ASCII-hex characters specify the watchdog output value for each channel. The first four characters correspond to the highest-numbered channel, and so on. If the channel is an output channel corresponding to a "1" bit in [*chnlEnable*], that channel will output the value of [*chnlWdgData*] in case of a watchdog timeout. The command returns a [*chnlWdgData*] for each channel on the module regardless of whether the channel is an output or an input, and regardless of whether watchdog data has been set or stored for the channel.

## **Error Responses**

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!U[checksum][cr]
```

```
A0100020002000101234567[checksum][cr]
```

This response indicates that the watchdog is enabled for the module and no timeout has occurred since the watchdog was enabled (0100); the watchdog timeout value is 5.12 s (0200); the module has two channels (02); the watchdog is enabled only for channel 0 (0001); the watchdog data for channel 1 is 0x0123 and the watchdog data for channel 0 is 0x4567.

The following command gets watchdog information from a 32-channel module:

```
>33!o!U[checksum][cr]
```

The response is as follows:

```
A0101031020FFFFFFFF000100000001000000010001000100000001000000000
```

```
000010000000100010000000000000000100010001000100010001000000000000  
[cr]
```

This response indicates that the watchdog is enabled for the module and a timeout has occurred since the watchdog was enabled (0101); the watchdog timeout value is 7.84 s (0310); the module has 32 channels (20); the watchdog is enabled for all channels (FFFFFFFF); the watchdog output value for channels 0, 1, 2, 9, 10, 11, 14, 16, 17, 18, 21, 22, 24, 28, and 30 is OFF; and the watchdog output value for channels 3, 4, 5, 6, 7, 8, 12, 13, 15, 19, 20, 23, 25, 26, 27, 29, and 31 is ON.

# Hotswap Reporting Mode

[cmdchars] = !b

## Description

The **Hotswap Reporting Mode** command enables or disables reporting of hotswapping of modules in the bank. This command should be sent only to a network module. It returns an error if it is sent to an I/O module.

## Hotswap Reporting

Some applications require notification whenever an I/O module is hotswapped. Hotswap reporting is disabled by default.

If hotswap reporting is enabled for the bank, the first command sent to a hotswapped module causes the bank to send the E\_HOTSWAP response and to ignore the first command. In this way, the E\_HOTSWAP response is similar to the E\_PUCLR\_EXP response.

The hotswap reporting mode is stored in the snapshot information when you use the **Store Snapshot** command. If you want the reporting mode to be restored at power-up, enable the snapshot feature.

## Syntax

`!b[flag]`

[*flag*] One ASCII-hex character represents the hotswap reporting mode. Sending a zero disables reporting; sending a "1" enables reporting.

## **Success Response**

A

## **Error Responses**

E\_BAD\_ADDRESS The addressed module does not support the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

## **Example**

```
>00!b1[checksum][cr]
```

This command instructs the FieldPoint network module at address 0x00 to enable hotswap reporting for the modules in the bank.



## **Read 16-Bit Data**

**[cmdchars] = !F**

### **Description**

The **Read 16-Bit Data** command reads data from targeted analog input and output channels of the addressed FieldPoint module. The command returns data as 16-bit values.

## Syntax

**!F**[*positions*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command reads the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

## Success Response

A[*data*]

[*data*] The command returns four ASCII-hex characters for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.

This command returns "???" for targeted discrete channels.

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!F0003[checksum][cr]
```

This command reads the data values for channels 0 and 1 of the FieldPoint module at address 51 (0x33). The response is as follows:

```
A01234567[checksum][cr]
```

The response indicates that the value on channel 0 is 0x4567 and the value on channel 1 is 0x0123.

## Read 16-Bit Data with Status

[cmdchars] = !G

### Description

The **Read 16-Bit Data with Status** command reads data from targeted analog input and output channels of the addressed FieldPoint module. The command returns data as 16-bit values. Additionally, the command reports the status of targeted channels to enable error checking.

Refer to [How to Interpret Data](#) for information about interpreting and converting data.

Use the **Read Module Status** command or the **Read Channel Status** command for details about an error condition of a bad channel.

## Syntax

**!G**[*positions*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command reads the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

## Success Response

A[*status*][*data*]

[*status*] Four ASCII-hex characters specify the status of all targeted channels. The most significant bit represents channel 15 and the least significant bit represents channel 0. A "1" in any bit means that the status of the corresponding channel is bad, and a zero in any bit means either that the status of the corresponding channel is good or that the corresponding channel was not targeted by the command.

If any channels return "?????" in the [*data*] field, the bits corresponding to those channels in the [*status*] field are meaningless.

[*data*] The command returns four ASCII-hex characters for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.

This command returns "?????" for targeted discrete channels.



**Note** This command returns data values for channels with bad status.



## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!G000B[checksum][cr]
```

This command reads the data values and status for channels 0 and 1 of the FieldPoint module at address 51 (0x33). The response is as follows:

```
A000201234567[checksum][cr]
```

The response indicates that the status of channel 0 is good and the status of channel 1 is bad. The data value of channel 0 is 0x4567 and that of channel 1 is 0x0123.

## **Read All Module IDs**

**[cmdchars] = !B**

### **Description**

The **Read All Module IDs** command reads the number of modules in the bank and the IDs of the network module and all I/O modules. Use the **Read Module ID (!A)** command to read the ID of a single module.

**Syntax**

!B

## Success Response

A[number][mod array]

- [number] Two ASCII-hex characters represent the number of modules in the bank, including the network module.
- [modID] Four ASCII-hex characters represent the ID of each module in the bank. The first four characters represent the ID of the network module, and each subsequent set of four characters corresponds to the module at the next higher address in the bank. The following table lists the module IDs and corresponding module types:

<b>[modID] Value</b>	<b>Module Type</b>
0001	FP-1000
0002	FP-1001
0101	[c]FP-AI-110
0102	[c]FP-AO-200
0103	[c]FP-DI-330
0104	[c]FP-DO-400
0105	[c]FP-DI-301
0106	[c]FP-DO-401
0107	[c]FP-TC-120
0108	FP-RLY-420
0109	[c]FP-DI-300
010A	[c]FP-AI-100
010B	[c]FP-RTD-122
010C	[c]FP-AI-111
010D	[c]FP-CTR-500
010E	[c]FP-PWM-520
010F	[c]FP-AO-210
0110	[c]FP-DO-410
0111	[c]FP-DO-403
0112	[c]FP-RLY-422
0113	[c]FP-PG-522
0114	[c]FP-CTR-502

0115	[c]FP-AI-102
0116	[c]FP-QUAD-510
0217	FP-TB-10
0118	[c]FP-RTD-124
0119	[c]FP-SG-140
011B	[c]FP-AIO-610
011E	[c]FP-AI-112
0121	cFP-RLY-421
0122	cFP-RLY-423
0123	[c]FP-AIO-600
0124	cFP-TC-125
0125	cFP-RLY-425
0126	[c]FP-DIO-550
0127	cFP-AI-118, Normal
0128	cFP-AI-118, Calibration
0129	cFP-DI-304
0300	cFP-180x
FFFF	Empty Base or Slot

## **Error Responses**

E\_NO\_MODULE    There is no module at the specified address.

E\_BAD\_ADDRESS    The addressed module does not support the command.

E\_INV\_LIMS\_GOT    Specified limits invalid for the command.

## Example

```
>00!B[checksum][cr]
```

This command requests that the FieldPoint network module at address 0x00 return the IDs of all the modules in the bank. The response is as follows:

```
A03000101020103[checksum][cr]
```

There are three modules in the bank: an FP-1000 network module (ID 0001), an FP-AO-200 (ID 0102), and an FP-DI-330 (ID 0103).



## **Read Bank Status**

**[cmdchars] = !P**

### **Description**

The **Read Bank Status** command reads the configuration status of the bank connected to the addressed network module.

# Syntax

!P

## Success Response

A[*bank\_status*]

[*bank\_status*] One ASCII-hex character specifies the status of the bank as shown in the following table:

<b>[<i>bank_status</i>] Value</b>	<b>Bank Status</b>
0	All I/O modules are configured.
1	One or more I/O modules are unconfigured.

## **Error Responses**

E\_BAD\_ADDRESS The command is valid, but the addressed module does not support it.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>00!P[checksum][cr]
```

This command queries the network module at address 0x00 for the status of the bank. The response is as follows:

```
A1[checksum][cr]
```

The response indicates that one or more I/O modules in the bank are unconfigured.

## **Read Channel Status**

**[cmdchars] = !O**

### **Description**

The **Read Channel Status** command reads the status of targeted channels of the addressed module.

## Syntax

!O[positions]



**Note** The command character is an uppercase O, not a zero.

[positions] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command reads the status of the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

## Success Response

### A[chnl\_status]

[chnl\_status] One ASCII-hex character specifies the status of each targeted channel. The first character corresponds to the most significant "1" in the [positions] field, and so on. The following table shows the meaning of each [chnl\_status] value:

[chnl_status] Value	Channel Status
0	The channel is configured and the channel status is good.
1	Channel-specific error 1
2	Channel-specific error 2
3	The channel is unconfigured or is processing configuration information.
?	The targeted channel does not exist.

The following table lists channel-specific error messages for FieldPoint I/O modules:

Module Name	[chnl_status] Value	Error Message
[c]FP-AI-100 [c]FP-AI-102 [c]FP-AI-110 [c]FP-AI-111 [c]FP-AI-112 cFP-AI-118	1	Out of Range
[c]FP-AIO-600	1 (Input Channels)	Out of Range
[c]FP-AIO-610	2 (Output Channels)	Overcurrent Protection
[c]FP-AO-200	1	Open Current Loop
[c]FP-AO-210	1	Overcurrent Protection
[c]FP-CTR-500 [c]FP-CTR-502	1	Overflow Since Last Read
[c]FP-DO-410	1	Overcurrent Protection
[c]FP-RTD-122	1	Out of Range
[c]FP-RTD-124	2	Open RTD



[c]FP-SG-140	1	Out of Range
	2	Overcurrent Protection
[c]FP-TC-120 cFP-TC-125	1	Out of Range
	2	Open Thermocouple

## Error Responses

E\_INVALID\_CMD Undefined command.

E\_INSUFF\_CHARS Data field error. An insufficient or incorrect number of characters were received for the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Examples

The following command reads the status of channels 12, 13, 14, and 15 of the FieldPoint module at address 51 (0x33).

```
>33!OF000[checksum][cr]
```

The response is as follows:

```
A??10[checksum][cr]
```

The response indicates that channel 12 has good status, channel 13 has channel-specific error condition, and channels 14 and 15 do not exist.

The following command reads the status of channels 0, 14, 24, 25, 28, 29, 30, and 31 of the FieldPoint module at address 34 (0x22):

```
>22!o!OF3004001[checksum][cr]
```

The response is as follows:

```
A00000000[checksum][cr]
```

The response indicates that all the targeted channels have good status.

## **Read Discrete**

**[cmdchars] = !J**

### **Description**

The **Read Discrete** command reads data from all discrete input and output channels of the addressed FieldPoint module.

## **Syntax**

!J (!o!J for modules with up to 32 channels)

## Success Response

A[*data*]

[*data*] Four ASCII-hex characters specify the channel levels. A "1" in any bit means that the corresponding channel is ON. A zero in any bit means either that the corresponding channel is OFF, that the corresponding channel is analog, or that there is no channel corresponding to that bit.

If you send !o!J, [*data*] contains eight ASCII-hex characters in the response.

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

The following command reads all channels of the FieldPoint module at address 51 (0x33):

```
>33!J[checksum][cr]
```

The response is as follows:

```
A0030[checksum][cr]
```

The response indicates that channels 4 and 5 are ON and all other channels are OFF.

The following command reads all 32 channels of the FieldPoint module at address 34 (0x22):

```
>22!o!J[checksum][cr]
```

This command reads all channels of the FieldPoint module at address 51 (0x33).

The response is as follows:

```
A00200030[checksum][cr]
```

The response indicates that channels 4, 5, and 21 are ON and all other channels are OFF.



## Read Discrete with Status

[cmdchars] = !K

### Description

The **Read Discrete with Status** command reads all discrete input and output channels of the addressed FieldPoint module. Additionally, the command reports the status of channels to enable error checking.

Use the **Read Module Status** command or the **Read Channel Status** command for details about an error condition of a bad channel.

## **Syntax**

!K (!o!K for modules with up to 32 channels)

## Success Response

A[*status*][*data*]

[*status*] Four ASCII-hex characters specify the status of all channels. The most significant bit represents channel 15 and the least significant bit represents channel 0. A "1" in any bit means that the status of the corresponding channel is bad, and a zero in any bit means either that the status of the corresponding channel is good, that the corresponding channel is analog, or that there is no channel corresponding to that bit.

If you send !o!K, [*status*] contains eight ASCII-hex characters in the response.

[*data*] Four ASCII-hex characters specify the channel levels. A "1" in any bit means that the corresponding channel is ON. A zero in any bit means either that the corresponding channel is OFF, that the corresponding channel is analog, or that there is no channel corresponding to that bit.

If you send !o!K, [*data*] contains eight ASCII-hex characters in the response.



**Note** This command returns data values for channels with bad status.

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_INV\_LIMS\_GOT E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

The following command reads all channels of the FieldPoint module at address 51 (0x33):

```
>33!K[checksum][cr]
```

The response is as follows:

```
A000000FF[checksum][cr]
```

The response indicates that all channels have good status; channels 0 to 7 are ON; and channels 8 to 15 are OFF, or the module has only eight discrete channels.

The following command reads all 32 channels of the FieldPoint module at address 34 (0x22):

```
>22!o!K[checksum][cr]
```

The response is as follows:

```
A00000000FF0000FF[checksum][cr]
```

The response indicates that all channels have good status; channels 0 to 7 and 24 to 31 are ON; and channels 8 to 23 are OFF.

# Read Firmware Revision

[cmdchars] = !e

## Description

The **Read Firmware Revision** command returns the firmware revision code for the FieldPoint network module.

# Syntax

!e

## Success Response

A[*revision*]

[*revision*] Four ASCII-hex characters specify the firmware revision.



## **Error Responses**

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>00!e[checksum][cr]
```

This command requests the firmware revision of the FieldPoint network module at address 0. The response is as follows:

```
A0021[checksum][cr]
```

The revision number is 0021. You can find the latest firmware updates by going to [ni.com/support](http://ni.com/support) and selecting **Drivers and Updates»Current Versions»Distributed I/O - FieldPoint**.

## **Read Module ID**

**[cmdchars] = !A**

### **Description**

The **Read Module ID** command reads the ID of the addressed FieldPoint module. Use the **Read All Module IDs (!B)** command to read the IDs of all the modules in a bank.

**Syntax**

!A

## Success Response

A[*modID*]

[*modID*] Four ASCII-hex characters represent the 16-bit module ID.

[ <i>modID</i> ] Value	Module Type
0001	FP-1000
0002	FP-1001
0101	[c]FP-AI-110
0102	[c]FP-AO-200
0103	[c]FP-DI-330
0104	[c]FP-DO-400
0105	[c]FP-DI-301
0106	[c]FP-DO-401
0107	[c]FP-TC-120
0108	FP-RLY-420
0109	[c]FP-DI-300
010A	[c]FP-AI-100
010B	[c]FP-RTD-122
010C	[c]FP-AI-111
010D	[c]FP-CTR-500
010E	[c]FP-PWM-520
010F	[c]FP-AO-210
0110	[c]FP-DO-410
0111	[c]FP-DO-403
0112	[c]FP-RLY-422
0113	[c]FP-PG-522
0114	[c]FP-CTR-502
0115	[c]FP-AI-102
0116	[c]FP-QUAD-510
0217	FP-TB-10
0118	[c]FP-RTD-124
0119	[c]FP-SG-140
011B	[c]FP-AIO-610
011E	[c]FP-AI-112
0121	cFP-RLY-421
0122	cFP-RLY-423
0123	[c]FP-AIO-600
0124	cFP-TC-125

0125	cFP-RLY-425
0126	[c]FP-DIO-550
0127	cFP-AI-118, Normal
0128	cFP-AI-118, Calibration
0129	cFP-DI-304
0300	cFP-180x
FFFF	Empty Base or Slot

## **Error Responses**

E\_NO\_MODULE    There is no terminal base or slot at the specified address.

E\_INV\_LIMS\_GOT    Specified limits invalid for the command.

## Example

```
>33!A[checksum][cr]
```

This command requests the ID of the FieldPoint module at address 51 (0x33).

The response is as follows:

```
A0101[checksum][cr]
```

The module ID is 0x0101. The module is a [c]FP-AI-110.



## **Read Module Status**

**[cmdchars] = !N**

### **Description**

The **Read Module Status** command reads the status of the addressed module.

**Syntax**

!N

## Success Response

A[*mod\_status*]

[*mod\_status*] One ASCII-hex character specifies the status of the addressed module as shown in the following table:

<b>[<i>mod_status</i>] Value</b>	<b>Module Status</b>
0	No Module. The terminal base or backplane slot is empty.
1	Unconfigured Module. The network module has not sent configuration information to the module.
2	Module in Configuration. The module is processing configuration information.
3	Configured Module. The module has been configured and is available on the network.

## **Error Responses**

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

## **Example**

```
>33!N[checksum][cr]
```

This command reads the status of the FieldPoint module at address 51 (0x33).

The response is as follows:

```
A3[checksum][cr]
```

The response indicates that the module is configured and available on the network.

# Read Snapshot Status

[cmdchars] = !Y

## Description

The **Read Snapshot Status** command reads the enabled or disabled status of the Snapshot settings for the bank.

**Syntax**

!Y

## Success Response

A[*status*]

[*status*] One ASCII-hex character indicates whether the Snapshot settings are enabled or disabled, as shown in the following table:

<b>[<i>status</i>] Value</b>	<b>Description</b>
0	Snapshot settings are disabled. If the bank is powered up again, all I/O modules will be initialized to factory default settings.
1	Snapshot settings are enabled. If the bank is powered up again, all I/O modules will be initialized to the Snapshot settings.



## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_BAD\_ADDRESS The addressed module does not support the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_HW\_FAILURE An unrecoverable fault has occurred.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

>00!Y[checksum][cr]

This command reads the status of the Snapshot settings for the bank at address 0x00. The response is as follows:

A1[checksum][cr]

This response indicates that the Snapshot settings are enabled.

## **Resend Last Response**

**[cmdchars] = !c**

### **Description**

The **Resend Last Response** command instructs the addressed module to resend the response to the previous command. This command returns an error if the addressed module is not the module that was addressed by the previous command. You can send this command multiple times.

# Syntax

!c

## **Success Response**

The addressed module resends the last response.

## **Error Responses**

E\_INV\_LIMS\_GOT      Specified limits invalid for the command.

E\_ADDR\_NOT\_SAME    The addressed module is not the one addressed by the previous command.

E\_NO\_RESEND\_BUFF    The response to the previous command is unavailable.

## Example

```
>33!c[checksum][cr]
```

This command instructs the FieldPoint module at address 51 (0x33) to resend the response it sent to the previous command.

## **Reset Module**

**[cmdchars] = !Z**

### **Description**

When the **Reset Module** is sent to a network module, it resets all I/O modules in the bank and sets the turnaround delay for all modules to zero. When this command is sent to an I/O module, it resets that module and sets the turnaround delay for that module to zero. In each case, the module or modules are initialized to factory default settings if the Snapshot is disabled, and to Snapshot settings if the Snapshot is enabled.



**Syntax**

!Z

## Success Response

A

## **Error Responses**

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## **Example**

```
>00!Z[checksum][cr]
```

This example resets the FieldPoint module at address 0 (0x00).

## Store 16-Bit Watchdog Data

[cmdchars] = !S

### Description

The **Set 16-Bit Watchdog Data** command sets output values for targeted analog output channels of the addressed FieldPoint module. The output channels will output the specified values if the watchdog timer expires.

## Syntax

**!S**[*positions*][*wdgData*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command sets an output value for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

[*wdgData*] Four ASCII-hex characters specify the output value for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.

## **Success Response**

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## Example

```
>33!S000C01234567[checksum][cr]
```

This command sets watchdog output values for channels of the FieldPoint module at address 51 (0x33). If the watchdog timer expires, channel 2 will output the value 0x4567 and channel 3 will output the value 0x1234.

## **Set Attributes**

**[cmdchars] = !D**

### **Description**

The **Set Attributes** command sets the levels that channels of the addressed FieldPoint module will output if the watchdog timer expires. This command can be sent only to analog modules.

## Syntax

**!D***[positions]*{*[attrMask]**[rangeMask]**[settings]* triplets}

*[positions]* Four ASCII-hex characters specify the channels to be configured. A "1" in any bit means that attributes and/or range are to be set for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

{*[attrMask]**[rangeMask]**[settings]* triplets}

For each "1" bit in the *[positions]* field, there must be an *[attrMask]**[rangeMask]**[settings]* triplet. The first triplet corresponds to the most significant "1" in the *[positions]* field, and so on. This command can contain up to 16 triplets, one for each channel represented by a "1" in the *[positions]* field.

*[attrMask]* Four ASCII-hex characters specify attributes to be set. The most significant bit corresponds to attribute 15, and the least significant bit corresponds to attribute 0. A "1" in any bit means that the corresponding attribute is targeted. A zero in any bit means that the corresponding attribute is not targeted. If an attribute is targeted, an entry for it must appear in the *[settings]* field of this triplet.

*[rangeMask]* One ASCII-hex character indicates whether or not the command sets a range. A "1" means that the range is targeted. A zero means that the range is not targeted. If the range is targeted, an entry for it must appear in the *[settings]* field of this triplet.

*[settings]* Two ASCII-hex characters correspond to each "1" in the preceding *[attrMask]* field. If the value in the *[rangeMask]* field is a "1," this field must contain an additional two-character entry for the range. The first (most significant) entry in this field corresponds to the first "1" in the *[attrMask]* field, and so on. If this field includes a range entry, the range entry is the last in the field.

Each two-character entry represents a setting ID for a channel attribute or range. The following topics contain definitions of attribute and range IDs for all FieldPoint I/O modules:

[\[c\]FP-AI-100](#)

[\[c\]FP-AI-102](#)

[\[c\]FP-AI-110](#)

[\[c\]FP-AI-111](#)

[cFP-AI-112](#)

[cFP-AI-118](#)

[\[c\]FP-AIO-600](#)

[\[c\]FP-AIO-610](#)

[\[c\]FP-AO-200](#)

[\[c\]FP-AO-210](#)

[\[c\]FP-CTR-500](#)

[\[c\]FP-CTR-502](#)

[\[c\]FP-DI-300](#)

[\[c\]FP-DI-301](#)

[\[c\]FP-DI-304](#)

[\[c\]FP-DI-330](#)

[\[c\]FP-DIO-550](#)

[\[c\]FP-DO-400](#)

[\[c\]FP-DO-401](#)

[\[c\]FP-DO-403](#)

[\[c\]FP-DO-410](#)

[\[c\]FP-PG-522](#)

[\[c\]FP-PWM-520](#)

[\[c\]FP-QUAD-510](#)

[FP-RLY-420](#)

[cFP-RLY-421](#)

[FP-RLY-422](#)

[\[c\]FP-RTD-122](#)

[cFP-RLY-423](#)

[cFP-RLY-425](#)

[\[c\]FP-RTD-124](#)

[\[c\]FP-SG-140](#)

[\[c\]FP-TC-120](#)

## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_INV_ATTR	One or more attributes specified in the command either do not exist or do not support the specified setting.
E_INV_RANGE	One or more ranges specified in the command either do not exist or do not support the specified setting.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!D0001000112244[checksum][cr]
```

This command sets attribute 0 and the range for channel 0 of the FieldPoint module at address 51 (0x33). Attribute 0 is set to 0x22 and the range is set to 0x44.

## **Set Discrete Watchdog Data**

**[cmdchars] = !R**

### **Description**

The **Set Discrete Watchdog Data** command sets output levels for targeted discrete output channels of the addressed FieldPoint module. The output channels will output the specified levels if the watchdog timer expires.

## Syntax

`!R[positions][wdgData]`

Use `!o!R` for modules with up to 32 channels.

*[positions]* Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command stores an output level for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send `!o!R`, *[positions]* must contain eight ASCII-hex characters.

*[wdgData]* Four ASCII-hex characters specify the levels that targeted channels must output if the bank watchdog timer expires. A "1" in any bit means ON. A zero in any bit means OFF. The command ignores bits corresponding to untargeted channels.

If you send `!o!R`, *[wdgData]* must contain eight ASCII-hex characters.



## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

The following command sets watchdog output levels for channels of the FieldPoint module at address 51 (0x33). If the watchdog timer expires, channels 0, 1, 2, and 3 will be turned OFF and channels 4, 5, 6, and 7 will be turned ON.

```
>33!R00FF00F0[checksum][cr]
```

The following command sets watchdog output levels for channels 0, 14, 24, 25, 28, 29, 30, and 31 of the FieldPoint module at address 34 (0x22). If the watchdog timer expires, channels 0, 14, 25, 28, 29, 30, and 31 will be turned ON and channel 24 will be turned OFF.

```
>22!o!RF3004001F2004001[checksum][cr]
```

## **Set Watchdog Data Status**

**[cmdchars] = !T**

### **Description**

The **Set Watchdog Data Status** command enables or disables the watchdog for targeted output channels of the addressed FieldPoint module. This command is part of the channel setup for the watchdog. You should store watchdog data for the channels using the (!i) and (!j) commands before sending this command.

## Syntax

**!T**[*positions*][*mask*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command sets the enabled or disabled status for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send !o!T, [*positions*] must contain eight ASCII-hex characters.

[*mask*] Four ASCII-hex characters specify the enabled or disabled status of the watchdog for each channel. A "1" in any bit means that the watchdog is enabled for the corresponding channel. A zero in any bit means that the watchdog is disabled for the corresponding channel. The command ignores bits corresponding to untargeted channels.

If you send !o!T, [*mask*] must contain eight ASCII-hex characters.

## Success Response

A

## Error Responses

- E\_INVALID\_CMD Undefined command.
- E\_INSUFF\_CHARS Data field error. An insufficient or incorrect number of characters were received for the command.
- E\_INV\_LIMS\_GOT Specified limits invalid for the command.
- E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).
- E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

The following command enables the watchdog for channels 0, 1, and 4 of the FieldPoint module at address 51 (0x33). All other channels are unaffected.

```
>33!T001300FF[checksum][cr]
```

The following command enables the watchdog for channels 0, 1, 4, 17, and 22 of the FieldPoint module at address 34 (0x22). All other channels are unaffected.

```
>22!o!T0042001300420013[checksum][cr]
```



## Set Watchdog Delay

[cmdchars] = !Q

### Description

The **Set Watchdog Delay** command sets the timeout value for the FieldPoint bank watchdog timer. If the command is addressed to an I/O module, it enables or disables the watchdog for that module. Use the **Set Discrete Watchdog Data (!R)** command or the **Set 16-Bit Watchdog Data (!S)** command before using this command.

## Syntax

**!Q**[*wdgTmo*]

[*wdgTmo*] Four ASCII-hex characters specify the watchdog timeout value. The result of this command depends on the value of [*wdgTmo*] and on whether the command is sent to a network module or an I/O module. The timeout value in ms is equal to 10 times the value of [*wdgTmo*].

## Success Response

A

## **Command Sent to Network Module**

If  $[wdgTmo] \geq 20$ , the watchdog timeout value for the bank is  $10 \times [wdgTmo]$  ms and the watchdog is enabled for the bank. If  $[wdgTmo] = 0$ , the watchdog is disabled for the bank. If  $0 < [wdgTmo] < 20$ , the command returns an error.

## Command Sent to I/O Module

Sending the command to an I/O module does not affect the watchdog timeout value for the bank. If  $[wdgTmo] \geq 20$ , the watchdog is enabled for the targeted I/O module. If  $[wdgTmo] = 0$ , the targeted I/O module is unaffected by watchdog timeouts. If  $0 < [wdgTmo] < 20$ , the command returns an error.

If  $[wdgTmo]$  is unspecified, the default value is zero and the targeted module is unaffected by watchdog timeouts.



**Note** This command does not affect watchdog settings for individual channels. If you disable the watchdog for a module and want to enable it again, send this command to the module with a valid  $[wdgTmo]$  value. When the watchdog is enabled again for the module, all stored watchdog output values for the module will also be enabled.

## Error Responses

E\_INSUFF\_CHARS Data field error. An insufficient or incorrect number of characters were received for the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>00!Q0015[checksum][cr]
```

This command sets the watchdog timeout value for the bank to 210 ms and starts the watchdog timer.

```
>33!Q0021[checksum][cr]
```

This command enables the watchdog for the I/O module at address 51 (0x33). If output channels on the module have watchdog output values configured, they will output those values in the event of a watchdog timeout.

## Store 16-Bit Data

[cmdchars] = !g

### Description

The **Store 16-Bit Data** command stores output values in nonvolatile memory for use as powerup settings for targeted analog output channels.

Refer to [How to Interpret Data](#) for information about interpreting and converting data.



## Syntax

**!g**[*positions*][*data*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command stores an output value for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

[*data*] This field should contain four ASCII-hex characters for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.

## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!g000301234567[checksum][cr]
```

This command stores the output value 0x4567 for channel 0 and the output value 0x0123 for channel 1 of the FieldPoint module at address 51 (0x33).

## Store 16-Bit Watchdog Data

[cmdchars] = !j

### Description

The **Store 16-Bit Watchdog Data** command stores output levels in nonvolatile memory for targeted analog output channels of the addressed FieldPoint module. The output channels will output the stored output levels if the watchdog timer expires.

## Syntax

!j[*positions*][*wdgData*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command stores an output for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

[*wdgData*] Four ASCII-hex characters specify the output value for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.

## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## Example

```
>33!j000C01234567[checksum][cr]
```

This command stores output values for channels 2 and 3 of the FieldPoint module at address 51 (0x33). If the watchdog timer expires, channel 2 will output the value 0x4567 and channel 3 will output the value 0x1234.

# Store Attributes

[cmdchars] = !f

## Description

The **Store Attributes** command stores specified channel attribute and range settings in nonvolatile memory for use as powerup settings.

## Syntax

!*[positions]*{*[attrMask]**[rangeMask]**[settings]* triplets}

*[positions]* Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that attributes and/or range are to be stored for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

{*[attrMask]**[rangeMask]**[settings]* triplets}

For each "1" bit in the *[positions]* field, there must be an *[attrMask]**[rangeMask]**[settings]* triplet. The first triplet corresponds to the most significant "1" in the *[positions]* field, and so on. This command can contain up to 16 triplets, one for each channel represented by a "1" in the *[positions]* field.

*[attrMask]* Four ASCII-hex characters specify attributes to be set. The most significant bit corresponds to attribute 15, and the least significant bit corresponds to attribute 0. A "1" in any bit means that the corresponding attribute is targeted. A zero in any bit means that the corresponding attribute is not targeted. If an attribute is targeted, an entry for it must appear in the *[settings]* field of this triplet.

*[rangeMask]* One ASCII-hex character indicates whether or not the command sets a range. A "1" means that the range is targeted. A zero means that the range is not targeted. If the range is targeted, an entry for it must appear in the *[settings]* field of this triplet.

*[settings]* Two ASCII-hex characters correspond to each "1" in the preceding *[attrMask]* field. If the value in the *[rangeMask]* field is a "1," this field must contain an additional two-character entry for the range. The first (most significant) entry in this field corresponds to the first "1" in the *[attrMask]* field, and so on. If this field includes a range entry, the range entry is the last in the field.

Each two-character entry represents a setting ID for a channel attribute or range. The following topics contain definitions of attribute and range IDs for all FieldPoint I/O modules:

[\[c\]FP-AI-100](#)

[\[c\]FP-AI-102](#)

[\[c\]FP-AI-110](#)

[\[c\]FP-AI-111](#)

[cFP-AI-112](#)

[cFP-AI-118](#)

[\[c\]FP-AIO-600](#)

[\[c\]FP-AIO-610](#)

[\[c\]FP-AO-200](#)

[\[c\]FP-AO-210](#)

[\[c\]FP-CTR-500](#)

[\[c\]FP-CTR-502](#)

[\[c\]FP-DI-300](#)

[\[c\]FP-DI-301](#)

[\[c\]FP-DI-304](#)

[\[c\]FP-DI-330](#)

[\[c\]FP-DIO-550](#)

[\[c\]FP-DO-400](#)

[\[c\]FP-DO-401](#)

[\[c\]FP-DO-403](#)

[\[c\]FP-DO-410](#)

[\[c\]FP-PG-522](#)

[\[c\]FP-PWM-520](#)

[\[c\]FP-QUAD-510](#)

[FP-RLY-420](#)

[cFP-RLY-421](#)

[FP-RLY-422](#)

[\[c\]FP-RTD-122](#)

[cFP-RLY-423](#)

[cFP-RLY-425](#)

[\[c\]FP-RTD-124](#)

[\[c\]FP-SG-140](#)

[\[c\]FP-TC-120](#)

## **Success Response**

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_INV_ATTR	One or more attributes specified in the command either do not exist or do not support the specified setting.
E_INV_RANGE	One or more ranges specified in the command either do not exist or do not support the specified setting.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!f0001000110204[checksum][cr]
```

This command stores settings for attribute 0 and the range for channel 0 of the FieldPoint module at address 51 (0x33). Attribute 0 is set to 0x02 and the range is set to 0x04. Assuming that the module is an FP-AI-110, the settings are for noise rejection of 500 Hz and a range of 0–10.4 V.

# Store Discrete

[cmdchars] = !h

## Description

The **Store Discrete** command stores data in nonvolatile memory for use as powerup settings for specified discrete output channels.

Refer to [How to Interpret Data](#) for information about interpreting and converting data.

## Syntax

`!h[positions][data]`

Use `!o!h` for modules with 32 channels.

*[positions]* Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command stores a value for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send `!o!h`, *[positions]* must contain eight ASCII-hex characters.

Targeting an input channel, an analog channel, or a channel that does not exist causes the command to return an error.

*[data]* Four ASCII-hex characters specify all of the output levels to be stored. A "1" in any bit means ON. A zero in any bit means OFF.

If you send `!o!h`, *[data]* must contain eight ASCII-hex characters.



## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!h0001FFFF[checksum][cr]
```

This command stores an ON level for channel 0 of the FieldPoint module at address 51 (0x33). Note that all other "1" bits are ignored because the command does not target the corresponding channels.

```
>22!o!h00010001FFFFFFFF[checksum][cr]
```

This command stores ON levels for channels 0 and 16 of the FieldPoint module at address 34 (0x22). Note that all other "1" bits are ignored because the command does not target the corresponding channels.

## **Store Discrete Watchdog Data**

**[cmdchars] = !i**

### **Description**

The **Store Discrete Watchdog Data** command stores output levels in nonvolatile memory for targeted discrete output channels of the addressed FieldPoint module. The output channels will output the stored output levels if the watchdog timer expires.

## Syntax

`!i[positions][wdgData]`

*[positions]* Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command stores an output level for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send `!o!i`, *[positions]* must contain eight ASCII-hex characters.

*[wdgData]* Four ASCII-hex characters specify the levels that targeted channels must output if the bank watchdog timer expires. A "1" in any bit means ON. A zero in any bit means OFF. The command ignores bits corresponding to untargeted channels.

If you send `!o!i`, *[wdgData]* must contain eight ASCII-hex characters.

## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!i00FF00F0[checksum][cr]
```

This command stores output levels for channels of the FieldPoint module at address 51 (0x33). If the watchdog timer expires, channels 0, 1, 2, and 3 will be turned OFF and channels 4, 5, 6, and 7 will be turned ON.

```
>22!o!i003000FF001000F0[checksum][cr]
```

This command stores output levels for channels of the FieldPoint module at address 34 (0x22). If the watchdog timer expires, channels 0, 1, 2, 3, and 21 will be turned OFF and channels 4, 5, 6, 7, and 20 will be turned ON.



# Store Snapshot

[cmdchars] = !W

## Description

The **Store Snapshot** command saves all current ranges, attributes, output values, and watchdog settings for all channels in the bank to nonvolatile memory. It also saves the hotswap reporting mode and the turnaround delay for the bank. If the Snapshot feature is enabled, the bank will use the saved settings on future powerups.

This command does not save the watchdog timeout value for the bank. To save the timeout value, use the *Store Watchdog Delay* (!V) command.

This command returns an error if it is sent to a non-network module.

**Syntax**

!W

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_BAD\_ADDRESS The addressed module does not support the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_HW\_FAILURE An unrecoverable fault has occurred.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>00!W[checksum][cr]
```

This command stores the current ranges, attributes, output values, and watchdog settings for all channels in the bank at address 0x00, as well as the hotswap reporting mode and turnaround delay for the bank.

## Store Watchdog Data Status

[cmdchars] = !k

### Description

The **Store Watchdog Data Status** command stores the enabled or disabled watchdog status in nonvolatile memory for targeted output channels of the addressed FieldPoint module. To enable or disable the watchdog for an entire module, use the **Store Watchdog Enable (!)** command.

## Syntax

!k[*positions*][*mask*]

Use !o!k for modules with 32 channels.

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command stores the enabled or disabled status for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send !o!k, [*positions*] must contain eight ASCII-hex characters.

[*mask*] Four ASCII-hex characters specify the enabled or disabled status of the watchdog for all channels. A "1" in any bit means that the watchdog is enabled for the corresponding channel. A zero in any bit means that the watchdog is disabled for the corresponding channel. The command ignores bits corresponding to untargeted channels.

If you send !o!k, [*mask*] must contain eight ASCII-hex characters.

## Success Response

A



## Error Responses

- E\_INVALID\_CMD Undefined command.
- E\_INSUFF\_CHARS Data field error. An insufficient or incorrect number of characters were received for the command.
- E\_INV\_LIMS\_GOT Specified limits invalid for the command.
- E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).
- E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!k001300FF[checksum][cr]
```

This command enables the watchdog for channels 0, 1, and 4 of the FieldPoint module at address 51 (0x33). All other channels are unaffected.

```
>22!o!k00100013FFFFFFFF[checksum][cr]
```

This command enables the watchdog for channels 0, 1, 4, and 20 of the FieldPoint module at address 34 (0x22). All other channels are unaffected.

## **Store Watchdog Delay**

**[cmdchars] = !V**

### **Description**

The **Store Watchdog Delay** command sets the value for the FieldPoint bank watchdog timer.

## Syntax

**!V[wdgTmo]**

[wdgTmo] Four ASCII-hex characters specify the powerup watchdog timeout value. The timeout value in ms is equal to 10 times the value of [wdgTmo].

If [wdgTmo]  $\geq$  20, the watchdog timeout value for the bank is 10 X [wdgTmo] ms and the watchdog is enabled for the bank. If [wdgTmo] = 0, the watchdog is disabled for the bank. If  $0 < [wdgTmo] < 20$ , the command returns an error.

## Success Response

A

## Error Responses

E\_INVALID\_CMD Undefined command.

E\_BAD\_ADDRESS The addressed module does not support the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).

E\_HW\_FAILURE An unrecoverable fault has occurred.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>00!V0200[checksum][cr]
```

This command stores the watchdog timeout value 0x200 (5.12 s) for the network module at address 0x00. If the Snapshot feature is enabled and the bank undergoes a power cycle, the watchdog timeout value will be set to 5.12 s.

## **Store Watchdog Enable**

**[cmdchars] = !l**

### **Description**

The **Store Watchdog Enable** command stores the enabled or disabled watchdog status in nonvolatile memory for the addressed FieldPoint module. To enable or disable the watchdog for an entire bank, use the **Store Watchdog Delay (!V)** command. To enable or disable the watchdog for individual channels, use the **Store Watchdog Data Status (!k)** command.



## Syntax

!![*wdgTmo*]



**Note** The command character is a lowercase l, not an uppercase I.

[*wdgTmo*] Four ASCII-hex characters specify the watchdog timeout value. The timeout value in ms is equal to 10 times the value of [*wdgTmo*].

If [*wdgTmo*]  $\geq 20$ , the watchdog timeout value for the bank is 10 X [*wdgTmo*] ms. If [*wdgTmo*] = 0, the targeted module is unaffected by watchdog timeouts, and the timeout value for the bank is unaffected. If  $0 < [\textit{wdgTmo}] < 20$ , the command returns an error.

If [*wdgTmo*] is unspecified, the default value is zero and the targeted module is unaffected by watchdog timeouts.

## Success Response

A

## Error Responses

E\_INSUFF\_CHARS Data field error. An insufficient or incorrect number of characters were received for the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_ILLEGAL\_DIGIT One or more characters in the command could not be properly converted to a digit (hex or decimal).

E\_NO\_MODULE There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!l0021[checksum][cr]
```

This command stores the watchdog timeout value 210 ms and enables the watchdog for the FieldPoint module at address 51 (0x33).

## **Use Snapshot**

**[cmdchars] = !X**

### **Description**

The **Use Snapshot** command enables or disables Snapshot settings for the bank.

## Syntax

**!X[*flag*]**

[*flag*] One ASCII-hex character indicates whether the command enables or disables the Snapshot settings as follows:

- 0 Disables the Snapshot settings. If the bank is powered up again, all I/O modules will be initialized to factory default settings.
- 1 Enables the Snapshot settings. If the bank is powered up again, all I/O modules will be initialized to the Snapshot settings.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_BAD\_ADDRESS The addressed module does not support the command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

E\_HW\_FAILURE An unrecoverable fault has occurred.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## **Example**

>00!X1[*checksum*][*cr*]

This command enables the Snapshot settings for the bank at address 0x00.

## Write 16-Bit Data

[cmdchars] = !H

### Description

The **Write 16-Bit Data** command writes output values to targeted output channels of the addressed FieldPoint module.

Refer to [How to Interpret Data](#) for information about interpreting and converting data.

## Syntax

**!H**[*positions*][*data*]

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command writes a value to the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

[*data*] Four ASCII-hex characters specify the output value for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.

## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!H000301234567[checksum][cr]
```

This command writes the output value 0x4567 to channel 0 and the output value 0x0123 to channel 1 of the FieldPoint module at address 51 (0x33).

## Write 16-Bit Data with Status

[cmdchars] = !I

### Description

The **Write 16-Bit Data with Status** command writes output values to targeted analog output channels of the addressed FieldPoint module. The command also returns the status of targeted channels to enable error checking.

Use the **Read Module Status** (!N) command or the **Read Channel Status** (!O) command for details about an error condition of a bad channel.

Refer to [How to Interpret Data](#) for information about interpreting and converting data.

## Syntax

!*I*[*positions*][*data*]



**Note** The command character is an uppercase I, not a lowercase L.

[*positions*] Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command writes a value to the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

[*data*] Four ASCII-hex characters specify the output value for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

Each set of four characters represents an unsigned 16-bit number.



## Success Response

A[*status*]

[*status*] Four ASCII-hex characters specify the status of all targeted channels. The most significant bit represents channel 15 and the least significant bit represents channel 0. A "1" in any bit means that the status of the corresponding channel is bad, and a zero in any bit means either that the status of the corresponding channel is good or that the corresponding channel was not targeted by the command.

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33!I000301234567[checksum][cr]
```

This command writes the output value 0x4567 to channel 0 and the output value 0x0123 to channel 1 of the FieldPoint module at address 51 (0x33). The command also requests the status of the channels. The response is as follows:

```
A0003[checksum][cr]
```

The response indicates that both channels have bad status.

## **Write Discrete**

**[cmdchars] = !L**

### **Description**

The **Write Discrete** command drives targeted discrete output channels ON or OFF on the addressed FieldPoint module.

## Syntax

`!L[positions][data]`

Use `!o!L` for modules with 32 channels.

*[positions]* Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command writes to the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send `!o!L`, *[positions]* must contain eight ASCII-hex characters.

Targeting an input channel or a channel that does not exist causes the command to return an error.

*[data]* Four ASCII-hex characters specify all of the output levels to be written. A "1" in any bit means ON. A zero in any bit means OFF. The command ignores bits that correspond to untargeted channels.

If you send `!o!L`, *[data]* must contain eight ASCII-hex characters.

## Success Response

A

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

The following command turns channel 0 ON on the FieldPoint module at address 51 (0x33). Note that all the other "1" bits in *[data]* are ignored.

```
>33!L0001FFFF[checksum][cr]
```

The following command turns channel 17 ON on the FieldPoint module at address 51 (0x33). Note that all the other "1" bits in *[data]* are ignored.

```
>33!o!L00020000FFFFFFFF[checksum][cr]
```



## Write Discrete with Status

[cmdchars] = !M

### Description

The **Write Discrete with Status** command drives targeted discrete output channels ON or OFF on the addressed FieldPoint module. The command also returns the status of targeted channels to enable error checking.

Use the **Read Module Status (!N)** command or the **Read Channel Status (!O)** command for details about an error condition of a bad channel.

## Syntax

`!M[positions][data]`

Use `!o!M` for modules with 32 channels.

*[positions]* Four ASCII-hex characters specify the targeted channels. A "1" in any bit means that the command writes to the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If you send `!o!M`, *[positions]* must contain eight ASCII-hex characters.

Targeting an input channel or a channel that does not exist causes the command to return an error.

*[data]* Four ASCII-hex characters specify all of the output levels to be written. A "1" in any bit means ON. A zero in any bit means OFF. The command ignores bits that correspond to untargeted channels.

If you send `!o!M`, *[data]* must contain eight ASCII-hex characters.

## Success Response

A

[*status*] Four ASCII-hex characters specify the status of all targeted channels. The most significant bit represents channel 15 and the least significant bit represents channel 0. A "1" in any bit means that the status of the corresponding channel is bad, and a zero in any bit means either that the status of the corresponding channel is good or that the corresponding channel was not targeted by the command.

If you send !o!M, [*status*] contains eight ASCII-hex characters in the response.

## Error Responses

E_INVALID_CMD	Undefined command.
E_INSUFF_CHARS	Data field error. An insufficient or incorrect number of characters were received for the command.
E_INV_LIMS_GOT	Specified limits invalid for the command.
E_ILLEGAL_DIGIT	One or more characters in the command could not be properly converted to a digit (hex or decimal).
E_INV_CHNL	One or more channels specified in the command either do not exist or do not support the specified operation.
E_NO_MODULE	There is no module at the specified address.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

The following command turns channel 0 OFF on the FieldPoint module at address 51 (0x33). The command also reads the status of channel 0.

```
>33!M00010000[checksum][cr]
```

The response is as follows:

```
>A0000[checksum][cr]
```

The response indicates that the channel status is good.

The following command turns channel 17 ON on the FieldPoint module at address 51 (0x33). Note that all the other "1" bits in [data] are ignored.

```
>33!o!M00020000FFFFFFFF[checksum][cr]
```

The response is as follows:

```
>A00000000[checksum][cr]
```

The response indicates that the channel status is good.

# Standard Optomux Commands

National Instruments recommends using the FieldPoint extended commands whenever possible. The cFP-180x supports only the extended commands and the [Power Up Clear](#) command.

Standard commands accept [*positions*] masks that do not address any channels. Extended commands do not accept such [*positions*] masks.

Command Name	Command Syntax	Success Response
<b>Utility Commands</b>		
<a href="#">Power Up Clear</a>	A	A
<a href="#">Reset</a>	B	A
<b>Configuration Commands</b>		
<a href="#">Configure As Inputs</a>	H[ <i>positions</i> ]	A
<a href="#">Configure As Outputs</a>	I[ <i>positions</i> ]	A
<a href="#">Configure Positions</a>	G[ <i>positions</i> ]	A
<a href="#">Identify Optomux Type</a>	F	A[ <i>type</i> ]
<a href="#">Read Module Configuration</a>	j	A[ <i>config</i> ]
<a href="#">Set Turnaround Delay</a>	C[ <i>data</i> ]	A
<b>Watchdog Commands</b>		
<a href="#">Enhanced Discrete Watchdog</a>	m[ <i>positions</i> ][ <i>wdgTmo</i> ]	A
<a href="#">Set Analog Watchdog Data</a>	m[ <i>positions</i> ][ <i>data</i> ]	A
<a href="#">Set Analog Watchdog Delay</a>	D[ <i>positions</i> ][ <i>wdgTmo</i> ]	A
<b>Discrete Commands</b>		
<a href="#">Activate Outputs</a>	K[ <i>positions</i> ]	A
<a href="#">Deactivate Outputs</a>	L[ <i>positions</i> ]	A
<a href="#">Read ON/OFF Status</a>	M	A[ <i>data</i> ]
<a href="#">Write Outputs</a>	J[ <i>positions</i> ]	A
<b>Analog Commands</b>		
<a href="#">Read Analog Inputs</a>	L[ <i>positions</i> ]	A[ <i>data</i> ]
<a href="#">Read Analog Outputs</a>	K[ <i>positions</i> ]	A[ <i>data</i> ]
<a href="#">Update Analog Outputs</a>	S[ <i>positions</i> ][ <i>data</i> ]	A
<a href="#">Write Analog Outputs</a>	J[ <i>positions</i> ][ <i>data</i> ]	A

## Activate Outputs

[cmdchars] = K

### Recommended Extended Commands

National Instruments recommends that you use the [Write Discrete \(!L\)](#) extended command or the [Write Discrete with Status \(!M\)](#) extended command instead of the **Activate Outputs** command.

## **Description**

The **Activate Outputs** command drives targeted output channels ON on the addressed FieldPoint module.



## Syntax

K[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit turns the corresponding output ON. A zero in any bit means that the corresponding channel is unaffected.

If [*positions*] contains one to three characters, the channels corresponding to missing bits are unaffected.

If [*positions*] is empty, the command supplies "FFFF" for the value.

This command does not affect input channels.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33K55CC[checksum][cr]
```

This command turns outputs 2, 3, 6, 7, 8, 10, 12, and 14 ON on the FieldPoint module at address 51 (0x33). All other channels are unaffected.

# Enhanced Discrete Watchdog

[cmdchars] = m

## Recommended Extended Commands

National Instruments recommends that you use either the [Set Watchdog Delay](#) (!Q), the [Set Discrete Watchdog Data](#) (!R), or the [Set Watchdog Data Status](#) (!T) extended command, instead of the **Enhanced Discrete Watchdog** command.

## Description

The **Enhanced Discrete Watchdog** command sets the timeout value for the FieldPoint bank watchdog and determines the ON/OFF status for each channel in case of a timeout. This command works only for discrete FieldPoint modules.



**Note** All modules in a FieldPoint bank share a common timeout value. The timeout value for the bank is always the most recent timeout value specified for a module in the bank. For more flexibility, use the recommended extended commands.

## Syntax

m[*positions*][*wdgTmo*]

[*positions*] Four ASCII-hex characters specify the ON/OFF status of all channels in case of a watchdog timeout. A "1" in any bit means that the corresponding channel will be turned ON if the watchdog timer expires. A zero in any bit means that the corresponding channel will be turned OFF if the watchdog timer expires.

This command has no effect on input channels.

[*wdgTmo*] Zero to four ASCII-hex characters set the timeout value. The timeout value in ms is equal to 10 times the value of [*wdgTmo*].

If [*wdgTmo*]  $\geq 20$ , the watchdog timeout value for the bank is 10 X [*wdgTmo*] ms. If [*wdgTmo*] = 0, the targeted module is unaffected by watchdog timeouts, and the timeout value for the bank is unaffected. If  $0 < [\textit{wdgTmo}] < 20$ , the command returns an error.

If [*wdgTmo*] is unspecified, the default value is zero and the targeted module is unaffected by watchdog timeouts.

## Success Response

A



## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33m0A841F4[checksum][cr]
```

This command sets the watchdog timeout value for the bank to 5 s, configures channels 2, 7, 9, and 11 to turn ON in case of a timeout, and configures all other channels to turn OFF in case of a timeout.

## **Configure as Inputs**

**[cmdchars] = H**

### **Description**

The **Configure as Inputs** command verifies that the specified channels of the addressed FieldPoint module are inputs. You do not need to use this command before reading from module channels. This command does not change the direction of channels; it only verifies the direction.

## Syntax

H[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit means that the corresponding channel is expected to be an input. A zero in any bit means that the corresponding channel is not to be verified.

If [*positions*] contains one to three characters, the channels corresponding to missing bits are not verified.

If [*positions*] is empty, the command supplies "FFFF" for the value.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## **Example**

```
>33H5[checksum][cr]
```

This command verifies that channels 0 and 2 on the FieldPoint module at address 51 (0x33) are inputs.

# Configure as Outputs

[cmdchars] = I

## Description

The **Configure as Outputs** command verifies that the specified channels of the addressed FieldPoint module are outputs. You do not need to use this command before writing to module channels. This command does not change the direction of channels; it only verifies the direction.



## Syntax

I[*positions*]



**Note** The command character is an uppercase I, not a lowercase L.

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit means that the corresponding channel is expected to be an output. A zero in any bit means that the corresponding channel is not to be verified.

If [*positions*] contains one to three characters, the channels corresponding to missing bits are not verified.

If [*positions*] is empty, the command supplies "FFFF" for the value.

## **Success Response**

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33I5[checksum][cr]
```

This command verifies that channels 0 and 2 on the FieldPoint module at address 51 (0x33) are outputs.

# Configure Positions

[cmdchars] = G

## Description

The **Configure Positions** command verifies whether the specified channels of the addressed FieldPoint module are inputs or outputs. You do not need to use this command before reading or writing to module channels. This command does not change the direction of channels; it only verifies the direction.

## Syntax

G[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit means that the corresponding channel is expected to be an output. A zero in any bit means that the corresponding channel is expected to be an input.

If [*positions*] contains one to three characters, the channels corresponding to missing bits are not verified.

If [*positions*] is empty, the command supplies "FFFF" for the value.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## Example

```
>33G1133[checksum][cr]
```

This command instructs the FieldPoint module at address 51 (0x33) to verify that channels 0, 1, 4, 5, 8, and 12 are outputs. All other channels are expected to be inputs.

## Deactivate Outputs

[cmdchars] = L

### Recommended Extended Commands

National Instruments recommends that you use the [Write Discrete \(!L\)](#) extended command or the [Write Discrete with Status \(!M\)](#) extended command instead of the **Deactivate Outputs** command.

## **Description**

The **Deactivate Outputs** command drives outputs OFF on targeted outputs of the addressed FieldPoint module.

## Syntax

L[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit turns the corresponding output OFF. A zero in any bit means that the corresponding output is unaffected.

If [*positions*] contains one to three characters, the channels corresponding to missing bits are unaffected.

If [*positions*] is empty, the command supplies "FFFF" for the value.

This command does not affect input channels.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## **Example**

>33L6[checksum][cr]

This command turns output channels 1 and 2 OFF on the FieldPoint module at address 51 (0x33).

# Identify Optomux Type

[cmdchars] = F

## Description

The **Identify Optomux Type** command returns the type of the addressed FieldPoint module. This command returns an error if you send it to a module that has both digital and analog channels.



# Syntax

F

## Success Response

A[*type*]

[*type*] Specifies the module type as shown in the following table:

<b>Value</b>	<b>Module Type</b>
00	Discrete (digital) module; responds to the discrete Optomux commands.
01	Analog module; responds to the analog Optomux commands.

## **Error Responses**

Refer to [FieldPoint Responses](#) for possible error responses, error numbers, and error descriptions.

## **Example**

>33F[*checksum*][cr]

This command reads the type of the FieldPoint module at address 51 (0x33).

A0161[cr]

This response identifies an analog FieldPoint module. 61 is the checksum.

# Power Up Clear

[cmdchars] = A

## Description

This command should be sent to all network and I/O modules in the system after a power cycle and before any other commands. This command prevents FieldPoint modules from returning error 00, power-up clear expected (E\_PONCLR\_EXP).

This command functions only if it is the first command sent after power-up. If this command is sent to a module after the first command has been sent, the module responds with a success response. A power-up clear expected error is returned if any other command is sent first. After a power-up clear expected error is returned this command does not need to be sent; the next command executes normally.

This command has no effect on the FieldPoint module operation or setup; the power-up clear expected error provides an indication to the host that there has been a power failure and that the FieldPoint module has been reset to power-up configuration.

# Syntax

A

## Success Response

A

## **Error Responses**

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## **Example**

>33A[*checksum*][cr]

This example sends Power Up Clear to the FieldPoint module at address 51 (0x33).

# Read Analog Inputs

[cmdchars] = L

## Recommended Extended Commands

National Instruments recommends that you use the [Read 16-Bit Data](#) (!F) extended command or the [Read 16-Bit Data with Status](#) (!G) extended command instead of the **Read Analog Inputs** command.

## **Description**

The **Read Analog Inputs** command reads the levels of the targeted channels on the addressed FieldPoint module. The command returns a 12-bit value for each output. The command reads the most significant 12 bits of channels that have greater than 12-bit resolution. For 16-bit resolution, you must use the extended commands.

## Syntax

L[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit means that the command reads the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If [*positions*] contains one to three characters, the command does not read channels corresponding to missing bits.

If [*positions*] is empty, the command supplies "FFFF" for the value.

## Success Response

*A[data]*

[*data*] The command returns four ASCII-hex characters for each targeted channel. The first four characters specify the value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

The first character in each set of four characters is a "1". The next three characters specify a 12-bit value between 0x000 (0 decimal) and 0xFFF (4095 decimal). 0x000 represents the zero level (or the full-scale negative value for bipolar ranges), and 0xFFF represents the full-scale level.

This command returns "???" for targeted output channels.

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33L5[checksum][cr]
```

This command reads the values for channels 0 and 2 of the FieldPoint module at address 51 (0x33). The response is as follows:

```
A10001888[checksum][cr]
```

The response indicates that the value on is 0x1000 and the value on channel 0 is 0x1888. Discount the 0x1000 offset for each value to determine the actual input values: 0x000 (0 decimal) for channel 2 and 0x0888 (2184 decimal) for channel 0.

# Read Analog Outputs

[cmdchars] = K

## Recommended Extended Commands

National Instruments recommends that you use the [Read 16-Bit Data](#) (!F) extended command or the [Read 16-Bit Data with Status](#) (!G) extended command instead of the **Read Analog Outputs** command.



## **Description**

The **Read Analog Outputs** command reads the output levels of the targeted channels on the addressed FieldPoint module. The command returns a 12-bit value for each output. The command reads the most significant 12 bits of channels that have greater than 12-bit resolution. For 16-bit resolution, you must use the extended commands.

## Syntax

K[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit means that the command reads the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

This command does not affect input channels.

If [*positions*] contains one to three characters, the command does not read channels corresponding to missing bits.

If [*positions*] is empty, the command supplies "FFFF" for the value.

## Success Response

A[*data*]

[*data*] Three ASCII-hex characters specify a 12-bit value for each targeted channel. The first three characters specify the output value for the channel corresponding to the most significant "1" in the [*positions*] field, and so on.

This command returns "???" for targeted input channels.

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33K380[checksum][cr]
```

This command reads the values for channels 7, 8, and 9 of the FieldPoint module at address 51 (0x33). The response is as follows:

```
A000BE2???[checksum][cr]
```

The response indicates that channel 9 has an output value of 0x000, channel 8 has an output value of 0xBE2, and channel 7 is configured as an input.

# Read Module Configuration

[cmdchars] = j

## Description

The **Read Module Configuration** command reads the current direction (input or output) of all channels of the addressed FieldPoint module.

# Syntax

j

## Success Response

A[*config*]

[*config*] Four ASCII-hex characters specify the directions of the channels of the module. A "1" in any bit means that the corresponding channel is configured as an output. A zero in any bit means that the corresponding channel is configured as an input.

This command returns a zero for any bit that does not correspond to a channel. For example, if the command is sent to an eight-channel module, it returns configuration data for the lowest eight bits and zeros for the highest eight bits.



## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33j[checksum][cr]
```

This command is sent to a 16-channel FieldPoint module at address 51 (0x33).

The response is as follows:

```
A0000[checksum][cr]
```

The response indicates that all 16 channels are configured as inputs.

## **Read ON/OFF Status**

**[cmdchars] = M**

### **Recommended Extended Commands**

National Instruments recommends that you use the [Read Discrete \(!J\)](#) extended command or the [Read Discrete with Status \(!K\)](#) extended command instead of the **Read ON/OFF Status** command.

## **Description**

The **Read ON/OFF Status** command reads the ON/OFF status of all channels of the addressed FieldPoint module.

**Syntax**

M

## Success Response

A[*data*]

[*data*] Four ASCII-hex characters specify the levels of all module channels. A "1" in any bit means that the corresponding channel is ON. A zero in any bit means that the corresponding channel is OFF.

This command returns a zero for any bit that does not correspond to a channel. For example, if the command is sent to an eight-channel module, it returns ON/OFF status for the lowest eight bits and only zeros for the highest eight bits.

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33M[checksum][cr]
```

This command reads the ON/OFF status of all channels of the FieldPoint module at address 51 (0x33). The response is as follows:

```
A0AC2[checksum][cr]
```

The response indicates that channels 1, 6, 7, 9, and 11 are ON and all other channels are OFF.



# Reset

[cmdchars] = B

## Recommended Extended Command

National Instruments recommends that you use the [Reset Module \(!Z\)](#) extended command instead of the **Reset** command.

## **Description**

The Reset command resets all of the operating characteristics of the addressed FieldPoint module to power-up conditions. If the SnapShot feature is enabled, the user-defined power-up settings are automatically written to the FieldPoint module. Otherwise, the FieldPoint module is initialized with its factory default settings. By default, turn-around delay and watchdog are disabled.

# Syntax

B

## Success Response

A

## **Error Responses**

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## **Example**

```
>33B[checksum][cr]
```

This example resets the FieldPoint module at address 51 (0x33) to power-up conditions.

## Set Analog Watchdog Data

[cmdchars] = m

### Recommended Extended Commands

National Instruments recommends that you use the [Set 16-Bit Watchdog Data](#) (!R) extended command instead of the **Set Analog Watchdog Data** command.

## **Description**

The **Set Analog Watchdog Data** command sets the levels that channels of the addressed FieldPoint module will output if the watchdog timer expires. This command can be sent only to analog modules.



## Syntax

m[*positions*][*data*]

[*positions*] Four ASCII-hex characters specify the channels to be configured with an output value. A "1" in any bit means that the command sets an output value for the corresponding channel. A zero in any bit means that the corresponding channel is not targeted.

If this command targets an input channel, the FieldPoint module responds with an error.

[*data*] Three ASCII-hex characters specify a 12-bit value for each targeted channel. The range of values is from 0x000 (0 decimal) to 0xFFF (4095 decimal). 0x000 represents the zero output level (or the full-scale negative value for bipolar ranges), and 0xFFF represents the full-scale output level.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33m0081A20555[checksum][cr]
```

This command instructs the FieldPoint module at address 51 (0x33) to output the value 0xA20 (2592 decimal) on channel 7 and the value 0x555 (1365 decimal) on channel 0 if a watchdog timeout occurs.

# Set Analog Watchdog Delay

[cmdchars] = D

## Recommended Extended Commands

National Instruments recommends that you use the [Set Watchdog Delay](#) (!Q) extended command or the [Set Watchdog Data Status](#) (!T) extended command instead of the **Set Analog Watchdog Delay** command.

## Description

The **Set Analog Watchdog Delay** command sets the timeout value for the FieldPoint bank watchdog. It can also enable channels to take predetermined actions if the watchdog timer expires.



**Note** All modules in a FieldPoint bank share a common timeout value. The timeout value for the bank is always the most recent timeout value specified for a module in the bank. For more flexibility, use the recommended extended commands.

## Syntax

D[*positions*][*wdgTmo*]

[*positions*] Four ASCII-hex characters specify the channels. A "1" in any bit means that the corresponding channel will output a predetermined value if the watchdog timer expires. A zero in any bit means that the corresponding channel is not targeted.

This command has no effect on input channels.

[*wdgTmo*] Zero to four ASCII-hex characters set the timeout value. The timeout value in ms is equal to 10 times the value of [*wdgTmo*].

If [*wdgTmo*]  $\geq 20$ , the watchdog timeout value for the bank is 10 X [*wdgTmo*] ms. If [*wdgTmo*] = 0, the targeted module is unaffected by watchdog timeouts, and the timeout value for the bank is unaffected. If  $0 < [\textit{wdgTmo}] < 20$ , the command returns an error.

If [*wdgTmo*] is unspecified, the default value is zero and the targeted module is unaffected by watchdog timeouts.

## Success Response

A



## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

```
>33D00011F4[checksum][cr]
```

This example sets the watchdog timeout value for the FieldPoint bank to 5 s and enables channel 0 of the module at address 51 (0x33) to respond to a watchdog timeout with the predetermined output value.

## **Set Turnaround Delay**

**[cmdchars] = C**

### **Description**

The **Set Turnaround Delay** command tells the FieldPoint module to wait for a specified time before responding to commands sent from the host.

## Syntax

C[*data*]

[*data*] Specifies the delay time as shown in the following table:

<b>[<i>data</i>] Value</b>	<b>Delay</b>
0	No Delay
1	10 ms
2	100 ms
3	500 ms

If you do not specify a delay time, the delay time is zero (no delay).

## Success Response

A

## **Error Responses**

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## **Example**

```
>33C2[checksum][cr]
```

This example sets the turnaround delay of the FieldPoint module at address 51 (0x33) to 100 ms.

# Update Analog Outputs

[cmdchars] = S

## Recommended Extended Commands

National Instruments recommends that you use the [Write 16-Bit Data \(!H\)](#) extended command or the [Write 16-Bit Data with Status \(!I\)](#) extended command instead of the **Update Analog Outputs** command.



## **Description**

The **Update Analog Outputs** command sets the targeted channels on the addressed module to specified output levels. Each output level is represented by a 12-bit value. If the targeted module has 16-bit resolution, use the extended commands.

## Syntax

S[*positions*][*data*]

[*positions*] Four ASCII-hex characters specify the channels. A "1" in any bit means that the command sets the corresponding channel to an output level specified by [*data*]. A zero in any bit means that the corresponding channel is unaffected.

This command does not affect input channels.

[*data*] Three ASCII-hex characters specify a 12-bit value for each targeted output channel. The first three characters specify the value for the channel corresponding to the most significant "1" in [*data*], and so on. The range of values is from 0x000 (0 decimal) to 0xFFF (4095 decimal). 0x000 represents the zero output level (or the full-scale negative value for bipolar ranges), and 0xFFF represents the full-scale output level.

## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

33S0224FFF0C01F0[*checksum*][*cr*]

This command instructs the FieldPoint module at address 51 (0x33) to write 0x1F0 to channel 2, 0x0C0 to channel 5, and 0xFFF to channel 9.

# Write Analog Outputs

[cmdchars] = J

## Recommended Extended Commands

National Instruments recommends that you use the [Write 16-Bit Data \(!H\)](#) extended command or the [Write 16-Bit Data with Status \(!I\)](#) extended command instead of the **Write Analog Outputs** command. The extended commands provide more flexibility. For example, they enable you to write to some channels and leave other channels unaffected.

## **Description**

The **Write Analog Outputs** command sets the targeted channels on the addressed module to a single specified output level. The output level is a 12-bit value, and all targeted output channels are set to that level. If the targeted module has 16-bit resolution, use the extended commands.

## Syntax

J[*positions*][*data*]

[*positions*] Four ASCII-hex characters specify the channels. A "1" in any bit means that the command sets the corresponding channel to a level specified by [*data*]. A zero in any bit means that the corresponding channel is unaffected.

This command does not affect input channels.

[*data*] Three ASCII-hex characters specify a 12-bit value for all targeted output channels. The range of values is from 0x000 (0 decimal) to 0xFFF (4095 decimal). 0x000 represents the zero output level (or the full-scale negative value for bipolar ranges), and 0xFFF represents the full-scale output level.



## Success Response

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.

## Example

For this example, channels 0 and 1 of the FieldPoint module at address 51 (0x33) are configured for the 0–5 V range. The command sets the output of the channels to 1.25 V. Calculate the *[data]* field as follows:

$$(1.25 \text{ V} - 0 \text{ V}) / 5 \text{ V} * 4095 = 1024 \text{ decimal} = 400 \text{ hex}$$

The following command sets the output level of channels 0 and 1 to 1.25 V:

```
>33J0003400[checksum][cr]
```

# Write Outputs

[cmdchars] = J

## Recommended Extended Commands

National Instruments recommends that you use the [Write Discrete \(!L\)](#) extended command or the [Write Discrete with Status \(!M\)](#) extended command instead of the **Write Outputs** command. The extended commands provide more flexibility. For example, they enable you to write to any or all channels and leave any other channels unaffected.

## **Description**

The **Write Outputs** command drives outputs ON or OFF on the addressed FieldPoint module.

## Syntax

### J[*positions*]

[*positions*] Zero to four ASCII-hex characters specify the channels. A "1" in any bit turns the corresponding output ON. A zero in any bit turns the corresponding output OFF.

This command does not affect input channels.

If [*positions*] contains one to three characters, the channels corresponding to missing bits are unaffected.

If [*positions*] is empty, the command supplies "FFFF" for the value.

## **Success Response**

A

## **Error Responses**

E\_INVALID\_CMD Undefined command.

E\_INV\_LIMS\_GOT Specified limits invalid for the command.

Refer to [FieldPoint Responses](#) for other possible error responses, error numbers, and error descriptions.



## **Example**

```
>33J0[checksum][cr]
```

This command turns outputs 0, 1, 2, and 3 OFF on the FieldPoint module at address 51 (0x33). Outputs 4–15 are unaffected.

## **[c]FP-AI-100**

### **Attributes**

The [c]FP-AI-100 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
07 (Analog Input Channels)	024 mA	00
	3.524 mA	01
	±24 mA	02
	±6 V	05
	06 V	06
	±1.2 V	07
	01.2 V	08
	018 V	0E
	±36 V	0F
	036 V	11
	±18 V	12

## **Commands**

The [c]FP-AI-100 does not support any commands.

## **[c]FP-AI-102**

### **Attributes**

The [c]FP-AI-102 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Input Channels)	±20 V	14
	060 V	15
	±60 V	16
	0120 V	17
	±120 V	18

## **Commands**

The [c]FP-AI-102 does not support any commands.

# [c]FP-AI-110

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0-7 (Analog Input Channels)	Noise Rejection	0001	60 Hz	00
			50 Hz	01
			500 Hz	02



## Ranges

Positions	Range	[settings] Value
0-7 (Analog Input Channels)	021 mA	00
	3.521 mA	01
	±21 mA	02
	±10.4 V	03
	010.4 V	04
	±5.2 V	05
	05.2 V	06
	±1.04 V	07
	0-1.04 V	08
	±325 mV	09
	±65 mV	0A

## **Commands**

The [c]FP-AI-110 does not support any commands.

# [c]FP-AI-111

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0–15 (Analog Input Channels)	Noise Rejection	0001	60 Hz	00
			50 Hz	01
			500 Hz	02

## Ranges

Positions	Range	[settings] Value
015 (Analog Input Channels)	021 mA	00
	3.521 mA	01
	±21 mA	02

## **Commands**

The [c]FP-AI-111 does not support any commands.

# cFP-AI-112

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0–15 (Analog Input Channels)	Noise Rejection	0001	60 Hz	00
			50 Hz	01
			500 Hz	02

## Ranges

Positions	Range	[settings] Value
0–15 (Analog Input Channels)	$\pm 10.4$ V	03
	010.4 V	04
	$\pm 5.2$ V	05
	05.2 V	06
	$\pm 1.04$ V	07
	0-1.04 V	08
	$\pm 325$ mV	09
	$\pm 65$ mV	0A

## **Commands**

The cFP-AI-112 does not support any commands.



# cFP-AI-118

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0-7 (Analog Input Channels)	Noise Rejection	0001	10 Hz	0B
			None	FE

## Ranges

Positions	Range	[settings] Value
0-7 (Analog Input Channels)	$\pm 10.4$ V	03
	010.4 V	04
	$\pm 5.2$ V	05
	05.2 V	06
	$\pm 1.04$ V	07
	0-1.04 V	08
	0-18 V	0E
	$\pm 18$ V	12

## **Commands**

The cFP-AI-118 does not support any commands.

## **[c]FP-AIO-600**

### **Attributes**

The [c]FP-AIO-600 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
03 (Input Channels)	024 mA	00
	3.524 mA	01
	±24 mA	02
	±12 V	03
	0-12 V	04
	±6 V	05
	06 V	06
	018 V	0E
	±36 V	0F
	036 V	11
	±18 V	12
47 (Output Channels)	3.521 mA	01

## **Commands**

The [c]FP-AIO-600 does not support any commands.

## **[c]FP-AIO-610**

### **Attributes**

The [c]FP-AIO-610 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0-3 (Input Channels)	024 mA	00
	3.524 mA	01
	±24 mA	02
	±12 V	03
	0-12 V	04
	±6 V	05
	06 V	06
	018 V	0E
	±36 V	0F
	036 V	11
	±18 V	12
4-7 (Output Channels)	±12 V	03
	012 V	04



## **Commands**

The [c]FP-AIO-610 does not support any commands.

## **[c]FP-AO-200**

### **Attributes**

The [c]FP-AO-200 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Output Channels)	021 mA	00
	3.521 mA	01

## **Commands**

The [c]FP-AO-200 does not support any commands.

## **[c]FP-AO-210**

### **Attributes**

The [c]FP-AO-210 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Output Channels)	010.2 V	04

## **Commands**

The [c]FP-AO-210 does not support any commands.

# [c]FP-CTR-500

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0–7 (Count Input Channels)	Terminal Count	0003	065535	0000-FFFF
	Clock Source	0004	External Count Input	00
			Previous Channel	01
			1 khz Reference	02
			32 kHz Reference	03
	Gate Source	0008	Gate Input 0	00
			Gate Input 1	01
			Gate Input 2	02
			Gate Input 3	03
			Always Disabled	04
			Always Enabled	05
	Read Reset Mode	0010	Don't Reset on Read	00
			Reset on Read	01
	Noise Rejection	0020	200 Hz	03
			50 kHz	04
12–15 (Discrete Output Channels)	Output Source	0001	Counter 0	00
			Counter 1	01
			Counter 2	02
			Counter 3	03
			Counter 4	04
			Counter 5	05
			Counter 6	06
			Counter 7	07
			Discrete Data	08
	Output Mode	0002	Toggle, Reset Off	00
			Toggle, Reset On	01
			On Pulse	02
			Off Pulse	03



## Ranges

<b>Positions</b>	<b>Range</b>	<b>[settings] Value</b>
0–7 (Count Input Channels)	065535 Counts	40
8–11 (Discrete Input Channels)	Boolean	10
12–15 (Discrete Output Channels)	Boolean	10

## Commands

Positions	Command Type	[command type] Value	Command	[command] Value
0–7 (Count Input Channels)	Control	0001	Reset	01
			Increment	02

# [c]FP-CTR-502

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0–7 (Count Input Channels)	Terminal Count	0003	065535	0000-FFFF
	Clock Source	0004	External Count Input	00
			Previous Channel	01
			1 khz Reference	02
			32 kHz Reference	03
	Gate Source	0008	Gate Input 0	00
			Gate Input 1	01
			Gate Input 2	02
			Gate Input 3	03
			Always Disabled	04
			Always Enabled	05
	Read Reset Mode	0010	Don't Reset on Read	00
			Reset on Read	01
	Noise Rejection	0020	200 Hz	03
50 kHz			04	
12–15 (Discrete Output Channels)	Output Source	0001	Counter 0	00
			Counter 1	01
			Counter 2	02
			Counter 3	03
			Counter 4	04
			Counter 5	05
			Counter 6	06
			Counter 7	07
			Discrete Data	08
	Output Mode	0002	Toggle, Reset Off	00
			Toggle, Reset On	01
			On Pulse	02
			Off Pulse	03

## Ranges

Positions	Range	[settings] Value
0–7 (Count Input Channels)	065535 Counts	40
8–11 (Discrete Input Channels)	Boolean	10
12–15 (Discrete Output Channels)	Boolean	10

## Commands

Positions	Command Type	[command type] Value	Command	[command] Value
0–7 (Count Input Channels)	Control	0001	Reset	01
			Increment	02

## **[c]FP-DI-300**

### **Attributes**

The [c]FP-DI-300 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–8 (Input Channels)	Boolean	10

## **Commands**

The [c]FP-DI-300 does not support any commands.



## **[c]FP-DI-301**

### **Attributes**

The [c]FP-DI-301 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–15 (Input Channels)	Boolean	10

## **Commands**

The [c]FP-DI-301 does not support any commands.

## **[c]FP-DI-304**

### **Attributes**

The [c]FP-DI-304 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–31 (Input Channels)	Boolean	10

## **Commands**

The [c]FP-DI-304 does not support any commands.

## **[c]FP-DI-330**

### **Attributes**

The [c]FP-DI-330 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–8 (Input Channels)	Boolean	10



## **Commands**

The [c]FP-DI-330 does not support any commands.

## **[c]FP-DIO-550**

### **Attributes**

The [c]FP-DIO-550 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0-3 (Discrete Input Channels)	Boolean	10
4-7 (Discrete Output Channels)	Boolean	10

## **Commands**

The [c]FP-DIO-550 does not support any commands.

## **[c]FP-DO-400**

### **Attributes**

The [c]FP-DO-400 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10

## **Commands**

The [c]FP-DO-400 does not support any commands.

## **[c]FP-DO-401**

### **Attributes**

The [c]FP-DO-401 does not support any attributes.



## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10

## **Commands**

The [c]FP-DO-401 does not support any commands.

## **[c]FP-DO-403**

### **Attributes**

The [c]FP-DO-403 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10

## **Commands**

The [c]FP-DO-403 does not support any commands.

## **[c]FP-DO-410**

### **Attributes**

The [c]FP-DO-410 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10

## **Commands**

The [c]FP-DO-410 does not support any commands.



# [c]FP-PG-522

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0-7 (Count Input Channels)	Pulse Mode	0001	Finite	00
			Continuous	01
	On Time	0006	1-65535	0001-FFFF
	Off Time	0018	0-65535	0000-FFFF
	Resolution	0020	100 $\mu$ s	00
			10 ms	01
1 s			02	

## Ranges

<b>Positions</b>	<b>Range</b>	<b>[settings] Value</b>
0–7 (Count Input Channels)	065535 Counts	40
8–15 (Discrete Input Channels)	Boolean	10

## Commands

Positions	Command Type	[command type] Value	Command	[command] Value
0-7 (Count Input Channels)	Control	0001	Stop Immediately	03
			Stop After Current Pulse	04
	Generate Pulses	0006	1-65535	0001-FFFF

# [c]FP-PWM-520

## Attributes

<b>Positions</b>	<b>Attribute Name</b>	<b>[attrMask] Value</b>	<b>Attribute Setting</b>	<b>[settings] Value</b>
0–7 (Analog Output Channels)	Period	0003	1–65535 ms	0001–FFFF

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Output Channels)	0100%	38

## **Commands**

The [c]FP-PWM-520 does not support any commands.

## **[c]FP-QUAD-510**

All addresses are decimal. All byte values are hexadecimal.

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0–3 (Count Input Channels)	Reset Mode	0001	Don't Reset on Index	00
			Reset on Index	01



## Ranges

Positions	Range	[settings] Value
0–3 (Count Input Channels)	065535 Counts	40
4–7 (Count Input Channels)	065535 Counts	40
8–11 (Analog Input Channels)	±160 count/μs	50
	±80 count/μs	51
	±40 count/μs	52
	±20 count/μs	53
	±10 count/μs	54
	±5 count/μs	55
	±2.5 count/μs	56
	±1.25 count/μs	57
12–15 (Discrete Input Channels)	Boolean	10

## Commands

Positions	Command Type	[command type] Value	Command	[command] Value
0–3 (Count Input Channels)	Control	0001	Reset	01

## **FP-RLY-420**

### **Attributes**

The FP-RLY-420 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10

## **Commands**

The FP-RLY-420 does not support any commands.

## **cFP-RLY-421**

### **Attributes**

The cFP-RLY-421 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10

## **Commands**

The cFP-RLY-421 does not support any commands.



## **FP-RLY-422**

### **Attributes**

The FP-RLY-422 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–3 (Discrete Output Channels)	Boolean	10

## **Commands**

The FP-RLY-422 does not support any commands.

## **cFP-RLY-423**

### **Attributes**

The cFP-RLY-423 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–3 (Discrete Output Channels)	Boolean	10

## **Commands**

The cFP-RLY-423 does not support any commands.

## **cFP-RLY-425**

### **Attributes**

The cFP-RLY-425 does not support any attributes.

## Ranges

Positions	Range	[settings] Value
0–7 (Discrete Output Channels)	Boolean	10



## **Commands**

The cFP-RLY-425 does not support any commands.

# [c]FP-RTD-122

## Attributes

### Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0-7 (Analog Input Channels)	RTD Type (R0 and TCR)	0001	Pt100, TCR=0.00375	00
			Pt100, TCR=0.00385	01
			Pt100, TCR=0.003911	02
			Pt100, TCR=0.003916	03
			Pt100, TCR=0.003920	04
			Pt100, TCR=0.003928	05
			Pt1000, TCR=0.00375	06
			Pt1000, TCR=0.00385	07
			Pt1000, TCR=0.003911	08
			Pt1000, TCR=0.003916	09
			Pt1000, TCR=0.003920	0A
			Pt1000, TCR=0.003928	0B

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Input Channels)	731123 K	26
	200 to 850 °C	27
	328 to 1562 °F	28
	0400 Ω	30
	04000 Ω	31

## **Commands**

The [c]FP-RTD-122 does not support any commands.

# [c]FP-RTD-124

## Attributes

### Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0-7 (Analog Input Channels)	RTD Type (R0 and TCR)	0001	Pt100, TCR=0.00375	00
			Pt100, TCR=0.00385	01
			Pt100, TCR=0.003911	02
			Pt100, TCR=0.003916	03
			Pt100, TCR=0.003920	04
			Pt100, TCR=0.003928	05

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Input Channels)	731123 K	26
	200 to 850 °C	27
	328 to 1562 °F	28
	0400 Ω	30

## **Commands**

The [c]FP-RTD-124 does not support any commands.

## **[c]FP-SG-140**

All addresses are decimal. All byte values are hexadecimal.



## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0–7 (Analog Input Channels)	Noise Rejection	0001	60 Hz	00
			15 Hz	09
			30 Hz	0A
			240 Hz	0B
	Excitation Voltage	0002	10 V	00
			5 V	01
			2.5 V	02
	Bridge Completion	0004	Half-Bridge Completion OFF	00
			Half-Bridge Completion ON	01

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Input Channels)	$\pm 3.90625$ mV/V	64
	$\pm 7.8125$ mV/V	65
	$\pm 31.25$ mV/V	66
	$\pm 62.5$ mV/V	67

## **Commands**

The [c]FP-SG-140 does not support any commands.

## **[c]FP-TC-120**

All addresses are decimal. All byte values are hexadecimal.

# Attributes

## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value
0-7 (Analog Input Channels)	Thermocouple Type	0001	J	00
			K	01
			T	02
			E	03
			R	04
			S	05
			N	06
			B	07
8 (CJC Analog Input Channel)	CJ Temperature	0001	Internal	00
			0 °C	01
			25 °C	02

## Ranges

Positions	Range	[settings] Value
0–7 (Analog Input Channels)	±50 mV	0A
	±25 mV	0B
	20 to 80 mV	0C
	±100 mV	0D
	02048 K	20
	270 to 1770 °C	21
	454 to 3218 °F	22
8 (CJC Analog Input Channel)	223358 K	23
	-50 to 85 °C	24
	58 to 185 °F	25

## **Commands**

The [c]FP-TC-120 does not support any commands.

## **cFP-TC-125**

All addresses are decimal. All byte values are hexadecimal.



## Attributes

Positions	Attribute Name	[attrMask] Value	Attribute Setting	[settings] Value	
0-7 (Analog Input Channels)	Thermocouple Type	0001	J	00	
			K	01	
			T	02	
			E	03	
			R	04	
			S	05	
			N	06	
			B	07	
	50/60 Hz Filter	0002	On	00	
			Off	01	
8 (CJC Analog Input Channel)	CJ Temperature	0001	Internal	00	
			0 °C	01	
			25 °C	02	
		50/60 Hz Filter	0002	On	00
				Off	01

## Ranges

Positions	Range	[settings] Value
0-7 (Analog Input Channels)	20 to 80 mV	0C
	02048 K	20
	270 to 1770 °C	21
	454 to 3218 °F	22
8 (CJC Analog Input Channel)	223.15358.15 K	23
	-50 to 85 °C	24
	58 to 185 °F	25

## **Commands**

The [c]FP-TC-120 does not support any commands.

# ASCII Chart

Hex	Dec	ASCII	Hex	Dec	ASCII	Hex	Dec	ASCII	Hex	Dec	ASCII
00	0	NUL	20	32	SP	40	64	@	60	96	`
01	1	SOH	21	33	!	41	65	A	61	97	a
02	2	STX	22	34	"	42	66	B	62	98	b
03	3	ETX	23	35	#	43	67	C	63	99	c
04	4	EOT	24	36	\$	44	68	D	64	100	d
05	5	ENQ	25	37	%	45	69	E	65	101	e
06	6	ACK	26	38	&	46	70	F	66	102	f
07	7	BEL	27	39	'	47	71	G	67	103	g
08	8	BS	28	40	(	48	72	H	68	104	h
09	9	HT	29	41	)	49	73	I	69	105	i
0A	10	LF	2A	42	*	4A	74	J	6A	106	j
0B	11	VT	2B	43	+	4B	75	K	6B	107	k
0C	12	FF	2C	44	,	4C	76	L	6C	108	l
0D	13	CR	2D	45	-	4D	77	M	6D	109	m
0E	14	SO	2E	46	.	4E	78	N	6E	110	n
0F	15	SI	2F	47	/	4F	79	O	6F	111	o
10	16	DLE	30	48	0	50	80	P	70	112	p
11	17	DC1	31	49	1	51	81	Q	71	113	q
12	18	DC2	32	50	2	52	82	R	72	114	r
13	19	DC3	33	51	3	53	83	S	73	115	s
14	20	DC4	34	52	4	54	84	T	74	116	t
15	21	NAK	35	53	5	55	85	U	75	117	u
16	22	SYN	36	54	6	56	86	V	76	118	v
17	23	ETB	37	55	7	57	87	W	77	119	w
18	24	CAN	38	56	8	58	88	X	78	120	x
19	25	EM	39	57	9	59	89	Y	79	121	y
1A	26	SUB	3A	58	:	5A	90	Z	7A	122	z
1B	27	ESC	3B	59	;	5B	91	[	7B	123	{
1C	28	FS	3C	60	<	5C	92	\	7C	124	
1D	29	GS	3D	61	=	5D	93	]	7D	125	}
1E	30	RS	3E	62	>	5E	94	^	7E	126	~
1F	31	US	3F	63	?	5F	95	_	7F	127	DEL

# **How to Interpret Data**

## **Discrete Data**

Discrete channels can take either of two values, generically known as asserted and negated states. The asserted state can be described as ON, TRUE, HIGH, HI, and so on, and the negated state can be described as OFF, FALSE, LOW, LO, and so on.

FieldPoint commands use 1 for the asserted state and 0 for the negated state.

## Analog Data

Analog channels can take a range of values between a defined minimum value, *minScale*, and a defined maximum value, *maxScale*. The range setting of the channel defines *minScale* and *maxScale*. For unipolar ranges such as 0–10 V and 3.5–21 mA, *minScale* is the lower end of the range and *maxScale* is the higher end of the range. For bipolar ranges such as ±21 mA, *minScale* is the maximum negative value and *maxScale* is the maximum positive value.

When you write analog data to a channel, you must convert engineering unit values to command data values. When you read analog data from a channel, you must convert the data to engineering unit values.

FieldPoint extended commands use 16-bit values, and FieldPoint standard commands use 12-bit values. The following sections explain how to calculate and convert data values for use with both types of command.

### Converting Data for Use with Extended Commands

This section shows how to convert between engineering unit values and command data values for use with extended FieldPoint commands, which have 16-bit resolution.

Use the following formula to convert an engineering unit value (*EUUV*) to a command data value (*[data]*):

$$[data] = \frac{EUUV - minScale}{maxScale - minScale} * 65535$$

You must convert *[data]* from decimal to hex before you use it in a FieldPoint command.

Use the following formula to convert a data value *[data]* to an engineering unit value (*EUUV*):

$$EUUV = \frac{[data]}{65535} * (maxScale - minScale) + minScale$$

You must convert *[data]* from hex to decimal before you use it in the calculation.

### Writing 4 mA to Channel with Range Setting 3.521 mA

The following example shows how to calculate the hex value that corresponds to 4 mA output on a channel configured for the 3.5–21 mA range:

$$\begin{aligned} [data] &= (4 - 3.5) \div (21 - 3.5) * 65535 \\ &= 1872.43 \\ &= 0x0750 \text{ (rounding down)} \end{aligned}$$

## Writing 10.5 mA to Channel with Range Setting 021 mA

The following example shows how to calculate the hex value that corresponds to 10.5 mA output on a channel configured for the 0–21 mA range:

$$\begin{aligned}[data] &= (10.5 - 0) \div (21 - 0) * 65535 \\ &= 32767.5 \\ &= 0x8000 \text{ (rounding up)} \\ &= 0x7FFF \text{ (rounding down)}\end{aligned}$$

## Reading 0x9000 from Channel with Range Setting ±21 mA

The following example shows how to calculate the engineering unit value that corresponds to a reading of 0x9000 hex from a channel configured for the ±21 mA range:

$$\begin{aligned}0x9000 \text{ hex} &= 36864 \text{ decimal} \\ EUV &= (36864 \div 65535 * (21 - (-21))) + (-21) \\ &= (0.56251 * 42) - 21 \\ &= 2.6254 \text{ mA}\end{aligned}$$

## Reading 0x0788 from Channel with Range Setting 3.521 mA

The following example shows how to calculate the engineering unit value that corresponds to a reading of 0x0788 hex from a channel configured for the 3.5–21 mA range:

$$\begin{aligned}0x0788 \text{ hex} &= 1928 \text{ decimal} \\ EUV &= (1928 \div 65535 * (21 - 3.5)) + 3.5 \\ &= (0.02942 * 17.5) + 3.5 \\ &= 4.0149 \text{ mA}\end{aligned}$$

## Converting Data for Use with Standard FieldPoint Commands

This section shows how to convert between engineering unit values and command data values when using standard FieldPoint commands, which support 12-bit resolution.

Use the following formula to convert an engineering unit value, *DesiredEUV*, to a command data value, *[data]*:

$$[data] = \frac{EUV - minScale}{maxScale - minScale} * 4095$$

You must convert *[data]* from decimal to hex before you use it in a FieldPoint command.

Use the following formula to convert a data value *[data]* to an engineering unit value (*EUV*):

$$EUV = \frac{[data] - 4096}{4095} * (maxScale - minScale) + minScale$$

You must convert [*data*] from hex to decimal before you use it in the calculation.

### **Writing 4 mA to Channel with Range Setting 3.521 mA**

The following example shows how to calculate the hex value that corresponds to 4 mA output on a channel configured for the 3.5–21 mA range:

$$\begin{aligned} [data] &= (4 - 3.5) \div (21 - 3.5) * 4095 \\ &= 117 \\ &= 0x0075 \text{ hex} \end{aligned}$$

### **Writing 10.5 mA to Channel with Range Setting 021 mA**

The following example shows how to calculate the hex value that corresponds to 10.5 mA output on a channel configured for the 0–21 mA range:

$$\begin{aligned} [data] &= (10.5 - 0) \div (21 - 0) * 4095 \\ &= 2047.5 \\ &= 0x0800 \text{ hex (rounding up)} \\ &= 0x07FF \text{ hex (rounding down)} \end{aligned}$$

### **Reading 0x1000 from Channel with Range Setting ±21 mA**

The following example shows how to calculate the engineering unit value that corresponds to a reading of 0x1000 hex from a channel configured for the ±21 mA range:

$$\begin{aligned} 0x1000 \text{ hex} &= 4096 \text{ decimal} \\ EUV &= ((4096 - 4096) \div 4095 * (21 - (-21))) + (-21) \\ &= (0 * 42) - 21 \\ &= 21.000 \text{ mA} \end{aligned}$$

### **Reading 0x1075 from Channel with Range Setting 3.521 mA**

The following example shows how to calculate the engineering unit value that corresponds to a reading of 0x1075 hex from a channel configured for the 3.5–21 mA range:

$$\begin{aligned} 0x1075 \text{ hex} &= 4213 \text{ decimal} \\ EUV &= ((4213 - 4096) \div 4095 * (21 - 3.5)) + 3.5 \\ &= (0.02857 * 17.5) + 3.5 \\ &= 4.000 \text{ mA} \end{aligned}$$