

# FP-DO-403 AND cFP-DO-403

## 16-Channel, 5 to 30 V Sinking Discrete Output Module

These operating instructions describe how to install and use the National Instruments FP-DO-403 and cFP-DO-403 discrete output modules (referred to inclusively as the [c]FP-DO-403). For information about configuring and accessing the [c]FP-DO-403 over a network, refer to the user manual for the FieldPoint network module you are using.

## Features

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The [c]FP-DO-403 is a FieldPoint discrete output module with the following features:

- 16 discrete output channels
- Sinking outputs supply 2 A per channel, 16 A<sup>2</sup> per module
- Compatible with voltages from 5 to 30 VDC
- On/Off LED indicators
- 2,300 V<sub>rms</sub> transient overvoltage protection between the inter-module communication bus and the I/O channels
- -40 to 70 °C operation
- Hot plug-and-play

## Installing the FP-DO-403

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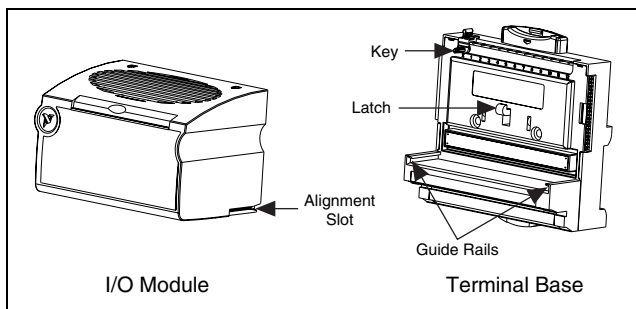
The FP-DO-403 mounts on a FieldPoint terminal base (FP-TB-*x*). Hot plug-and-play enables you to install the FP-DO-403 onto a powered terminal base without disturbing the operation of other modules or terminal bases. The FP-DO-403 receives operating power from the terminal base.

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To install the FP-DO-403, refer to Figure 1 and complete the following steps:

1. Slide the terminal base key to either position X, used for any module, or position 6, used for the FP-DO-403 module.
2. Align the FP-DO-403 alignment slots with the guide rails on the terminal base.
3. Press firmly to seat the FP-DO-403 on the terminal base. When the module is firmly seated, the terminal base latch locks it into place.



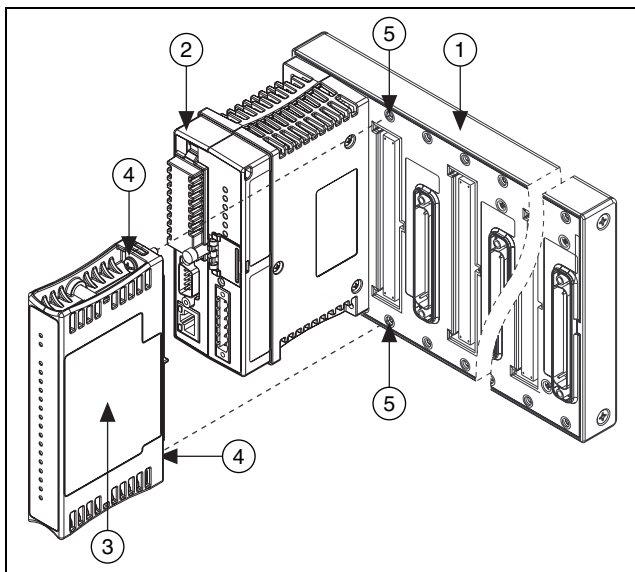
**Figure 1.** Installing the FP-DO-403

## Installing the cFP-DO-403

The cFP-DO-403 mounts on a Compact FieldPoint backplane (cFP-BP-*x*). Hot plug-and-play enables you to install the cFP-DO-403 onto a powered backplane without disturbing the operation of other modules or connector blocks. The cFP-DO-403 receives operating power from the backplane.

To install the cFP-DO-403, refer to Figure 2 and complete the following steps:

1. Align the captive screws on the cFP-DO-403 with the holes on the backplane. The alignment keys on the cFP-DO-403 prevent backward insertion.
2. Press firmly to seat the cFP-DO-403 on the backplane.
3. Using a number 2 Phillips screwdriver with a shank of at least 64 mm (2.5 in.) length, tighten the captive screws to 1.1 N · m (10 lb · in.) of torque. The nylon coating on the screws prevents them from loosening.



- |                         |                  |               |
|-------------------------|------------------|---------------|
| 1 cFP Backplane         | 3 cFP I/O Module | 5 Screw Holes |
| 2 cFP Controller Module | 4 Captive Screws |               |

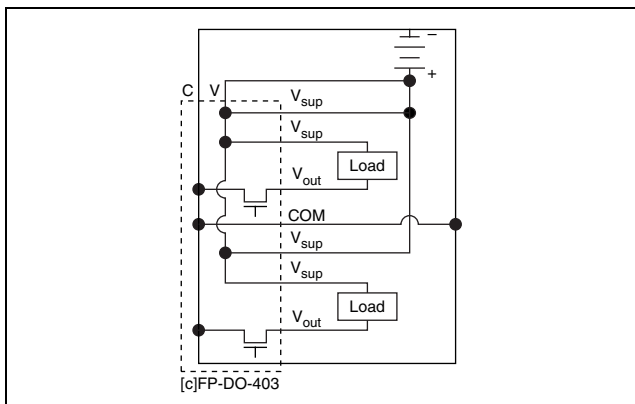
**Figure 2.** Installing the cFP-DO-403

## Wiring the [c]FP-DO-403

The FP-TB-*x* terminal bases have connections for each FP-DO-403 output channel and for an external supply to power field devices. The cFP-CB-*x* connector blocks provide the same connections for the cFP-DO-403.

Each channel has one output terminal,  $V_{out}$ ; a common terminal, COM (internally connected to the C terminal); and a supply terminal,  $V_{sup}$  (internally connected to the V terminal). The  $V_{out}$  terminal sinks current to external devices. Sinking current means the  $V_{out}$  terminal provides a path to the supply common.

National Instruments recommends that you wire the external power supply to the  $V_{sup}$  and COM terminal of the individual channels as shown in Figure 3.

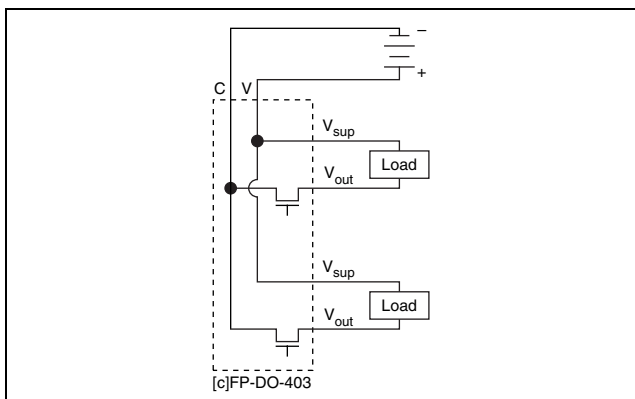


**Figure 3.** Recommended Field Connections

If the total current the [c]FP-DO-403 sinks is less than 5 A, you can connect the external power supply to the V and C terminals on the [c]FP-DO-403 as shown in Figure 4.



**Note** If you are not sure whether the module is sinking less than 5 A, connect the external power supply to the  $V_{sup}$  and COM terminals of the individual channels.



**Figure 4.** Optional Wiring If Total Current Is Less than 5 A

Table 1 lists the terminal assignments for the signals associated with each channel. Terminal assignments and wiring diagrams are also listed on the side panel of the cFP-DO-403 and under the slide-in card on the front of the FP-DO-403 module.

**Table 1.** Terminal Assignments

Chan- nel	Terminal Numbers		
	V <sub>out</sub>	V <sub>sup</sub>	COM
0	1	17	18
1	2	17	18
2	3	19	20
3	4	19	20
4	5	21	22
5	6	21	22
6	7	23	24
7	8	23	24

Chan- nel	Terminal Numbers		
	V <sub>out</sub>	V <sub>sup</sub>	COM
8	9	25	26
9	10	25	26
10	11	27	28
11	12	27	28
12	13	29	30
13	14	29	30
14	15	31	32
15	16	31	32

## Discrete Output Circuit

The [c]FP-DO-403 discrete outputs are sinking outputs that are optically isolated from the inter-module communication bus. In the ON state, a transistor is turned on between the output (V<sub>out</sub>) terminal and the external supply (the C and COM terminals). In the OFF state, this transistor is turned off, allowing only a small leakage current to flow. Choose the impedance of the loads driven by the output channels so that the current supplied by any one channel in the ON state is no more than 2 A, and the total current supplied by all channels at any one time is no more than 16 A<sup>2</sup>.

To determine whether the total current is within the limit, square the current on each channel and add the squares together. If the sum of all the squares is less than or equal to 16 A<sup>2</sup>, the total current is within the limit. In the following example, three channels supply 2 A and four channels supply 1 A each:

$$(2 \text{ A})^2 + (2 \text{ A})^2 + (2 \text{ A})^2 + (1 \text{ A})^2 + (1 \text{ A})^2 + (1 \text{ A})^2 + (1 \text{ A})^2 \leq 16 \text{ A}^2$$



**Caution** The outputs must *not* be short circuited to the potential of the V or V<sub>sup</sub> terminals (the positive voltage of the external supply). Short circuits damage the [c]FP-DO-403 output channels. Check all wiring carefully before applying power.

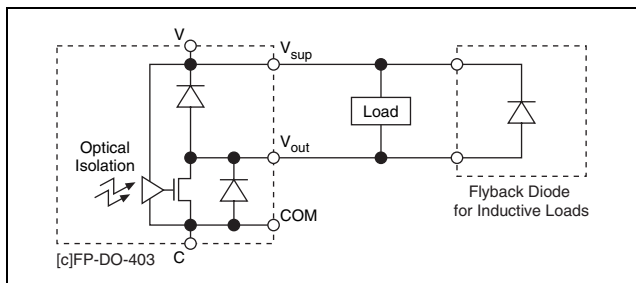
In the ON state, there is an effective resistance of 0.12 Ω between the output (V<sub>out</sub>) and the supply voltage (the C and COM terminals). This resistance causes a voltage drop between the external supply voltage and the output voltage. For example, if the external supply voltage is 5 V and the output current is 1 A, the output voltage is 4.88 V:

$$5 \text{ V} - 1 \text{ A} \times 0.12 \text{ } \Omega = 4.88 \text{ V}$$

## Protection for Inductive Loads

When an inductive load, such as a motor or relay, is connected to an output, a large counter-electromotive force may occur at switching time because of the energy stored in the inductive load. This flyback voltage can damage the outputs and the power supply.

It is best to limit such flyback voltages at the inductive load by installing a flyback diode across the load. Typically, you should mount the flyback diode within 18 in. of the load. Figure 5 shows the discrete-output circuit on one channel. The channel is connected to an external device with a flyback diode.

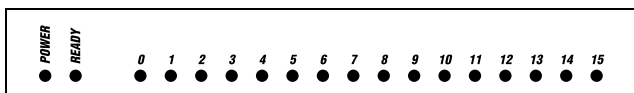


**Figure 5.** Discrete Output Circuit

Even though the [c]FP-DO-403 contains flyback diodes to prevent excessively high voltage from damaging the module, National Instruments recommends the use of an external protection circuit across your inductive load.

# Status Indicators

Figure 6 shows status indicator LEDs on the [c]FP-DO-403.



**Figure 6.** Status Indicators

The [c]FP-DO-403 has two green status LEDs, **POWER** and **READY**. After you insert the FP-DO-403 into a terminal base or the cFP-DO-403 into a backplane and apply power to the connected network module, the green **POWER** indicator lights and the [c]FP-DO-403 informs the network module of its presence. When the network module recognizes the [c]FP-DO-403, it sends initial configuration information to the [c]FP-DO-403. After receiving this initial information, the green **READY** indicator lights and the [c]FP-DO-403 is in normal operating mode.

In addition to the green **POWER** and **READY** indicators, each channel has a numbered, green output state indicator, which lights when the channel is in the ON state.

## Isolation and Safety Guidelines



**Caution** Read the following information before attempting to connect the [c]FP-DO-403 to any circuits that may contain hazardous voltages.

This section describes the isolation of the [c]FP-DO-403 and its compliance with international safety standards. The field wiring connections are isolated from the backplane and the inter-module communication bus. The isolation is provided by the module, which has optical and galvanic isolation barriers designed and tested to protect against transient fault voltages of up to 2,300 V<sub>rms</sub>.

Follow these guidelines to ensure a safe total system:

- The [c]FP-DO-403 has a safety isolation barrier between the I/O channels and the inter-module communication bus. There is no isolation between channels unless otherwise noted. If any of the channels on a module are wired at a hazardous potential, make sure that all other devices or circuits connected to that module are properly insulated from human contact.

- Do *not* share the external supply voltages (the V and C terminals) with other devices (including other FieldPoint devices), unless those devices are isolated from human contact.
- For Compact FieldPoint, you *must* connect the protective earth (PE) ground terminal on the cFP-BP-*x* backplane to the system safety ground. The backplane PE ground terminal has the following symbol stamped beside it:  $\oplus$ . Connect the backplane PE ground terminal to the system safety ground using 14 AWG (1.6 mm) wire with a ring lug. Use the 5/16 in. panhead screw shipped with the backplane to secure the ring lug to the backplane PE ground terminal.
- As with any hazardous voltage wiring, make sure that all wiring and connections meet applicable electrical codes and commonsense practices. Mount terminal bases and backplanes in an area, position, or cabinet that prevents accidental or unauthorized access to wiring that carries hazardous voltages.
- Operate the [c]FP-DO-403 only at or below Pollution Degree 2. Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Refer to the FieldPoint product label for regulatory certification under hazardous location standards. If the FieldPoint product is not certified for operation in hazardous locations, do not operate it in an explosive atmosphere or where there may be flammable gases or fumes.

## Specifications

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These specifications are typical for the range  $-40$  to  $70$  °C unless otherwise noted.

### Input Characteristics

Number of channels .....	16
Output type .....	Sinking
Voltage range .....	5 to 30 VDC
Output impedance .....	0.12 $\Omega$ (0.12 V drop at 1 A)
Maximum output current	
Per channel.....	2 A
Across all channels .....	16 A <sup>2</sup>



Maximum OFF state leakage.....	50 $\mu$ A
Output delay time .....	50 $\mu$ s

## Physical Characteristics

Indicators .....	Green <b>POWER</b> and <b>READY</b> indicators, 16 green output state indicators
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### Weight

FP-DO-403 .....	140 g (4.8 oz)
cFP-DO-403 .....	110 g (3.7 oz)

## Power Requirements

Power from network module .....	600 mW
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## Isolation Voltage

Channel-to-channel isolation.....	No isolation between channels
Transient overvoltage.....	2,300 V <sub>rms</sub>

## Environmental

FieldPoint modules are intended for indoor use only. For outdoor use, FieldPoint modules must be mounted inside a sealed enclosure.

Operating temperature .....	-40 to 70 °C
Storage temperature .....	-55 to 85 °C
Humidity .....	10 to 90% RH, noncondensing
Maximum altitude.....	2,000 m
Pollution Degree .....	2

## Shock and Vibration

Operating shock, panel mount (IEC 68-2-27)	
cFP-DO-403 .....	50 g, 3 ms half sine, 3 shocks; 30 g, 11 ms half sine, 3 shocks
Operating vibration, random (IEC 60068-2-34)	
FP-DO-403 .....	10–500 Hz, 2.2 g <sub>rms</sub>
cFP-DO-403 .....	10–500 Hz, 5 g <sub>rms</sub>

Operating vibration, sinusoidal (IEC 60068-2-6)

FP-DO-403 ..... 10–500 Hz, 5 g

cFP-DO-403 ..... 10–500 Hz, 5 g

## Safety

The [c]FP-DO-403 is designed to meet the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use.

- EN 61010-1, IEC 61010-1
- UL 3121-1
- CAN/CSA C22.2 No. 1010.1

For certifications under regulatory standards, including hazardous location standards, refer to the product label or to [ni.com](http://ni.com).

## Electromagnetic Compatibility

CE, C-Tick, and FCC Part 15 (Class A) Compliant

Electromagnetic emissions ..... EN 55011 Class A at 10 m  
FCC Part 15A above 1 GHz

Electromagnetic immunity..... Evaluated to EN 61326:  
1997/A1: 1998, Table 1



**Note** For full EMC compliance, you must operate this device with shielded cabling. See the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declaration of Conformity** at [ni.com/hardref.nsf/](http://ni.com/hardref.nsf/).

## Mechanical Dimensions

Figure 7 shows the mechanical dimensions of the FP-DO-403 installed on a terminal base. Dimensions are given in millimeters [inches]. If you are using the cFP-DO-403, refer to the Compact FieldPoint controller user manual for the dimensions and cabling clearance requirements of the Compact FieldPoint system.

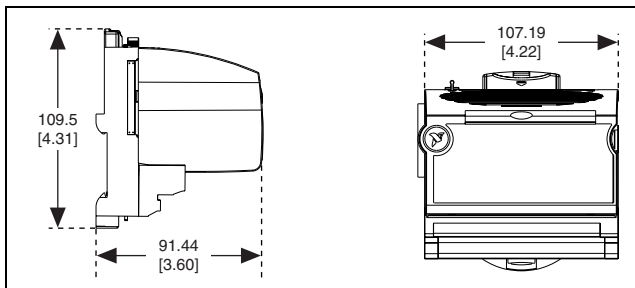


Figure 7. FP-DO-403 Mechanical Dimensions

## Where to Go for Support

For more information about setting up the FieldPoint system, refer to these National Instruments documents:

- FieldPoint network module user manual
- Other FieldPoint I/O module operating instructions
- FieldPoint terminal base operating instructions

Go to [ni.com/support](http://ni.com/support) for the most current manuals, examples, and troubleshooting information.

For telephone support in the United States, create your service request at [ni.com/ask](http://ni.com/ask) and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 03 9879 5166, Austria 0662 45 79 90 0,  
Belgium 02 757 00 20, Brazil 55 11 3262 3599,  
Canada (Calgary) 403 274 9391,  
Canada (Montreal) 514 288 5722,  
Canada (Ottawa) 613 233 5949, Canada (Québec) 514 694 8521,  
Canada (Toronto) 905 785 0085, China 86 21 6555 7838,  
Czech Republic 02 2423 5774, Denmark 45 76 26 00,  
Finland 09 725 725 11, France 01 48 14 24 24,  
Germany 089 741 31 30, Greece 01 42 96 427,

Hong Kong 2645 3186, India 91 80 4190000,  
Israel 03 6393737, Italy 02 413091, Japan 03 5472 2970,  
Korea 02 3451 3400, Malaysia 603 9596711,  
Mexico 001 800 010 0793, Netherlands 0348 433466,  
New Zealand 09 914 0488, Norway 32 27 73 00,  
Poland 22 3390 150, Portugal 210 311 210, Russia 095 238 7139,  
Singapore 65 6 226 5886, Slovenia 3 425 4200,  
South Africa 11 805 8197, Spain 91 640 0085,  
Sweden 08 587 895 00, Switzerland 056 200 51 51,  
Taiwan 02 2528 7227, United Kingdom 01635 523545



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