	NOvA Project Office **BASIS of ESTIMATE FORM (BoE)**	**Document Number: 2087** **Date of Estimate:** **May 28, 2007** **Prepared by:** **Andrew Norman**

UID Number:	**WBS Section:** **2.7.4.1.2.1**		
Task Name: Environmental and water cooling system sensor readout stations			
Cost Type: **_X_ M&S __Labor**	**Costing Method:** ___Engineering Estimate	_ Prior purchase or experience Source:	_X__ Catalog Price Source: National Insturments
	_X_Vendor Quote (attached)	__ Other- Description:_____	
Attach Relevant Documents (including but not limited to): RFP, Responses to RFP, Technical Evaluation of RFP, Vendor Quotes, Technical Specifications, drawing numbers			
Task Duration: (calendar weeks, 85% achievable): **see table below**			

Task M&S Cost (FY07$)**: $224,160** **See cost table below** **Task M&S Contingency** (%)**: 10%** **See cost table below**	**Task Labor** (resource type & work hours or % for duration of task, 85% efficiency assumed)**:** **See cost table below** **Task Labor Contingency** (%)**:See cost table below**

Details of Estimate:
Estimate is based upon 40 readout stations in the following base configuration:

Configuration 1:

Part Number	Description	Number	Cost	Total
778617-08	cFP-BP-8 8-Slot Backplane	1	549.00	549.00
779463-01	cFP-1808, 8-slot Ethernet/Serial Interface for Compact FieldPoint	1	999.00	999.00
777584-01	PS-2 Power Supply, 24 VDC, 0.8 A, US (120 VAC)	1	79.00	79.00
777318-122	cFP-RTD-122, 16 Bit RTD Input Module (RTD, Ohms)	2	469.00	938.00
777318-550	cFP-DIO-550, Digital Input/Output Module (AC-DC sink/DC source)	1	279.00	279.00
777318-500	cFP-CTR-500, Counter Input Module	1	429.00	429.00
777318-112	cFP-AI-112 16 ch, 16-Bit Analog Input Module (V)	4	599.00	2,396.00
			Total:	5,669.00

Configuration 2:

Part Number	Description	Number	Cost	Total
778617-08	cFP-BP-8 8-Slot Backplane	1	549.00	549.00
779463-01	cFP-1808, 8-slot Ethernet/Serial Interface for Compact FieldPoint	1	999.00	999.00
777584-01	PS-2 Power Supply, 24 VDC, 0.8 A, US (120 VAC)	1	79.00	79.00
777318-122	cFP-RTD-122, 16 Bit RTD Input Module (RTD, Ohms)	2	469.00	938.00
777318-550	cFP-DIO-550, Digital Input/Output Module (AC-DC sink/DC source)	1	279.00	279.00
777318-304	cFP-DI-304, 32-channel sinking Digital Input Module, 10-30 VDC	1	299.00	299.00
777318-112	cFP-AI-112 16 ch, 16-Bit Analog Input Module (V)	4	599.00	2,396.00
			Total:	5,539.00

See attached quotes and catalog pages for details of exact pricing for large orders.

My Shopping Cart (US Dollars)

Questions? Call me now! or (866) 337-8762

	Part Number Description	Est Ship	Unit Price	Qty	Line Total
	779463-01 cFP-1808, 8-slot Ethernet/Serial Interface for Compact FieldPoint	5 - 10	$ 999.00	1	$ 999.00
	778617-08 cFP-BP-8 8-Slot Backplane	5 - 10	$ 549.00	1	$ 549.00
	777584-01 PS-2 Power Supply, 24 VDC, 0.8 A, US (120 VAC)	1 - 2	$ 79.00	1	$ 79.00
	777318-112 cFP-AI-112 16 ch, 16-Bit Analog Input Module (V)	1 - 2	$ 599.00	4	$ 2,396.00
	777318-550 cFP-DIO-550, Digital Input/Output Module (AC-DC sink/DC source)	1 - 2	$ 279.00	1	$ 279.00
	777318-500 cFP-CTR-500, Counter Input Module	1 - 2	$ 429.00	1	$ 429.00
	777318-122 cFP-RTD-122, 16 Bit RTD Input Module (RTD, Ohms)	1 - 2	$ 469.00	2	$ 938.00

Click the symbol to remove the item

UPDATE QUANTITY

Total Items: 11

Subtotal: $ 5,669.00

Shipping in United States FedEx 2-Day $ 50.88

Order Total: $ 5,719.88

Add Part Numbers | Continue Shopping

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My Shopping Cart (US Dollars)

Questions? Call me now! or (866) 337-8762

	Part Number Description	Est Ship	Unit Price	Qty	Line Total
	779463-01 cFP-1808, 8-slot Ethernet/Serial Interface for Compact FieldPoint	5 - 10	$ 999.00	1	$ 999.00
	778617-08 cFP-BP-8 8-Slot Backplane	5 - 10	$ 549.00	1	$ 549.00
	777584-01 PS-2 Power Supply, 24 VDC, 0.8 A, US (120 VAC)	1 - 2	$ 79.00	1	$ 79.00
	777318-112 cFP-AI-112 16 ch, 16-Bit Analog Input Module (V)	1 - 2	$ 599.00	4	$ 2,396.00
	777318-550 cFP-DIO-550, Digital Input/Output Module (AC-DC sink/DC source)	1 - 2	$ 279.00	1	$ 279.00
	777318-122 cFP-RTD-122, 16 Bit RTD Input Module (RTD, Ohms)	1 - 2	$ 469.00	2	$ 938.00
	777318-304 cFP-DI-304, 32-channel sinking Digital Input Module, 10-30 VDC	5 - 10	$ 299.00	1	$ 299.00

Click the symbol to remove the item

UPDATE QUANTITY

Total Items: 11

Subtotal: $ 5,539.00

Shipping in United States FedEx 2-Day $ 49.02

Order Total: $ 5,588.02

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Compact FieldPoint Backplanes

NI cFP-BP-4, NI cFP-BP-8

- 4 and 8-slot backplanes
- Solid metal construction for rugged installations
- Panel, DIN rail, and 19 in. rack mounting
- Local bus for communications and module power
- Secure screw mounting for I/O and control modules
- -25 to 60 °C operating range

NEW

Back Plane	I/O Module Slots	Standard Mounting Hardware
cFP-BP-4	4	cFP-PM-H horizontal panel mounting bracket
cFP-BP-8	8	cFP-PM-H horizontal panel mounting bracket

Overview

National Instruments offers two backplanes for mounting Compact FieldPoint modules – the cFP-BP-4 (4 slots) and the cFP-BP-8 (8 slots). Both backplanes, which are constructed of extruded metal with grounding lugs on the bottom, feature screw-down connections for a controller module, four or eight I/O modules, and 37 pin D-Sub connectors for I/O connections. The backplanes all come with a cFP-PM-H horizontal mounting bracket, which provides mounting holes on either side of the backplane so you can mount it to a panel. For other mounting options, you can purchase a vertical panel mount, a DIN rail mount, or a 19 in. rack mount separately.

Compact FieldPoint and FieldPoint

These backplanes are used with Compact FieldPoint only. Compact FieldPoint is designed for industrial control applications that perform advanced embedded control, data logging, headless operation, and Ethernet connectivity. Compact FieldPoint is our most rugged and reliable platform and is designed for industrial and mobile environments with high shock, vibration, and temperature extremes. FieldPoint is a lower-cost distributed I/O system with a variety of communication options besides Ethernet. It is designed to mount on DIN rails in static applications where the FieldPoint bank is connected to a PC for data collection, analysis, display, and storage.

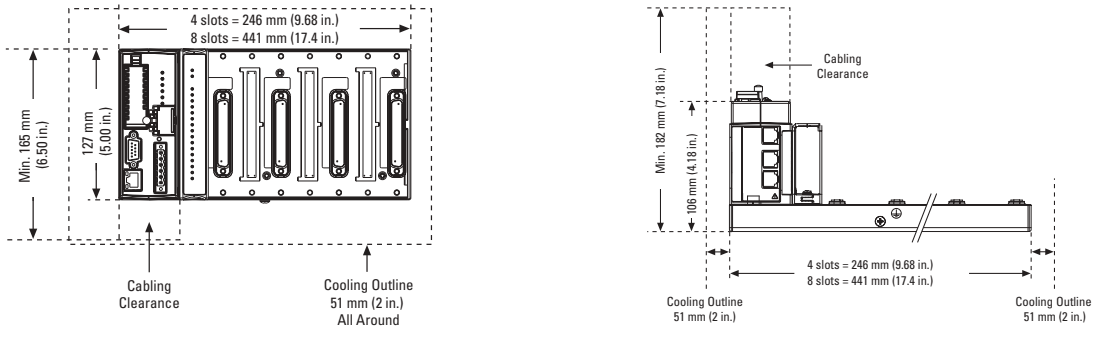

Figure 1. Dimensions of the Compact FieldPoint systems with the cFP-BP-4 and cFP-BP-8 backplanes.

Compact FieldPoint Backplanes

High Shock and Vibration

To withstand high levels of shock and vibration, Compact FieldPoint backplanes are made of extruded metal and provide a rigid mounting surface for the Compact FieldPoint modules. The backplane also provides screw-down connections for the controller module, I/O modules, and connector blocks.

Mounting

NI offers four mounting options for Compact FieldPoint backplanes including panel mounting, DIN-rail mounting, and 19 in. rack mounting.

Mounting Option	Description	Number Needed to Mount cFP-BP-4	Number Needed to Mount cFP-BP-8
cFP-PM-H	Panel mount with bolt holes at the sides of the backplane. (included with all backplane)	1	1
cFP-PM-V	Panel mount with bolt holes at the top and bottom of the backplane	1	1
cFP-RM-8	19 in. rack mount. Features captive screws for easy mounting and cutouts for running grounding cables	1	1
DIN rail mounting clip	DIN rail clip for cFP-BP-4	1	2*

* DIN rail mounting is not recommended for the cFP-BP-8

Compact FieldPoint System Configuration

Compact FieldPoint I/O modules mount on either the cFP-BP-4 or cFP-BP-8 backplane. The backplane also contains a controller module, which runs embedded LabVIEW Real-Time and can connect over Ethernet to a PC, to other FieldPoint banks, to Web browsers, or to other Ethernet devices. The Compact FieldPoint backplane also provides a 37-pin D-Sub connector to connect your field signal wiring for each I/O module. You have three options to connect field wiring to this 37-pin D-Sub connector:

1. Using an integrated connector block such as the cFP-CB-1 or cFP-CB-11;
2. Using a cable to an external connector block mounted on a DIN rail;
3. Making your own custom cable.

For more details on configuring your Compact FieldPoint system, please see 517.

Ordering Information

NI cFP-BP-4 778617-04
NI cFP-BP-8 778617-08

Recommended Compact FieldPoint System Products

NI cFP-2020 777317-2020
NI cFP-CB-1 778618-01
NI PS-5 Power Supply 778805-90
NI Developer Suite Professional Control Edition.....777906-03

BUY ONLINE!

Visit ni.com/info and enter cfppb4, and/or cfppb8.

Compact FieldPoint Accessories

Figure 1. cFP-PM-V, Vertical-Mounting Kit

Figure 2. cFP-PM-H, Horizontal-Mounting Kit

Figure 3. cFP-RM-8, Rack-Mounting Kit

Figure 4. PS-5 Power Supply (24 VDC)

Figure 5. Panel and DIN Rail-Mounting Kits

Mounting Options (see figures 1, 2, and 3)

NI offers four mounting options for Compact FieldPoint, including panel mounting, DIN rail mounting, and 19 in. rack mounting.

Mounting Option	Description	Quantity Needed to Mount cFP-BP-4	Quantity Needed to Mount cFP-BP-8	Part Number
cFP-PM-H	Panel mount with bolt holes at the sides of the backplane (included with all backplane)	1	1	778616-01
cFP-PM-V	Panel mount with bolt holes at the top and bottom of the backplane	1	1	778688-01
cFP-RM-8	19 in. rack mount; features captive screws for easy mounting and cutouts for running grounding cables	1	1	778615-01
DIN Rail-Mounting Clip	DIN rail clip for cFP-BP-4	1	2[1]	778614-01

[1]DIN rail mounting is not recommended for the cFP-BP-8.

Power Supplies (see Figure 4)

National Instruments offers five DC supplies for Compact FieldPoint systems. You connect the power supply output to the Compact FieldPoint controller, which regulates, filters, and distributes power to the bank of up to eight I/O modules that it controls. All five power supplies can power an entire bank of Compact FieldPoint I/O modules. The PS-5 mounts on a DIN rail and is recommended for most Compact FieldPoint installations.

Model	Output Voltage (VDC)	Output Current (A)	Input Voltage	Part Number
PS-1	20	0.8	120 VDC	777567-01
PS-2	24	0.8	P = 1 U.S. 120/Japan 100 VAC 2 Swiss 220 VAC, 3 Australian 4 Universal Euro 240 VAC 5 North American 240 VAC 6 United Kingdom 240 VAC	777584-0P
PS-3	13.8	4	Same as PS-2	777585-0P
PS-4	24	0.625	90 to 260 VAC 50/60 Hz	778586-90
PS-5	24	5	90 to 260 VAC 50/60 Hz	778805-90

Power connects to the cFP-21xx modules, which regulate, filter, and distribute to attached I/O modules.

Stand-Alone Controller-Mounting Accessories (see Figure 5)

National Instruments offers options for mounting stand-alone Compact FieldPoint controllers. These accessories support applications for redundant controllers without redundant I/O. The panel and DIN rail-mounting kits also provide mounting options for a stand-alone Compact FieldPoint real-time controller running LabVIEW Real-Time software. Controller-mounting options include panel and DIN rail-mounting.

Model	Description	Part Number
Panel	Panel-mounting kit for stand-alone controllers	779549-01
DIN rail	DIN rail-mounting kit for stand-alone controllers	779552-01

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For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S.) or go to **ni.com/compactfieldpoint**.

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351355A-01 2006-6643-161-101-D

Ethernet/Serial Interfaces for Compact FieldPoint

NI cFP-180x

- Distributed I/O interfaces for Ethernet and RS232 networks
- 4 or 8-slot Compact FieldPoint distributed Ethernet/serial network interfaces
- FieldPoint software for rapid distributed I/O access
- Modbus Support
- OPC server included
- Intelligent diagnostics and maintenance
- Industrial specifications for harsh environments
  - 50 g shock
  - 5 g vibration
  - -40 to 70 °C

Operating Systems
- Windows 2000/XP

Recommended Software
- LabVIEW
- LabVIEW Datalogging and Supervisory Control Module

Other Compatible Software
- LabWindows/CVI
- Measurement Studio
- Lookout
- VI Logger

Driver Software (included)
- Measurement & Automation Explorer
- OPC server (2.0 compliant)

Overview and Distributed Applications

National Instruments cFP-180x interfaces connect four or eight Compact FieldPoint I/O modules to a high-speed Ethernet network or to an RS232 serial port. With up to 100 Mb/s data communication rates and event-driven communications, an NI cFP-180x delivers a high-performance network connection for Compact FieldPoint that is easy to interface with a PC or PAC-like Compact FieldPoint embedded controller. One or more cFP-180x interfaces, connected by standard networking equipment, provide expanded I/O that you can control with a single Compact FieldPoint controller, see Figure 1. You can also build a PC-based distributed I/O and control system by connecting two or more cFP-180x devices to your PC.

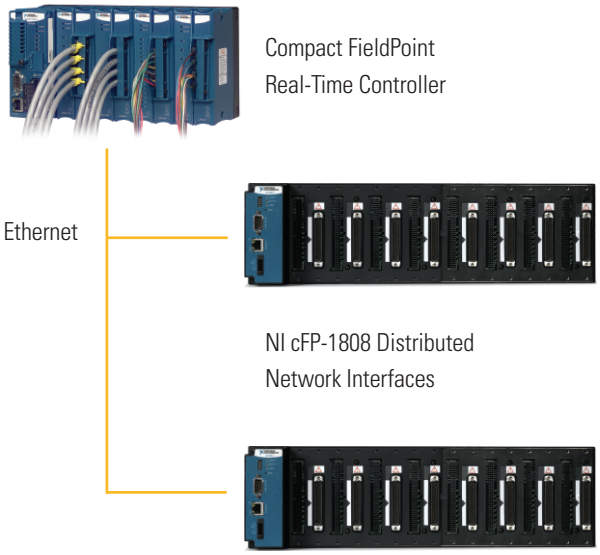

Figure 1. Expansion I/O for Compact FieldPoint Embedded Controller with cFP-1808 Network Interfaces

Hardware Architecture

A cFP-180x provides an integrated network interface (Ethernet or serial) and a 4 or 8-slot backplane, and it works with the same modules and connector blocks used in other Compact FieldPoint systems.

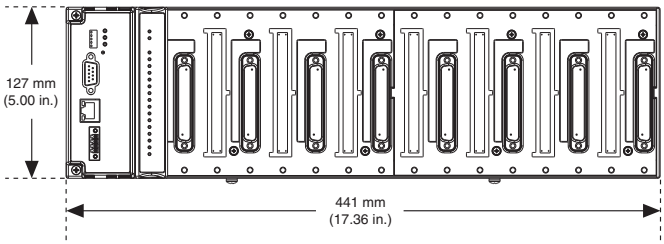

Figure 2. cFP-1808 Mechanical Dimensions

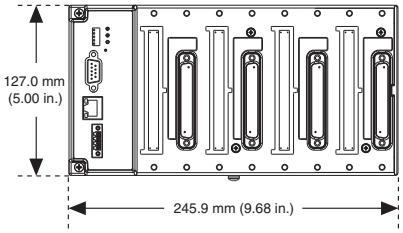

Figure 3. cFP-1804 Mechanical Dimensions

Building Ethernet-Based Distributed I/O Systems

A cFP-180x can communicate with Compact FieldPoint real-time embedded controllers; any Ethernet-based programmable automation controller (PAC); and a Windows computer running LabVIEW, LabWindows/CVI, Measurement Studio, Lookout, or your choice of OPC client application software. Using a cFP-180x, you can rapidly build flexible, modular distributed measurement and automation systems.

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Figure 4. Ethernet-based distributed systems work with Compact FieldPoint embedded controllers, PACs, human-machine interfaces, and Enterprise/SCADA systems.

Network Communications Interface

A cFP-180x connects directly to Ethernet networks, autonegotiating on the network for 10 Mb/s or 100 Mb/s communication rates. It includes an RJ-45 connector for connection to 10BaseT and 100BaseTX networks, using a protocol based on standard TCP/IP to maintain full compatibility with existing networks. FieldPoint builds on standard TCP/IP network protocols and adds a number of key enhancements, including event-driven communications and publisher-subscriber networking. In a publisher-subscriber architecture, one or more client PCs subscribe to I/O data from Compact FieldPoint banks. The network interface monitors connected I/O modules and publishes I/O data only when the value changes. Analog signals can change value within selectable ranges, called deadbands, without causing the system to report data. This event-driven method, along with data compression, helps you avoid unnecessary Ethernet traffic and maximizes communication efficiency. A cFP-180x also includes a standard DB-9 connector for RS232 serial communication. Through direct connectivity, you can read and write data directly from a program running on your PC or embedded controller. You access I/O through the serial interface using a serial protocol called Optomux, in the same way you would access data through classic FieldPoint network interfaces such as the FP-1000.

Configuring and Accessing Tags on a Compact FieldPoint System with LabVIEW 8

National Instruments LabVIEW 8 and Compact FieldPoint create a flexible PAC system that offers easy-to-access I/O through the FieldPoint programming environment. Accessing data from multiple cFP-180x distributed nodes with LabVIEW is as easy as three simple steps:

1. Configure IP address using NI Measurement & Automation Explorer (MAX)
2. Import a FieldPoint configuration file or add a new Compact FieldPoint system
3. Expand I/O in the LabVIEW Project and drag and drop I/O tags to VIs

After configuring the IP address for a FieldPoint bank in MAX, either import the configuration file created from MAX, or simply add a new target to a LabVIEW Project as shown in Figure 5.

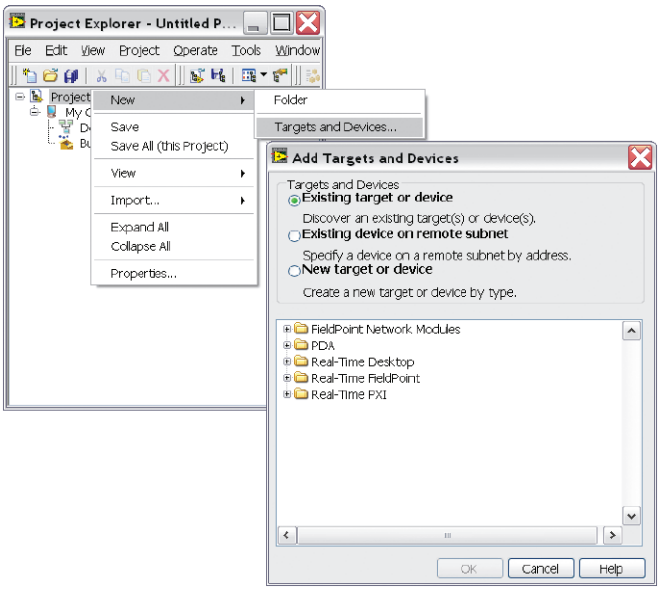

Figure 5. Add a new FieldPoint target to your LabVIEW 8 Project.

After adding all FieldPoint networks available on the network, you can expand each FieldPoint bank and see the I/O modules and tags available from the LabVIEW Project Explorer. Using these tags in an application is as easy as dragging the tag from the Project Explorer to the VI where the data is needed. LabVIEW automatically creates the correct FieldPoint read/write VI and associated tag.

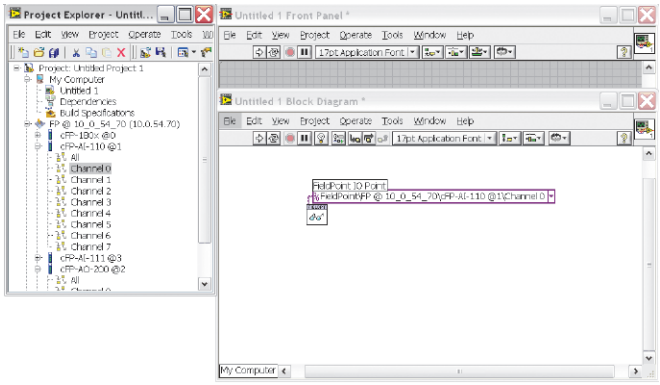

Figure 6. Drag and drop an I/O tag from a LabVIEW Project to any VI.

Accessing Network I/O Data on a cFP-180x Using Shared Variables

You can create a shared variable for any tag that is available on a cFP-180x bank connected to the network. You then can use this shared variable in multiple LabVIEW applications either targeted to Windows OS or running embedded on a Compact FieldPoint real-time controller such as the NI cFP-2120. To create a shared variable to be hosted on a Windows system, simply right-click on My Computer in the LabVIEW Project and select New Variable; select the option to bind this shared variable to a source, and then you can either select IO from your local LabVIEW Project or any I/O available on the network, as shown in Figure 7.

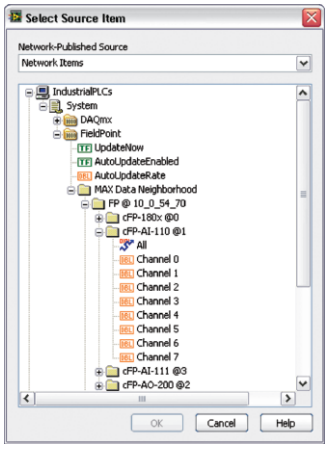

Figure 7. Compact FieldPoint distributed I/O channels are accessible as network items from LabVIEW.

After you create a shared variable, it appears in LabVIEW Project Manager and is available for use in your LabVIEW applications simply by dragging the variable from the Project Explorer to an existing VI (see Figure 8). From a PC, PAC, or embedded Compact FieldPoint controller, you can use MAX with LabVIEW 8 to configure I/O settings for the cFP-180x to access data on distributed Compact FieldPoint banks. Accessing distributed I/O is now easier than ever with LabVIEW 8 and a cFP-180x.

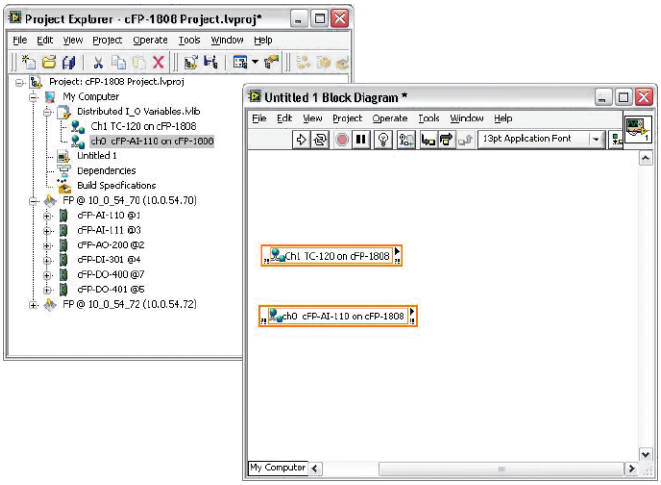

Figure 8. Use a shared variable to access distributed I/O for all channels.

Ordering Information

NI cFP-1808	779463-01
NI cFP-1804	779490-01
PS-5 (power supply 24 VDC, 5 A, universal power input)	778805-90

BUY NOW!

For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S.) or go to **ni.com/fieldpoint**.

Specifications

Network

Network interface	10BaseT and 100BaseTX Ethernet
Compatibility	IEEE802.3
Communication rates	10 or 100 Mb/s, autonegotiated
Maximum cabling distance	100 m/segment
Maximum power to I/O modules	9 W
Maximum number of banks	Determined by network topology

Serial Port

One RS232 (DCE) serial port

Baud rate	300 to 115,200 b/s
Data bits	8
Stop bits	1
Parity	None
Flow control	None

Power Requirement

Power supply range	11 to 30 VDC
Recommended power supply	20 W
Power consumption	6.1 W + 1.1 (I/O module)

Safety Isolation Voltage

Isolation voltage is verified by a dielectric withstand test between module and backplane.

Continuous	250 V_{rms}, Measurement Category II
Withstand	2,300 V_{rms}, 5 s max

Physical Characteristics

Screw-terminal wiring	14 to 22 AWG copper wire with 7 mm (0.28 in.) of insulation stripped from the end
Torque for screw terminals	0.5 to 0.6 N • m (4.4 to 5.3 lb • in.)

Weight

cFP-1804	935 g (2 lb 1 oz)
cFP-1808	1,595 g (3 lb 8 oz)

Environmental

FieldPoint modules are intended for indoor use only. For outdoor use, they must be installed in a suitable sealed enclosure.

Operating temperature	-40 to 70 °C
Storage temperature	-55 to 85 °C
Relative humidity	10 to 90%, noncondensing
Maximum altitude	2,000 m; at higher altitudes the isolation voltage ratings must be lowered
Pollution Degree	2

Shock and Vibration

Operating vibration

Random (IEC 60068-2-64)	10 to 500 Hz, 5 g_{rms}
Sinusoidal (IEC 60068-2-6)	10 to 500 Hz, 5 g

Operating shock

(IEC 60068-2-27)	50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

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

Note: *For UL, hazardous location, and other safety certifications, refer to the product label or visit* **ni.com/certification**, *search by model number or product line, and click the appropriate link in the Certification column.*

Electromagnetic Compatibility

Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity	EN 61326:1997 + A2:2002, Table 1 CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note: *For EMC compliance, operate this device with shielded cabling.*

CE Compliance

This product meets the essential requirements of applicable European directives, as amended for CE marking, as follows:

Low-voltage directive (safety)	73/23/EEC
Electromagnetic compatibility directive (EMC)	89/336/EEC

Note: *Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit* **ni.com/certification**, *search by model number or product line, and click the appropriate link in the Certification column.*

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342572A-01 2006-6507-161-101-D

Thermocouple and RTD Modules for Compact FieldPoint

NI cFP-TC-120, NI cFP-TC-125, NI cFP-RTD-122, NI cFP-RTD-124

- 8 temperature inputs
  - Thermocouple or millivolt
  - 2, 3, or 4-wire RTD
- Built-in signal conditioning between channels
  - 250 V common-mode isolation on TC-125
  - 50 and 60 Hz noise rejection
- 16-bit resolution
- Input ranges configurable in software for each channel
- 2,300 V_{rms} bank isolation for transient overvoltage protection
- Hot-swappable with autoconfiguration
- -40 to 70 °C operating range

Module	Input Channels	Resolution (bits)	Input Type	Input Ranges Software Configurable per Channel	50/60 Hz Noise Filter	All-Channel Update Period	Common-Mode Between Channels	Safety Isolation
cFP-TC-120	8	16	Thermocouple	J,K,R,S,T,N,E, and B ± 25 mV, ±50 mV,	✓	1.13 s (0.88 Hz)	–	2,300 V_{rms} bank isolation
			Millivolt	±100 mV, -20 to 80 mV				
cFP-TC-125	8	16	Thermocouple	J,K,R,S,T,N,E, and B	✓	0.22 s (Filter Off) 0.99 s (Filter On)	250 V_{rms}	2,300 V_{rms} bank isolation
			Millivolt	-20 to 80 mV				
cFP-RTD-122	8	16	2, 3-Wire RTD	Pt 100, Pt 1,000	✓	1.08 s (0.93 Hz)	–	2,300 V_{rms} bank isolation
			Resistance	0 to 400, 0 to 4000 Ω				
cFP-RTD-124	8	16	2, 4-Wire RTD	Pt 100	✓	1.08 s (0.93 Hz)	–	2,300 V_{rms} bank isolation
			Resistance	0 to 400 Ω				

Overview

The National Instruments cFP-TC-12x and cFP-RTD-12x are versatile temperature input modules for Compact FieldPoint, used to measure thermocouples, millivolt-level voltages, thermistors, and 2, 3, and 4-wire RTDs. They are used in applications such as temperature chamber control, device testing, and process control. Thermocouples are low-cost, flexible temperature devices. RTD sensors are used in applications for acquiring temperatures with high accuracy. Two and 3-wire RTDs work well for applications with short signal wires and low noise levels; 4-wire RTDs are well-suited for applications with long signal wires or high noise levels. All of these I/O modules include overranging and onboard diagnostics to ensure trouble-free installation and maintenance. The modules measure and linearize signals on board to return scaled values to your control or monitoring software. NI cFP-TC-12x and cFP-RTD-12x modules have NIST-traceable calibration certificates (available on request), ensuring accurate and reliable analog measurements.

Compact FieldPoint

Compact FieldPoint is designed for industrial control applications that perform advanced embedded control, data logging, headless operation, and Ethernet connectivity. Compact FieldPoint, a rugged, reliable NI platform, is designed for industrial and mobile environments with high shock, vibration, and temperature extremes.

Isolation

The cFP-TC-125 provides 250 V_{rms} common-mode voltage protection between channels, and all cFP-TC-12x and cFP-RTD-12x modules feature optical bank isolation with 2,300 V_{rms} of breakdown isolation. In addition, the cFP-TC-12x and cFP-RTD-12x provide double insulation for up to 250 V_{rms} of operational isolation. You can safely use Compact FieldPoint with the cFP-CB-1 or cFP-CB-3 connector block in applications where hazardous voltages are present.

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Smart I/O Modules

The cFP-TC-12x and cFP-RTD-12x modules offer 16-bit resolution for high-accuracy measurements, and you can connect directly to industrial sensors or units under test with the safety isolation available. The modules filter, calibrate, and scale raw sensor signals to engineering units, as well as perform self-diagnostics to look for problems such as open thermocouples. With cFP-TC-12x and cFP-RTD-12x modules, your software application reads a linearized, calibrated, scaled value from the I/O module, eliminating the error-prone step of converting binary values to temperature. For increased accuracy and noise rejection, the modules use a 16-bit delta-sigma ADC with an integrated lowpass filter on each channel, which is configured for 50 and 60 Hz rejection. With high-accuracy 16-bit delta-sigma ADCs on the I/O modules, you also get instrument-quality measurements on an industrially rugged, distributed, embedded system. cFP-TC-12x and cFP-RTD-12x modules offer a variety of different update rates to fit your application, ranging from 0.22 s with filters off and 1.08 to 1.13 s with filters enabled. Overall data throughput depends on filter settings across all channels, software loop speeds, and network speeds.

cFP-TC-120

The cFP-TC-120 includes eight differential inputs for thermocouples. It also provides cold-junction compensation using a thermistor embedded in the connector block. An onboard microcontroller compensates and linearizes the thermocouple reading to the NIST IST-90 standard, using an advanced linearization routine for maximum accuracy.

cFP-TC-125

In addition to the thermistor and linearization features of the cFP-TC-120, the cFP-TC-125 provides 250 V_{rms} of common-mode rejection, ideal for applications where differences in voltages might exist between connected thermocouples. The cFP-TC-125 also provides 0.22 s update rates when the 50/60 Hz filter is not enabled.

cFP-RTD-122

The cFP-RTD-122 includes eight inputs for 2 and 3-wire RTDs. The module uses a stable current source for sensor excitation and an onboard microcontroller that linearizes and scales the measurements to temperature units. You can configure each channel of the module to return data scaled to temperature (°C, °F, or °K) or resistance. The 3-wire configuration used with the cFP-RTD-122 eliminates errors caused by lead wire resistance but does not reduce errors caused by noise. If your application involves high noise or long wires, you should use 4-wire RTDs with the cFP-RTD-124.

cFP-RTD-124

The cFP-RTD-124 includes eight inputs for 2 and 4-wire RTDs. The module uses a stable current source for sensor excitation and an onboard microcontroller that linearizes and scales the measurements to temperature units. You can configure each channel of the modules to return data scaled to temperature (°C, °F, or °K) or resistance. Four-wire RTDs used with the cFP-RTD-124 are ideal for applications involving long signal wires or high signal noise. The 4-wire configuration eliminates the voltage drop caused by lead wire resistance and reduces errors caused by noise.

Isothermal Connectivity for the cFP-TC-12x

For maximum accuracy, NI recommends using an isothermal connector block with the cFP-TC-12x. The cFP-CB-3 isothermal connector block minimizes the temperature gradient across wiring connections, improving the accuracy of the cold-junction measurement, and, therefore, of thermocouple measurements.

Compact FieldPoint I/O Connections

Compact FieldPoint modules include a built-in power distribution bus that provides multiple power connections on the module. A field-wired power supply connected to the voltage (V) and common (C) terminals is internally connected to a power distribution bus that provides additional breakout terminals for voltage supply (VSUP) and common (COM). These terminals offer a convenient way to distribute power to field devices that require external power.

Each cFP-TC-12x input channel has two terminals for differential input:

1. Thermocouple positive input (IN+)
2. Thermocouple negative input (IN-)

Each cFP-RTD-122 input channel has three terminals:

1. Excitation output (EXCITE)
2. Sensing input (SENSE)
3. Common input (COM)

Each cFP-RTD-124 input channel has four terminals:

1. Excitation output (EXCITE)
2. Positive sensing input (SENSE+)
3. Negative sensing input (SENSE-)
4. Common input (COM)

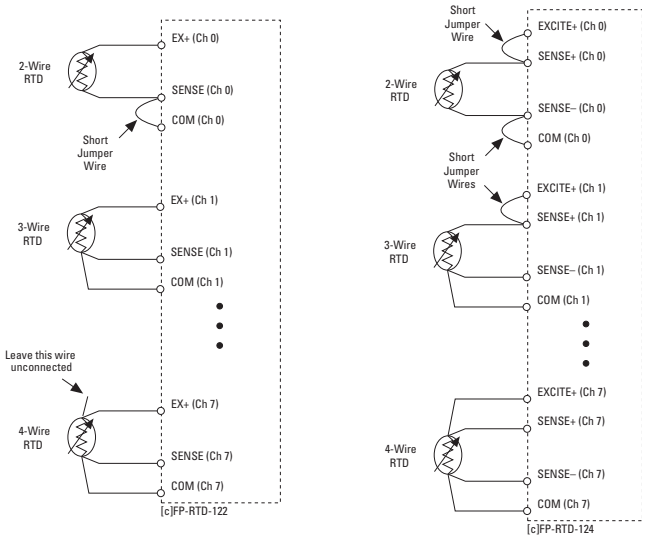

Figure 1. Wiring Diagram for cFP-RTD-12x

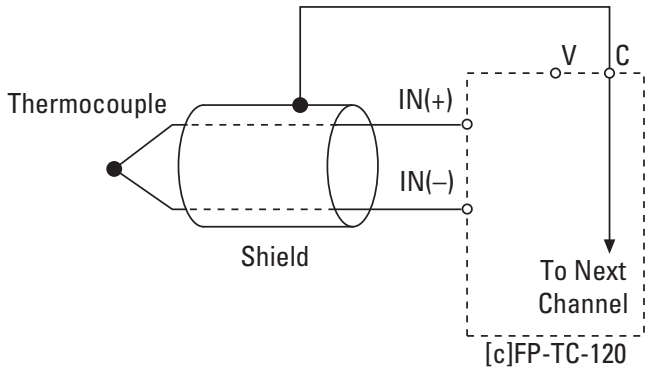

Figure 2. Wiring Diagram for cFP-TC-120

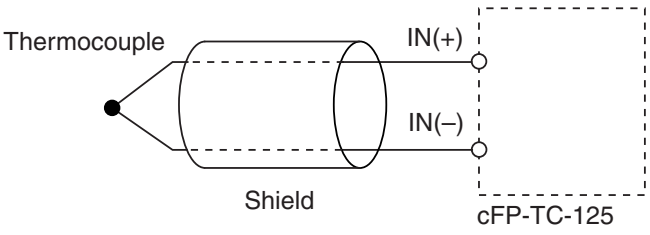

Figure 3. Wiring Diagram for cFP-TC-125
Note: Connections will depend on the application.

Ordering Information

NI cFP-TC-120	777318-120
NI cFP-TC-125	777318-125
NI cFP-RTD-122	777318-122
NI cFP-RTD-124	777318-124

Recommended System Products

NI cFP-2120	777317-2120
NI cFP-1804	779490-01
NI cFP-BP-4	778617-04
NI cFP-CB-1	778618-01
NI cFP-CB-3	778618-03
NI PS-5 Power Supply	778805-90

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For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S.) or go to **ni.com/advisors.**

Specifications

Typical for -40 to 70 °C unless otherwise noted.

Input Characteristics

Number of inputs	8
ADC resolution	16 bits, 1 in 65,536
Type of ADC	Delta-sigma
Filters	50/60 Hz rejection
Excitation current	
cFP-RTD-122	0.25 mA
cFP-RTD-124	2 mA
Data scaling options	
cFP-TC-120	Temperature (°C, °F, °K) or mV
cFP-RTD-12x	Temperature (°C, °F, °K) or resistance (Ω)
Update period, all channels	
cFP-TC-125	
Filter off	0.22 s
Filter on	0.99 s
cFP-TC-120	1.13 s
cFP-RTD-12x	1.08 s
Signal input bandwidth	
cFP-TC-120	3 Hz
cFP-TC-125	12 Hz
Cold-junction accuracy cFP-TC-12x	
With cFP-CB-3 connector block	0.25 °C typ, 0.5 °C max
Input impedance (cFP-TC-12x)	20 MΩ
Input current (cFP-TC-12x)	35 nA typ, 140 nA max
Input noise	±1 LSB_{pp}
Overvoltage protection	
cFP-TC-120	±40 V
cFP-TC-125	±250 V
Common-mode voltage between channels referenced to isolated ground	
cFP-TC-125	250 V
cFP-TC-120	1 V
cFP-RTD-12x	2 V

Safety Isolation Voltage

Maximum safety isolation voltage	250 V_{rms}, Installation Category II (cFP-TC-12x only)
Channel-to-channel safety isolation	No isolation between channels
Transient overvoltage	2,300 V_{rms}

Physical Characteristics

LED indicators	
POWER (green)	Power on and self-test passed
READY (green)	Module configured and ready
OPEN TC <0..7> (red) (cFP-TC-12x)	Open or broken thermocouple on channel
Dimensions	128 by 88 by 25 mm (5.0 by 3.5 by 1.0 in.)
Weight	
cFP-TC-120	130 g (4.6 oz)
cFP-TC-125	125 g (4.4 oz)
cFP-RTD-12x	110 g (3.7 oz)

Power Requirement

Power from network module	
cFP-TC-120	350 mW
cFP-TC-125	650 mW

Environmental

Operating temperature	-40 to 70 °C
Storage temperature	-55 to 85 °C (cFP-TC-125 -40 to 80 °C)
Relative humidity	10 to 90%, noncondensing
Maximum altitude	2,000 m; at higher altitudes the isolation voltage ratings must be lowered
Pollution degree	2

Shock and Vibration

Operating vibration, random (IEC 60068-2-64)	10 to 500 Hz, 5 g_{rms}
Operating vibration, sinusoidal (IEC 60068-2-6)	10 to 500 Hz, 5 g
Operating shock (IEC 60068-2-27)	50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety and Compliance

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

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

For UL, hazardous location, and other safety certifications, refer to the product label or to **ni.com**

Electromagnetic Compatibility

CE, C-Tick, and FCC Part 15 (Class A) Compliant Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz Immunity EN 61326:1997 +A2:2001, Table 1

Note: For EMC compliance, you must operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE Marking, as follows:

Low-Voltage Directive (safety) 73/23/EEC
Electromagnetic Compatibility
Directive (EMC)..... 89/336/EEC

Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit **ni.com/certification** and search by model number or product line.

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351395A-01 2006-7533-161-101-D

Digital Input Modules for Compact FieldPoint and FieldPoint

NI [c]FP-DI-300, NI [c]FP-DI-301, NI cFP-DI-304, NI [c]FP-DI-330 *NEW!*

- 8,16, or 32 channel inputs
  - 24 VDC inputs
  - 4 to 250 VDC inputs
  - 15 to 250 VAC inputs (50/60 Hz AC)
  - 3 to 250 VAC inputs (1 kHz AC)
- 2,300 V_{rms} bank isolation for transient overvoltage protection
- Hot-swappable with autoconfiguration
- -40 to 70 °C operating range

FieldPoint Software (included)

- FieldPoint 5.0 (for all models)

Module	Input Channels	Input Ranges	Input Type	Compatibility Examples	Separate Ground Plane per Channel	All Channel Update Rate	Additional Features
[c]FP-DI-300	8	18 to 30 VDC	Sinking	24 VDC sourcing devices	–	1 kHz	–
[c]FP-DI-301	16	18 to 30 VDC	Sinking	24 VDC sourcing devices	–	1 kHz	–
cFP-DI-304	32	10 to 30 VDC	Sinking	24 VDC sourcing devices	–	1 kHz	Hysteresis
[c]FP-DI-330	8	5 to 48 VDC 5 to 250 VAC	Sinking or sourcing	TTL, CMOS, 12 VDC, 24 VDC, 48 VDC, 120/240 VAC/VDC	✓	1 kHz	Input current limiting (1.5 mA)

Overview

The National Instruments [c]FP-DI-3xx devices are versatile digital input modules. The DI-300, DI-301, and DI-330 are available in the Compact FieldPoint and FieldPoint product families. The new NI cFP-DI-304 module is available for Compact FieldPoint systems. You can use these modules to monitor digital signals ranging from low voltage levels up to 250 V. They are commonly used to monitor proximity and limit switches, pushbutton switches, thermostat outputs, relay closures, power circuits, and TTL devices. All the modules include onboard diagnostics to ensure trouble-free installation and maintenance.

Digital Input Modules

The [c]FP-DI-3xx modules provide built-in module-to-module isolation to protect your FieldPoint system and controller or communication interface from high voltage levels. The DI-300, DI-301, and DI-304 modules use a common ground plane for all the input channels. Each channel on the DI-300, DI-301, and DI-304 modules include current-limiting circuitry to prevent module damage when connected directly to a 24 VDC source. The DI-330 uses eight optically isolated input channels so that each digital input has a separate ground plane, and you can use each channel with a different voltage potential. Thus, you can connect one channel to a 5 VDC TTL signal and another signal on the same DI-330 module to a 250 VAC line voltage. Each channel on the DI-330 includes current-limiting circuitry that limits the total current to 1.5 mA to prevent damaging the module. All channels on the DI-3xx modules feature LEDs that indicate the input state of each channel. The modules feature an all channel update rate of 1 kHz. Overall data throughput depends on software loop speeds and network speeds.

Isolation

The [c]FP-DI-3xx modules feature bank isolation with 2,300 V_{rms} of breakdown isolation. In addition, the DI-330 provides double insulation for up to 250 V_{rms} of operational isolation. You can safely use Compact FieldPoint in applications where hazardous voltages are present when used with the cFP-CB-1 connector block. You can safely use FieldPoint in applications where hazardous voltages are present with the FP-TB-x terminal base. These Compact FieldPoint and FieldPoint modules do not have channel-to-channel isolation.

Field I/O Connections

Compact FieldPoint and FieldPoint modules include a built-in power distribution bus that provides multiple power connections on the module. A field wired power supply connected to the voltage (V) and common (C) terminals is internally connected to a power distribution bus that delivers additional breakout terminals for voltage supply (V_{SUP}) and common (COM). These terminals offer a convenient way to distribute power to field devices that require external power.

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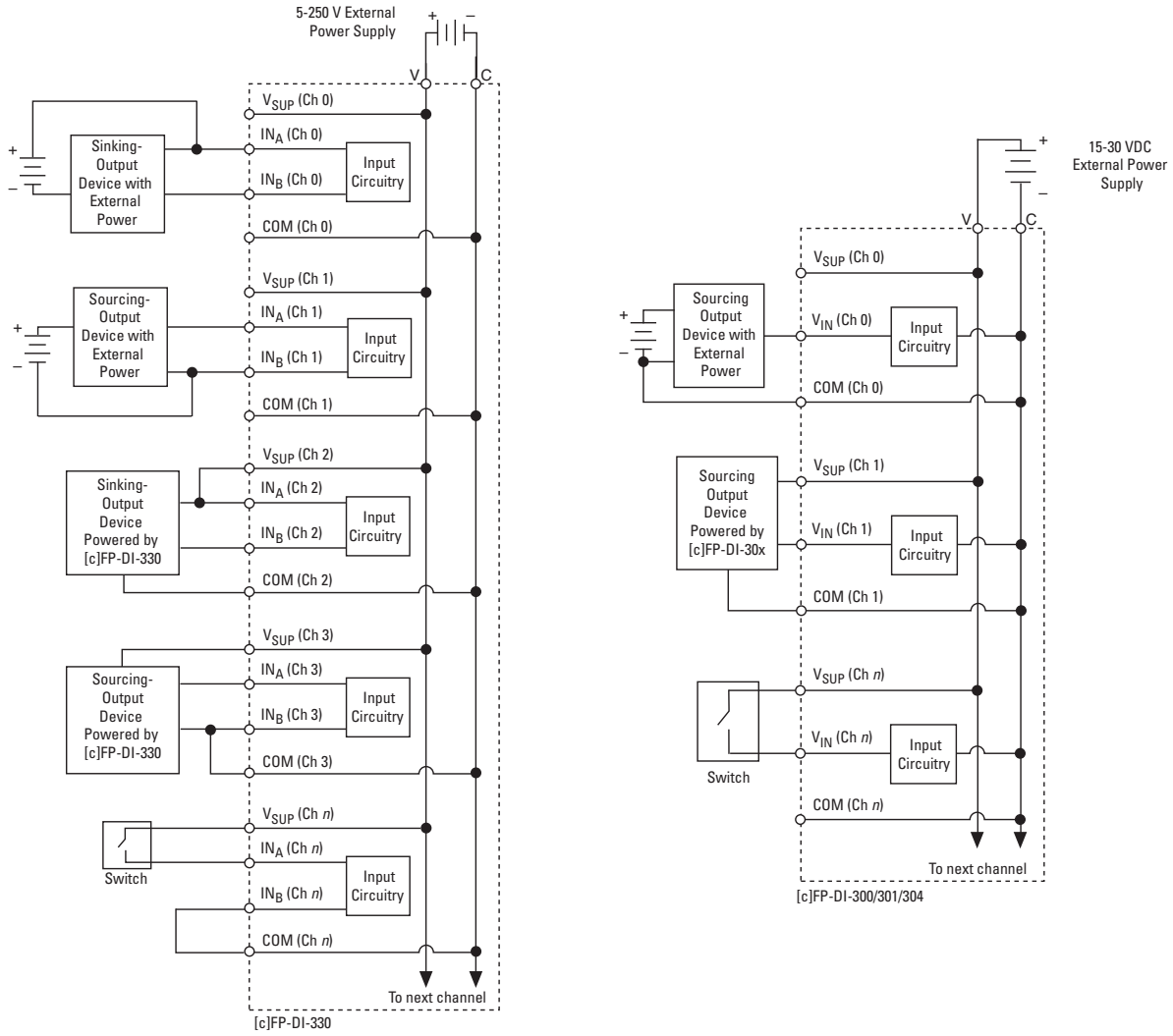

Wiring Schematics for the [c]FP-DI-3xx Modules

Ordering Information

Compact FieldPoint

NI cFP-DI-300 777318-300
NI cFP-DI-301 777318-301
NI cFP-DI-304 777318-304
NI cFP-DI-330 777318-330

Recommended Compact FieldPoint System Products

NI cFP-2120 777317-2120
NI cFP-BP-4 778617-04
NI cFP-BP-8 778617-08
NI cFP-CB-1 779618-01
NI PS-5 Power Supply 778805-90
NI Developer Suite Professional Control Edition 777906-03

FieldPoint

NI FP-DI-300 777518-300
NI FP-DI-301 777518-301
NI FP-DI-330 777518-330

Recommended FieldPoint System Products

NI FP-1601 777792-01
NI FP-TB-1 777519-01
NI PS-4 Power Supply 778586-90
NI Developer Suite Control Edition 777905-03

BUY NOW!

For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S.) or go to **ni.com**.

Specifications

Typical for -40 to 70 °C unless otherwise noted.

Digital Input Channels

[c]FP-DI-300, [c]FP-DI-330 8
[c]FP-DI-301 16
cFP-DI-304 32

Input Characteristics

Input impedance
  [c]FP-DI-300, [c]FP-DI-301 ..... 5 kΩ
  cFP-DI-304 ..... 30 kΩ
Input current limiting [c]FP-DI-330 ..... 1.5 mA

Input Voltages

[c]FP-DI-300, [c]FP-DI-301, cFP-DI-304 ..... 0 to 30 VDC
[c]FP-DI-330 ..... 0 to 250 VDC or 0 to 250 VAC (50/60 Hz AC) or 0 to 250 VAC (1 KHz AC)

Digital Logic Levels

	[c]FP-DI-300		[c]FP-DI-301		cFP-DI-304		[c]FP-DI-330	
	OFF State	ON State	OFF State	ON State	OFF State	ON State	OFF State	ON State
Input Voltage (V)	<5	>15	<5	>15	≤5	≥10	≤1 VDC, ≤1 VAC	≥4 VDC, ≥15 VAC (50/60 Hz AC), ≥3 VAC (1 KHz AC)
Input Current (µA)	≤1000	≥3000	≤1000	≥3000	≤150	≥330		

Hysteresis (cFP-DI-304)

Input voltage ..... 2 V min
Input current ..... 60 µA min

Isolation Voltage

[c]FP-DI-30x
  Channel-to-ground
    Continuous ..... 250 V_{rms}
    Withstand ..... 2,300 V_{rms}, 5 s max
  Channel-to-backplane
    Continuous ..... 250 V_{rms}
    Withstand ..... 2,300 V_{rms}, 5 s max
  Channel-to-channel ..... None
[c]FP-DI-330
  Maximum isolation voltage ..... 250 V_{rms}, Installation Category II
Transient overvoltage ..... 2,300 V_{rms}

Physical Characteristics

LED indicators
  Power (green) ..... Power on and self-test passed
  Ready (green) ..... Module configured and ready
  <0..31>, <0..15>, or <0..7> (green) ..... Input state of each channel
Dimensions
  Compact FieldPoint ..... 2.4 by 12.7 by 6.6 cm (0.94 by 5 by 2.6 in.)
  FieldPoint (including terminal base) ..... 10.7 by 10.9 by 9.1 cm (4.2 by 4.3 by 3.6 in.)
Weight
  FP-DI-300/301 ..... 130 g (4.6 oz)
  cFP-DI-300/301 ..... 100 g (3.6 oz)
  FP-DI-330 ..... 133 g (4.7 oz)
  cFP-DI-330 ..... 103 g (3.7 oz)
  cFP-DI-304 ..... 193 g (6.81 oz)

Power Requirements (from Network Module)

[c]FP-DI-300	185 mW
[c]FP-DI-301	325 mW
[c]FP-DI-330	200 mW
cFP-DI-304	1 W

Environment

Operating temperature	-40 to 70 °C
Storage temperature	-55 to 85 °C
Relative humidity	10 to 90%, noncondensing

Shock and Vibration

These specifications apply only to Compact FieldPoint.
NI recommends Compact FieldPoint if your application is subject to shock and vibration.

Operating vibration, random (IEC 60068-2-64)	10 to 500 Hz, 5 g_{rms}
Operating vibration, sinusoidal (IEC 60068-2-6)	10 to 500 Hz, 5 g
Operating shock (IEC 60068-2-27)	50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1
- CAN/CSA-22.2 No. 61010-1

For UL, hazardous location, and other safety certifications, refer to the product label or to **ni.com/certification**.

Electromagnetic Compatibility

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

Emissions	EN 55011 Class A at 10 m; FCC Part 15A above 1 GHz
Immunity	EN 61326:1997 + A2:2001, Table 1

For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety)	73/23/EEC
Electromagnetic Compatibility Directive (EMC)	89/336/EEC

Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit **ni.com/certification**.

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NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with **ni.com/pxiadvisor**.

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NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit **ni.com/calibration**.

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2005-6214-161-101

High-Speed Counter Modules for Compact FieldPoint and FieldPoint

NI [c]FP-CTR-500, NI [c]FP-CTR-502

- 8 inputs
  - 5 to 30 VDC inputs
  - 16-bit counter registers
  - 50 kHz, maximum
  - Gate inputs and digital outputs
  - Cascadable counters for higher counts
- 2,300 V_{rms} bank isolation for transient overvoltage protection
- Hot swappable with autoconfiguration
- -40 to 70 °C operating range

NEW

Module	Counter Inputs	Input Ranges	Inputs Type	Counter Resolution	Gate Inputs	Configurable Outputs	Internal Reference Clock for Frequency Measurements	Maximum Input Frequency
[c]FP-CTR-500	8	10 to 30 VDC	Sourcing	16 bit, cascadable to 128 bit	4	4	1 and 32 kHz	50 kHz
[c]FP-CTR-502	8	5 to 30 VDC	Sinking	16 bit, cascadable to 128 bit	4	4	1 and 32 kHz	50 kHz

Overview

The National Instruments [c]FP-CTR-50x devices are versatile, high-speed digital counter input modules for Compact FieldPoint and FieldPoint that can be used to count digital signals ranging from 5 to 30 VDC and to measure frequency. These modules are fast enough to handle input signals up to 50 kHz for high-speed applications, and flexible enough to measure frequency using the internal frequency reference or the external gate inputs. These powerful and versatile counter modules feature configurable lowpass filters to eliminate high-frequency noise and cascadable counter channels that can be used to create counters up to 128 bits wide that will store trillions of counts. For discrete control applications such as packaging, the digital output channels can be configured to automatically energize external devices.

All the modules include onboard diagnostics to ensure trouble-free installation and maintenance.

Counter Modules

The CTR-500 and CTR-502 counter modules include eight 16-bit, 50 kHz counters with dedicated clock inputs. For higher resolution counting, you can combine counter channels to provide cascaded counters of up to 128 bits. In addition, for each counter, you can set a terminal count at which the counter automatically rolls over or resets. For frequency measurement, you can configure each channel to use any one of the four gate inputs provided. In this mode, you can enable counting only when the state of the specified gate input is logic high. By sending the digital pulse train to the gate input and using the internal reference clock of 1 or 32 kHz, you can measure the frequency of the incoming pulse train. Because you can read the state of the gate input, you can also use the four gate inputs as general-purpose digital input channels.

You can configure each of the four counter outputs to either pulse or toggle states when you reach the terminal count for a counter input. This is useful when you need to energize external equipment upon reaching a particular count for applications like packaging. You can also use each of the outputs as general-purpose digital outputs.

The **CTR-500** modules work with 10 to 30 VDC sourcing devices and provides sourcing outputs. A sourcing device is one that connects and disconnect a voltage to the counter module. CTR-500 modules use a common ground plane for all the digital input channels.

The **CTR-502** modules work with 5 to 30 VDC sinking devices and provides sinking outputs. A sinking device is one that connects and disconnects a common to the counter module. CTR-502 modules use a common ground plane for all the digital input channels.

All the channels on the digital input modules feature LEDs that indicate the input state of each channel.

Isolation

CTR-50x modules feature optical bank isolation with 2,300 V_{rms} of breakdown isolation. These Compact FieldPoint and FieldPoint modules do not have channel-to-channel isolation.

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High-Speed Counter Modules for Compact FieldPoint and FieldPoint

Field I/O Connections

Compact FieldPoint and FieldPoint modules include a built-in power distribution bus that provides multiple power connections on the module. A field-wired power supply connected to the voltage (V) and common (C) terminals is internally connected to a power distribution bus that provides additional breakout terminals for voltage supply (V_{SUP}) and common (COM). These terminals provide a convenient way to distribute power to field devices that require external power.

The CTR-500 and CTR-502 have:

- 8 high speed digital counter input terminals (V_{IN})
- 4 digital gate input terminals (V_{IN})
- 4 digital output terminals (V_{OUT})
- 8 common terminals (C_{OM})
- 8 power connections to power field devices (V_{SUP})

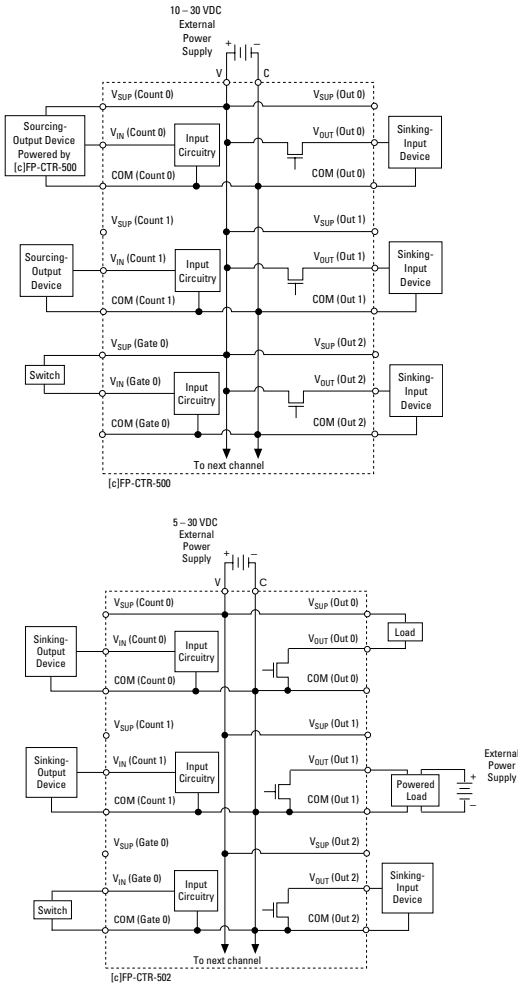

Figure 1. Wiring Schemtatic for CTR Modules

Ordering Information

Compact FieldPoint

NI cFP-CTR-500 777318-500
NI cFP-CTR-502 777318-502

Recommended Compact FieldPoint System Products

NI cFP-2020 777317-2020
NI cFP-BP-4 778617-04
NI cFP-CB-1 778618-01
NI PS-5 power supply 778805-90
NI Developer Suite Professional Control Edition 777906-03

FieldPoint

NI FP-CTR-500 777518-500
NI FP-CTR-502 777518-502

Recommended FieldPoint System Products

NI FP-1601 777792-01
NI FP-TB-1 777519-01
NI PS-4 power supply 778586-90
NI Developer Suite Standard Control Edition 777905-03

BUY ONLINE!

Visit ni.com/info and enter cfpctr500, cfpctr502, fpctr500, and/or cfpftr502.

High-Speed Counter Modules for Compact FieldPoint and FieldPoint

Specifications

Typical for -40 to 70 °C unless otherwise noted.

Input Characteristics

Input channels ..... 12 (8 count, 4 gate)
Input type
  [c]FP-CTR-500 ..... 10-30 VDC, sinking
  [c]FP-CTR-502 ..... 5-30 VDC, sourcing
Maximum input voltage ..... 30 VDC
Input threshold level
  [c]FP-CTR-500 ..... 8 V typ
  6 V min
  10 V max
  [c]FP-CTR-502 ..... V_{SUP} – 2.5 V typ
  V_{SUP} – 3.0 V min
  V_{SUP} – 2.0 V max
  (V_{SUP} is the external supply voltage)
Input current limiting
  [c]FP-CTR-500 ..... 5 mA
  [c]FP-CTR-502 ..... 6 mA
Input bandwidth
  Count inputs ..... 50 kHz or software-enabled 200 kHz lowpass filter
  Gate inputs ..... 50 kHz
Maximum off-state leakage current for external devices
  [c]FP-CTR-500 ..... 0.2 mA
  [c]FP-CTR-502 ..... 0.3 mA

Output Characteristics

Output channels 4
Output type
  [c]FP-CTR-500 ..... 10-30 VDC sourcing, compatible with most 12 and 24 VDC devices
  [c]FP-CTR-502 ..... 5-30 VDC sinking, compatible with TTL and other 5, 12, and 24 VDC devices
Supply voltage
  [c]FP-CTR-500 ..... 10-30 VDC, user-provided
  [c]FP-CTR-502 ..... 5-30 VDC, user-provided
Maximum output current
  FP-CTR-500/502 ..... 1 A per channel
  cFP-CTR-500/502 ..... 1 A per channel at -40 to 50 °C; 0.75 A per channel at 50 to 60 °C
Maximum output current on all channels ..... 4 A
Output impedance
  [c]FP-CTR-500 ..... 0.3 Ω
  [c]FP-CTR-502 ..... 0.12 Ω
Output bandwidth ..... 16 kHz for a current flow ≥3.2 mA
Maximum off-state leakage current ..... 25 µA

Power Requirement

Power from network module ..... 800 mW

Physical Characteristics

LED indicators
  POWER (green) ..... Power on and self-test passed
  READY (green) ..... Module configured and ready
Count inputs <0..7> (green) ..... On/off state of counter input
Gate inputs <0..3> (green) ..... On/off state of gate input
Outputs <0..3> (green) ..... On/off state of output
Dimensions (including terminal base) ..... 10.7 by 10.9 by 9.1 cm (4.2 by 4.3 by 3.6 in.)
Weight
  FP-CTR-500/502 ..... 130 g (4.6 oz)
  cFP-CTR-500/502 ..... 100 g (3.5 oz)

Isolation Voltage

Maximum isolation voltage ..... 250 V_{rms}, Installation Category II
Channel-to-channel isolation ..... No isolation between channels
Transient overvoltage ..... 2,300 V_{rms}

Environment

Operating temperature
  FP-CTR-500/502 ..... -40 to 70 °C
  cFP-CTR-500/502 ..... -40 to 60 °C
Storage temperature ..... -55 to 85 °C
Relative humidity ..... 10 to 90%, noncondensing

Shock and Vibration

These specifications apply only to Compact FieldPoint. NI recommends Compact FieldPoint if your application is subject to shock and vibration.

Operating vibration, random
  (IEC 60068-2-64) ..... 10 to 500 Hz, 5 g_{rms}
Operating vibration, sinusoidal
  (IEC 60068-2-6) ..... 10 to 500 Hz, 5 g
Operating shock
  (IEC 60068-2-27) ..... 50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

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

For UL, hazardous location, and other safety certifications, refer to the product label or to ***ni.com***

Electromagnetic Compatibility

CE, C-Tick, and FCC Part 15 (Class A) Compliant
Emissions ..... EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity ..... EN 61326:1997 + A2:2001, Table 1
For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE Marking, as follows:
Low-Voltage Directive (safety) 73/23/EEC
Electromagnetic Compatibility
  Directive (EMC) 89/336/EEC
Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit ***ni.com/hardref.nsf/*** and search by model number or product line.

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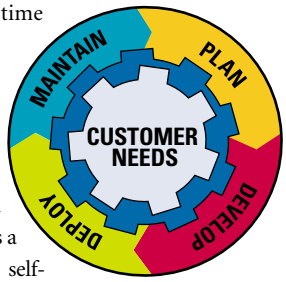

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Dallas, TX 75284-0909
www.ni.com

Andrew Norman
University of Virginia
Physics Department
CHARLOTTESVILLE, VA 22903

Quotation Date : 05/29/2007

Phone : 434 9825382

Fax :

Quotation No. 928105

Please indicate the above quote number when ordering for faster processing.

Item	Qty.	Part Number	Description	List Price	Disc. %	Net Price
1	1	779463-01	cFP-1808, 8-slot Ethernet/Serial Interface for Compact FieldPoint	$ 999.00	10%	$ 899.10
			Estimated Delivery Days : 5 - 10 business days ARO.			
2	1	778617-08	cFP-BP-8 8-Slot Backplane	$ 549.00	10%	$ 494.10
			Estimated Delivery Days : 5 - 10 business days ARO.			
3	1	777584-01	PS-2 Power Supply (US 120 VAC) for FieldPoint Output: 24VDC, 0.8A; Input: US 120 VAC	$ 79.00	10%	$ 71.10
			Estimated Delivery Days : 1 - 2 business days ARO.			
4	4	777318-112	cFP-AI-112 16 ch, 16-Bit Analog Input Module (V)	$ 599.00	10%	$ 2,156.40
			Estimated Delivery Days : 1 - 2 business days ARO.			
5	1	777318-550	cFP-DIO-550, Digital Input/Output Module (AC-DC sink/DC source) 8 channel AC or DC Sinking Digital Input 8 channel DC Sourcing Digital Output	$ 279.00	10%	$ 251.10
			Estimated Delivery Days : 1 - 2 business days ARO.			
6	1	777318-500	cFP-CTR-500, Counter Input Module, 8 channel, external power supply optional.	$ 429.00	10%	$ 386.10
			Estimated Delivery Days : 1 - 2 business days ARO.			
7	2	777318-122	cFP-RTD-122, 16 Bit RTD Input Module (RTD, Ohms), 8 channel.	$ 469.00	10%	$ 844.20
			Estimated Delivery Days : 1 - 2 business days ARO.			
			Shipping and Handling:			$ 50.88
			Total :			$ 5,152.98

Currency quoted in : U. S. Dollars

To ensure the highest quality service in order processing and support after delivery, please provide end-user information with your purchase order.

Payment Terms : Net 30

Quote Valid Until : 28-JUN-07

Freight Terms : NI Weight Based Shipping

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Andrew Norman
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Physics Department
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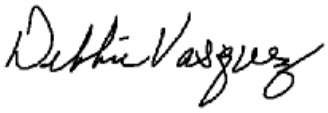
Quotation Date : 05/29/2007

Phone : 434 9825382

Fax :

Yours sincerely,
National Instruments Corporate



Debbie Vasquez

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