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**PXI-8156B**

# *FieldPoint*<sup>™</sup>

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## **FP-2000/2010/2015 User Manual**

### **Note to Users**

*The contents of this document that refer to FieldPoint software are not intended for use with FieldPoint Software 4.0 or LabVIEW 7.0. Refer to the Measurement & Automation Explorer Help for FieldPoint and the FieldPoint LabVIEW Interface Help.*

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# Conventions

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The following conventions appear in this manual:

» The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.



This icon denotes a note, which alerts you to important information.



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on the product, refer to the *FieldPoint Safety Information* section for precautions to take.

**bold** Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names and LED names.

FP-20xx FP-20xx refers to the FP-2000, FP-2010, and FP-2015.

*italic* Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.

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

**monospace bold** Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

*monospace italic* Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

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# Overview of the FP-20xx Network Module

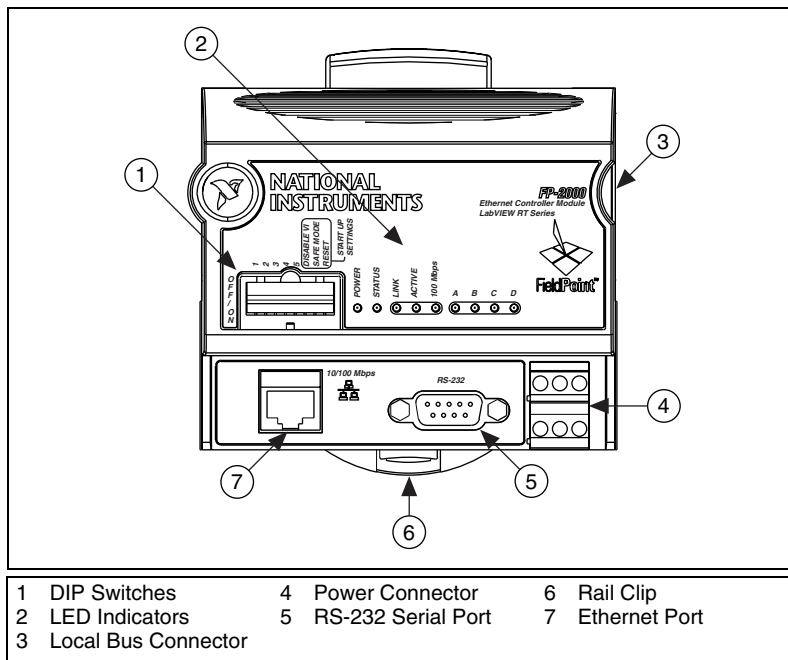
This chapter provides an overview of the FieldPoint FP-20xx network module and FieldPoint software.

## FP-20xx Hardware Overview

---

Using the FP-20xx module with LabVIEW RT provides an easy-to-use system for real-time embedded applications. When you run the LabVIEW RT engine on an FP-20xx, the module can run applications without input from the host computer. You can use a separate host PC running Windows to control the FP-20xx through an Ethernet connection. Refer to the *LabVIEW RT User Manual* for more information about the LabVIEW RT engine.

Besides the Ethernet port, the FP-20xx has an RS-232 serial port that is accessible through software. It also has LED indicators to communicate status information and DIP switches that perform various functions. Figure 1-1 shows where these features are located on the FP-20xx.



**Figure 1-1.** FP-20xx Parts Locator Diagram

A FieldPoint bank consists of one network module, one or more terminal bases, and one or more I/O modules. Each FP-20xx can support up to nine I/O modules. Each bank can be accessed by an unlimited number of host computers or FieldPoint modules, forming a distributed computing system. The maximum number of FP-20xx network modules that can be installed on your Ethernet network is limited only by your network topology.

The FP-20xx network module connects directly to a 10 or 100 Mbps Ethernet network. The module auto-detects the speed of the connection and configures itself accordingly.

Figure 1-2 shows an FP-20xx connected to an Ethernet network. For detailed hardware specifications and cabling information, refer to Appendix E, [Specifications](#).

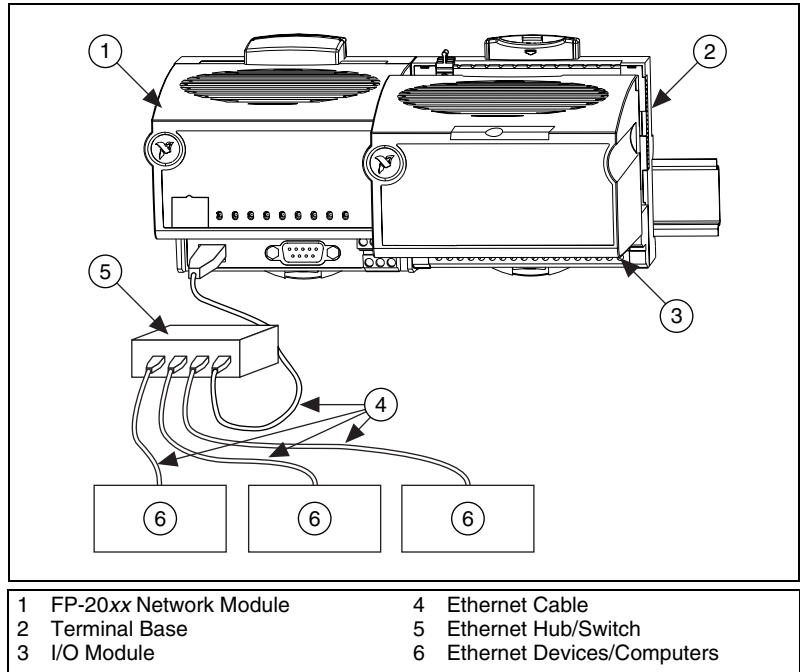


Figure 1-2. FP-20xx Connected to an Ethernet Network

## FieldPoint Software Overview

Your FieldPoint software includes a configuration utility as well as server and driver software for easy integration into application software packages. These software components manage the low-level communications and hardware details, simplifying programmatic access to I/O channels. Version 3.0.1 of the FieldPoint software runs on Windows 2000/NT 4.0/XP/Me/9x and includes the following components:

- FieldPoint Explorer configuration utility
- LabVIEW VIs
- LabWindows/CVI Functions
- Lookout driver
- Measurement Studio instrument drivers
- OPC Server

You can download a current version of FieldPoint software from the National Instruments Web site. Using your Web browser, go to [ni.com](http://ni.com),

select **Download Software»Drivers and Updates»Current Software Versions»Fieldpoint Explorer**, and follow the instructions on that page.

## FP-20xx Setup Overview

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The following list is an overview of the steps required to get up and running with your FP-20xx and LabVIEW RT.

1. Install hardware as described in Chapter 2, *Installing the Hardware and Software*.
  - a. Mount FP-20xx, terminal bases, and I/O modules.
  - b. Connect FieldPoint system to network.
  - c. Wire power to FieldPoint system.
  - d. Wire signals to I/O modules.
2. Install the software as described in Chapter 2, *Installing the Hardware and Software*.
  - a. Install programming software (LabVIEW RT).
  - b. Install FieldPoint Explorer.
3. Configure the FieldPoint system, and verify the configuration, as described in Chapter 3, *Hardware and Software Configuration*.
  - a. Configure FP-20xx network settings.
  - b. Configure I/O module ranges and settings.
  - c. Configure security.
  - d. Test channels.
  - e. Save settings.
4. Configure optional settings as described in Chapter 4, *Feature Set Description*.
5. Develop your application, as described in Chapter 5, *LabVIEW RT Programming*.
  - a. Launch LabVIEW RT.
  - b. Develop code.
  - c. Switch execution target to test code on FP-20xx.
  - d. Build application by building .exe with LabVIEW RT targeted to FP-20xx.
  - e. Test embedded application.
6. Deploy system.

---

# Installing the Hardware and Software

This chapter explains how to install the FieldPoint hardware and software.

## What You Need to Get Started

---

To set up and use LabVIEW RT with the FP-20xx, you need the following:

- FP-20xx network module
- Mounting hardware (DIN rail or panel-mount accessory)
- Terminal base(s) and I/O module(s)
- Power supply
- Accessories: Ethernet cable, screwdriver
- FieldPoint Software CD
- A host PC running Windows 2000/NT 4.0/XP/Me/9x
- LabVIEW RT software
- LabVIEW RT User Manual*

## FieldPoint Safety Information

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The following section contains important safety information that you *must* follow when installing and using FieldPoint products.

Do *not* operate the FieldPoint product in a manner not specified in the user manual or operating instructions. Misuse of the product can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to National Instruments for repair.

Do *not* substitute parts or modify the FieldPoint product. Use the product only with the modules, accessories, and cables specified in the installation instructions.

Always operate the FieldPoint product in a suitable enclosure that will prevent unintentional access to live terminals and will prevent the spread of fire.

Do *not* operate FieldPoint products in an explosive atmosphere or where there may be flammable gases or fumes. If you need to operate FieldPoint products in such an environment, the FieldPoint products *must* be in a suitably rated enclosure. Operate the product only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs which becomes conductive due to condensation.

If you need to clean a FieldPoint product, use a soft nonmetallic brush. The product *must* be completely dry and free from contaminants before you return it to service.

You *must* insulate signal connections for the maximum voltage for which the FieldPoint product is rated. Do *not* exceed the maximum ratings for the product. Do *not* install wiring while the product is live with electrical signals. Do *not* remove or add terminal bases when power is connected to the FieldPoint system. Avoid contact between your body and the terminal base signal wiring when hot-swapping modules.

Operate FieldPoint products at or below Installation Category II. The following is a description of installation categories:

- Installation Category I is for measurements performed on circuits not directly connected to MAINS<sup>1</sup>. This category is a signal level such as

---

<sup>1</sup> MAINS is defined as the electricity supply system to which the equipment concerned is designed to be connected for either powering the equipment or for measurement purposes.

voltages on a printed wiring board (PWB) on the secondary of an isolation transformer.

Examples of Installation Category I are measurements on circuits not derived from MAINS and specially protected (internal) MAINS-derived circuits.

- Installation Category II is for measurements performed on circuits directly connected to the low-voltage installation. This category refers to local-level distribution, such as that provided by a standard wall outlet.

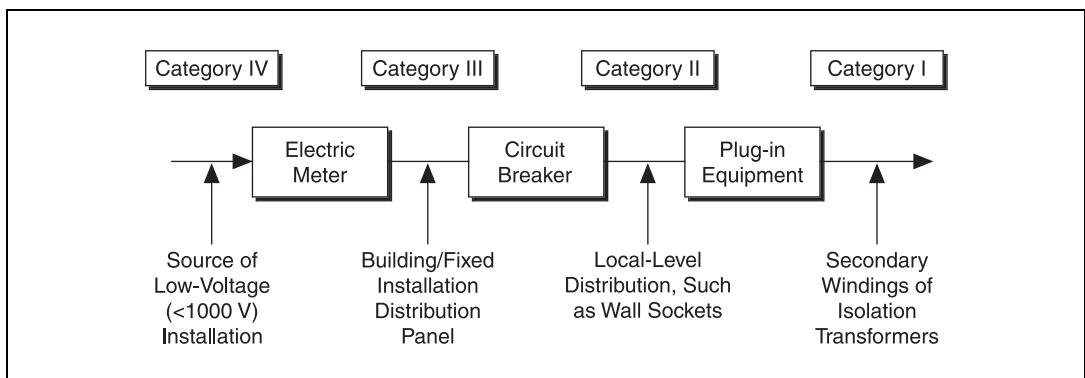
Examples of Installation Category II are measurements on household appliances, portable tools, and similar equipment.

- Installation Category III is for measurements performed in the building installation. This category is a distribution level, referring to hard-wired equipment that does not rely on standard building insulation.

Examples of Installation Category III include measurements on distribution circuits and circuit-breakers. Other examples of Installation Category III are wiring including cables, bus-bars, junction boxes, switches, socket-outlets in the building/fixed installation, and equipment for industrial use, such as stationary motors with a permanent connection to the building/fixed installation.

- Installation Category IV is for measurements performed at the source of the low-voltage (< 1,000 V) installation.

Examples of Installation Category IV are electric meters, and measurements on primary overcurrent protection devices and ripple-control units.



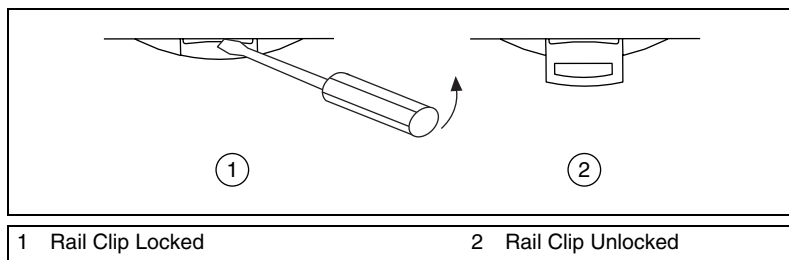
## Mounting the FP-20xx and Terminal Bases

You can mount the FieldPoint system either to a DIN rail or directly on a panel. Panel mounting is generally the more secure option, but DIN rail mounting might be more convenient for your application. The following sections give instructions for both mounting methods.

### Mounting the FP-20xx on a DIN Rail

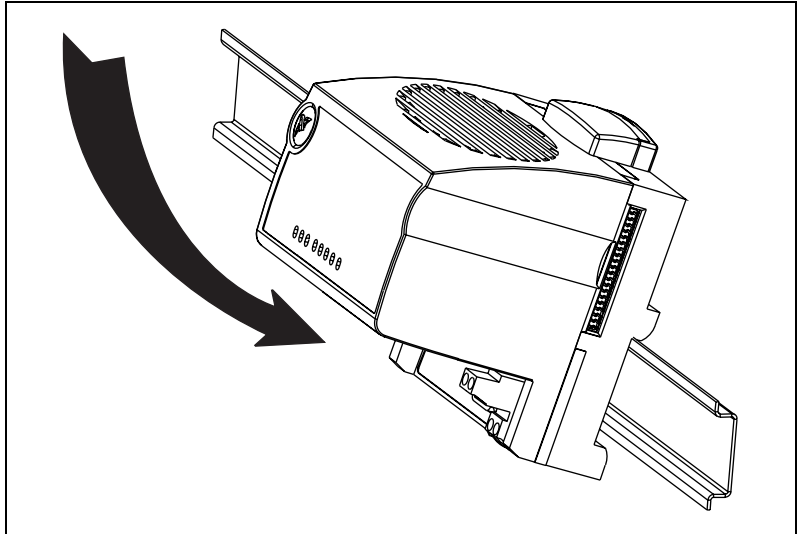
The FP-20xx network module has a simple rail clip for reliable mounting onto a standard 35 mm DIN rail. Follow these steps if you choose to mount the module on a DIN rail:

1. Write down the serial number from the back of the FP-20xx before you mount it.
2. Use a flathead screwdriver to open the DIN rail clip to the unlocked position, as shown in the following figure.

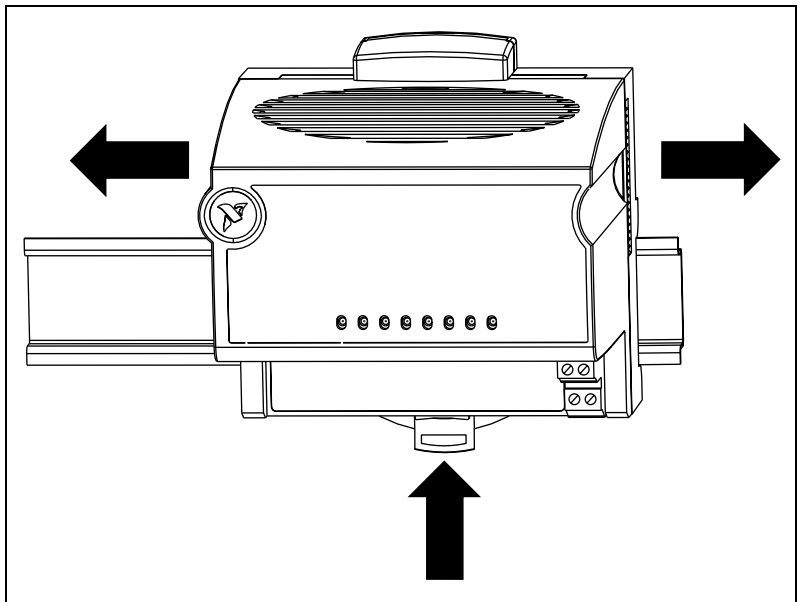


3. Hook the lip on the rear of the FP-20xx onto the top of a 35 mm DIN rail and press it down onto the DIN rail, as shown in the following figure.





4. Slide the FP-20xx to the desired position along the DIN rail. After it is in position, lock it to the DIN rail by pushing the rail clip to the locked position, as shown in the following figure.



After the FP-20xx is mounted to the DIN rail, connect the terminal base to it.

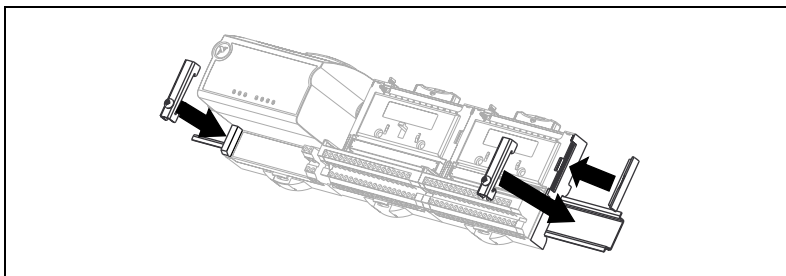
## Connecting Terminal Bases with DIN Rail Mounting

Follow these steps to connect a terminal base to an FP-20xx network module using DIN rail mounting.



**Caution** To avoid damaging the FP-20xx and the terminal bases, make sure that power is *not* applied to it while you install or remove terminal bases.

1. Mount the terminal base onto the DIN rail in the same way you installed the network module.
2. Attach the terminal base to the FP-20xx by firmly mating the local bus connectors. Be careful not to bend any pins.
3. To add more terminal bases, install them on the rail and connect their local bus connectors together. In most cases a single FP-20xx can support up to nine terminal bases, depending on the power consumption of the I/O modules. Refer to the [Wiring Power to the FieldPoint System](#) section for more information about power requirements.
4. Place the protective cover onto the local bus connector of the last terminal base on the bank, as shown in the following figure. Add the rail locks by sliding them on and tightening the screws.



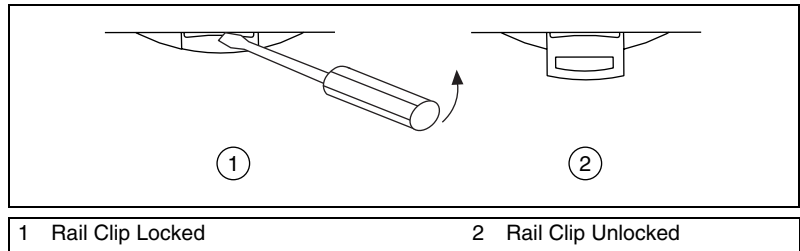
## Removing the FP-20xx and Terminal Bases from the DIN Rail

Remove an I/O module from its terminal base before lifting the terminal base off the rail. To remove an FP-20xx network module or terminal base, unlock it from the DIN rail by placing a screwdriver in the slot on the rail clip and opening it to the unlocked position. After you disconnect the network module from the local bus connector of the terminal base, you can lift it off the rail.

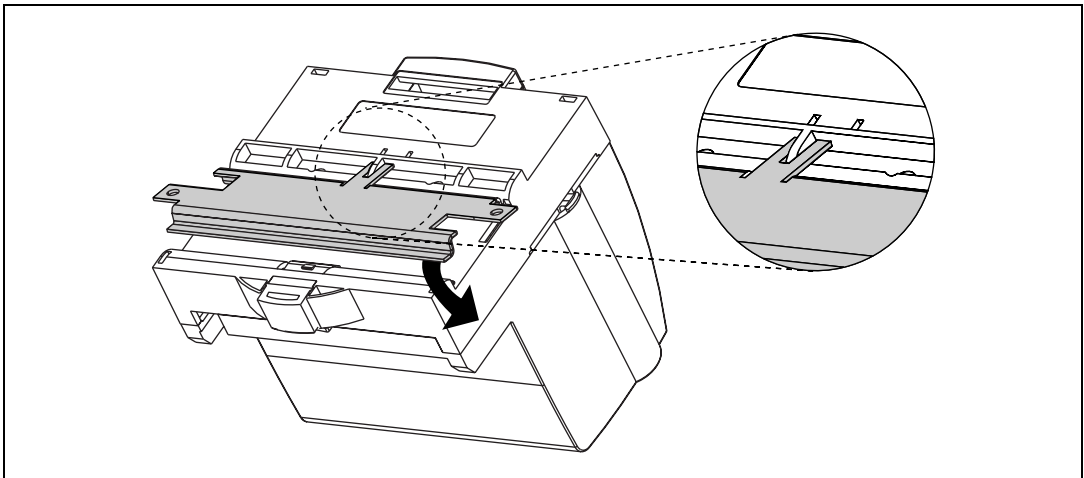
## Mounting the FP-20xx to a Panel

Follow these steps if you choose to install the optional FieldPoint network panel-mount accessory and mount the FP-20xx network module to a panel. You can order the panel-mount accessory, part number 777609-01, from National Instruments.

1. Write down the serial number from the back of the FP-20xx before you mount it.
2. Use a flathead screwdriver to open the rail clip to the unlocked position, as shown in the following figure.

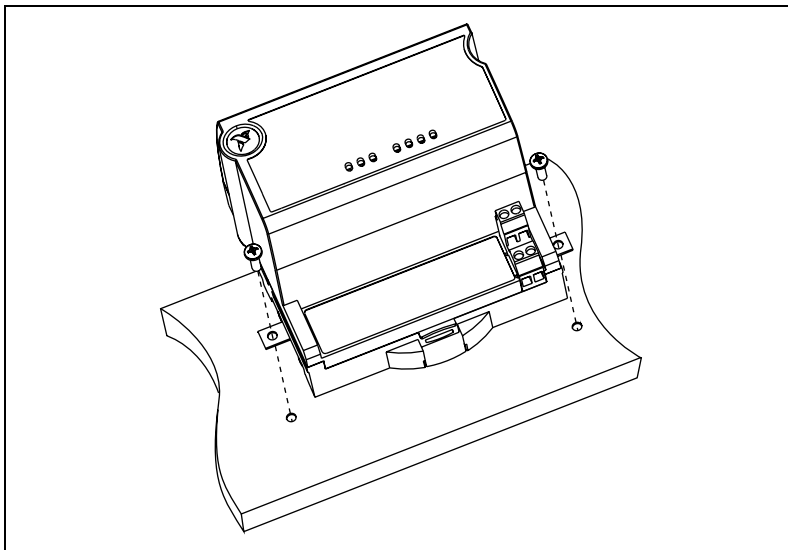


3. Snap the panel-mount accessory onto the module, as shown in the following figure.



4. Lock the panel-mount accessory into place by pushing the rail clip to the locked position.

5. Mount the FP-20xx to your panel with the panel-mount accessory, as shown in the following figure. The installation guide that came with the panel-mount accessory includes a template that you can use to drill pilot holes for mounting.



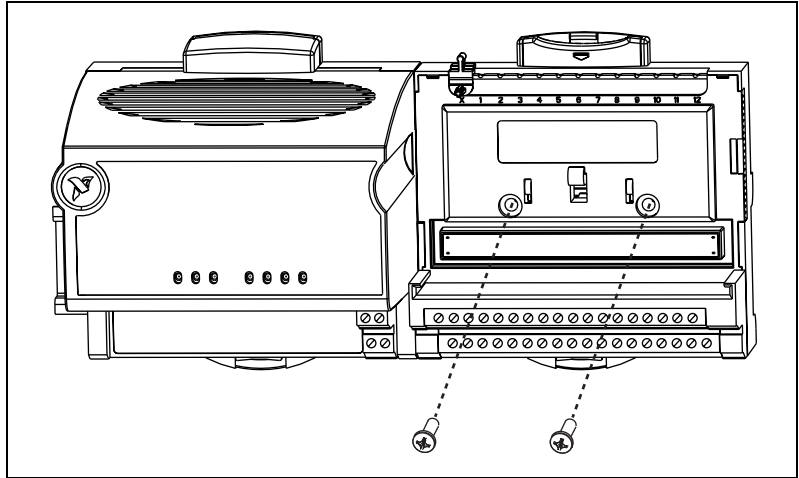
## Connecting Terminal Bases with Panel Mounting

You can install terminal bases directly, without using the panel-mount accessory needed to mount the FP-20xx network module. Follow these steps to connect terminal bases to the network module using panel mounting.



**Caution** To avoid damaging the FP-20xx and the terminal bases, make sure that power is *not* applied to it while you install or remove terminal bases.

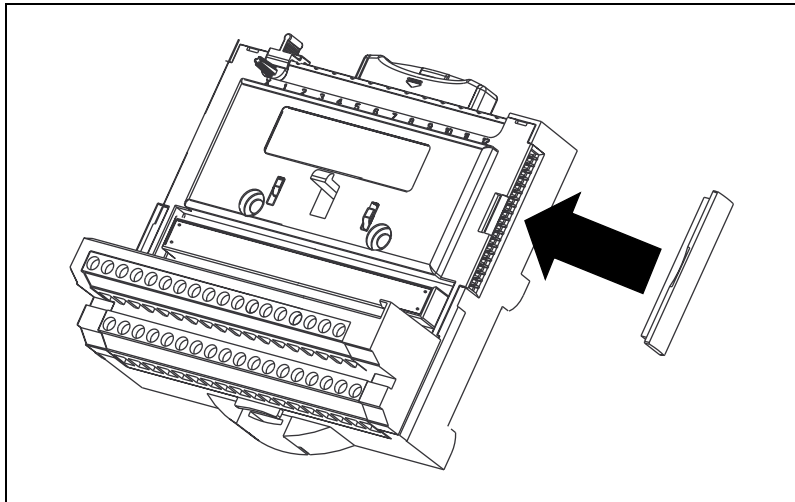
1. Drill pilot holes in the panel to mount the terminal bases. A drilling template is provided with the network module panel-mount accessory.
2. Connect the terminal base to the FP-20xx by firmly mating the local bus connectors. Be careful not to bend any connector pins.
3. Bolt, screw, or otherwise fasten the terminal base to the panel. Make sure that the local bus connectors remain firmly mated after the terminal base is mounted.



4. To add more terminal bases, repeat steps 1 through 3, mating the local bus connectors of each new terminal base to the connector of the last installed base. In most cases a single FP-20xx can support up to nine terminal bases, depending on the power consumption of the I/O modules. Refer to the [Wiring Power to the FieldPoint System](#) section for more information about power requirements.

If all the pilot holes were correctly drilled, the local bus connectors should remain firmly mated after all the bases are mounted to the panel.

5. Place the protective cover onto the local bus connector of the last terminal base on the bank, as shown in the following figure.



## Removing the FP-20xx and Terminal Bases from the Panel

To remove an FP-20xx network module and terminal bases from the panel, first remove the terminal bases, starting with the last one, then remove the network module.

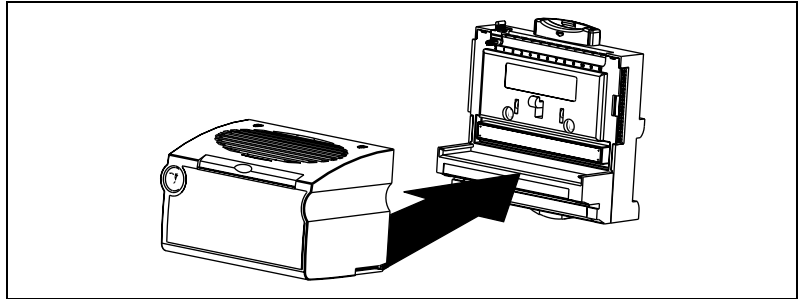
## Mounting I/O Modules onto Terminal Bases

Generally, it does not matter where you install each I/O module, except in the following situations:

- If you plan to cascade power between any I/O modules using the V and C terminals, those modules should be grouped together.
- For more accurate measurements, you might want to locate any thermocouple modules away from heat sources, including network modules or relay modules, unless you are mounting them on an FP-TB-3.

Refer to the following figure and follow these steps to connect an I/O module to a terminal base:

1. Position the first module with its alignment slots aligned with the guide rails on the terminal base.



2. Firmly press the module onto the terminal base. The terminal base latch locks the I/O module into place when the ejector button pops up on top of the terminal base.
3. Repeat this procedure to install additional I/O modules onto terminal bases.

To remove a module, press the ejector button on top of the terminal base and pull off the module.



**Note** Some older modules may require more force to remove from the terminal base. Make sure you firmly pull the module straight off the terminal base.

## Connecting the FP-20xx to the Network

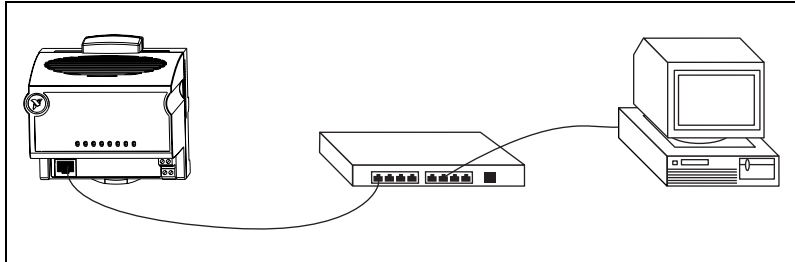
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Connect the FP-20xx network module to an Ethernet network using the RJ-45 Ethernet port on the module. Connect the RJ-45 Ethernet port of the module to an Ethernet hub using a standard Category 5 Ethernet cable. You also can connect the module directly to a computer using an Ethernet crossover cable.

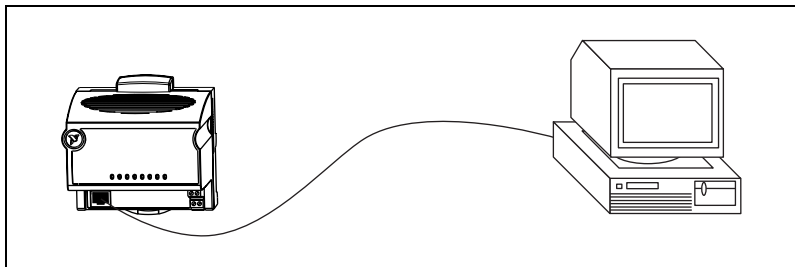


**Caution** To prevent data loss and to maintain the integrity of your Ethernet installation, do *not* use a cable longer than 100 m. If you are using a 100 Mbps Ethernet, National Instruments recommends using a Category 5 shielded twisted-pair Ethernet cable.

The following figure shows the FP-20xx connected to an Ethernet hub.



The following figure shows the FP-20xx connected directly using a crossover cable.



The host PC communicates to the FP-20xx over a standard Ethernet connection. If the host PC is already configured on a network, you must configure the FP-20xx on the same network. If neither is connected to a network, you can connect the two directly using a CAT-5 crossover cable. If you need to build your own cable, refer to Appendix E, [Specifications](#), for more information about Ethernet cable wiring connections.

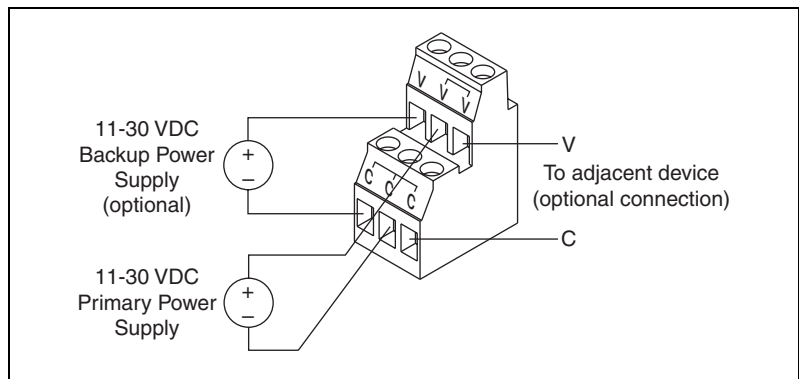
In order to configure the FP-20xx, it must reside on the same subnet as the host PC. If you want to use the FP-20xx on a subnet other than the one the host PC is on, first connect and configure it on the same subnet as the host PC, then reassign a static IP address for the subnet where you want it to be and physically move it to the other subnet. Contact your network administrator if you need assistance configuring the host PC and FP-20xx on the same subnet.



## Wiring Power to the FieldPoint System

Each FP-20xx on your network requires an 11–30 VDC power supply. The FP-20xx filters and regulates the supplied power and provides power for all the I/O modules in the bank. This power is sufficient for most FieldPoint I/O modules. Refer to the documentation for the individual I/O modules to determine whether they require any additional power in your applications.

Figure 2-1 shows the 6-pin screw-terminal power connector on the FP-20xx.



**Figure 2-1.** FP-20xx Power Connector Pinout

Follow these steps to connect power to the FieldPoint system:

1. Connect the primary power supply to the center V and C pair. You can connect an optional backup power supply to the left V and C pair. The FP-20xx uses the power supply with the higher voltage level. The V terminal for backup power is isolated from the other V terminals. The right V and C pair provides a convenient means of connecting power to the V and C terminals of a terminal base. Figure 2-2 shows this optional connection, called *cascading power*. To verify that your power supply is sufficient for your modules and devices, refer to the *Calculating Power for a FieldPoint Bank* section for instructions on calculating power requirements.



**Caution** Cascading power defeats isolation between the cascaded modules.

2. Connect power to the FieldPoint modules that require external power for inputs or outputs (may include output modules, counter modules, PWM, PG, QUAD). Refer to the I/O module's operating instructions

for power requirement details. You can power a module by connecting the V and C inputs on its terminal base to a separate power supply, connecting the V and C outputs of a neighboring terminal base or network module, or using a combination of both methods. If you want to power field I/O devices from a terminal base, supply power to the terminal base, and then connect the terminal base V and C output terminals to the field device.

Figure 2-2 shows an example of a FieldPoint system correctly wired to power sources.

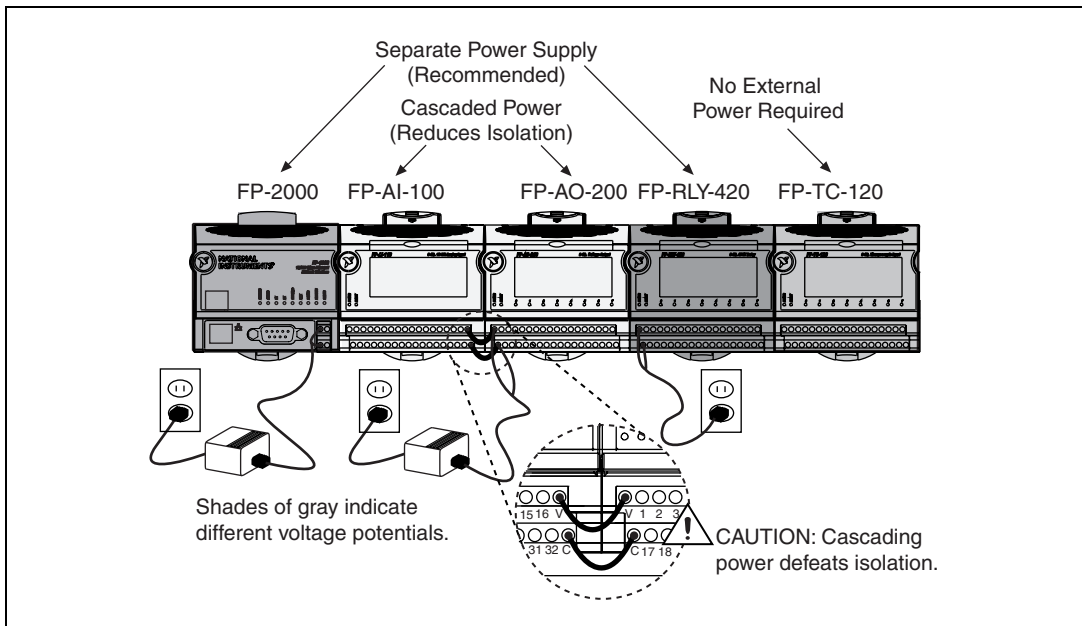


Figure 2-2. FieldPoint Bank with Power Connections

## Calculating Power for a FieldPoint Bank

The power requirements for a FieldPoint bank that uses an FP-20xx network module are calculated as follows:

$$Power = 4.5 \text{ W} + 1.1 * \sum(I/O \text{ Module Consumption})$$

This is the amount of power the FP-20xx network module consumes from the power supply to power itself and the I/O modules. It does not include any power consumed by devices that you wire to the terminal bases.

The FP-20xx supplies 9 W of power to the I/O modules. Using certain I/O modules that consume more than 1 W may reduce the total number of I/O modules allowed in the bank to less than nine. Refer to the operating instructions for each I/O module for power consumption information.

## Connecting to Field Devices

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Use each I/O module's operating instructions, or the diagram under its removable label, to help you connect your field devices.

## Powering Up the FP-20xx

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Plug in each power supply to the FieldPoint bank. At power-up, the FP-20xx runs a power-on self test (POST) that takes several seconds. You should see the **POWER** and **STATUS** LEDs come on. After about five seconds, the **STATUS** LED begins flashing. This indicates that the FP-20xx is ready to be configured, and you can proceed to installing the FieldPoint software.

If you have already assigned an IP address to the FP-20xx, the **STATUS** LED turns off, and the **A**, **B**, **C**, and **D** LEDs come on for about 15 seconds as LabVIEW RT starts up. Once they turn off, the I/O module **READY** LEDs come on, and the FP-20xx is ready for use.

If the **STATUS** LED does not light up as described here, refer to the [STATUS LED Error Indications](#) section of Appendix C, *Troubleshooting*.

## Installing Software on the Host PC

---

The FP-20xx has the embedded LabVIEW RT Engine and FieldPoint software pre-installed, but you must install the necessary software on the host PC. Follow these steps to install the FieldPoint software on the host PC.

1. Install the software packages you plan to use, such as LabVIEW, LabVIEW RT, Lookout, Measurement Studio, or LabWindows/CVI, before you install the FieldPoint software. The FieldPoint software installation installs the LabVIEW VIs and examples, Lookout driver class, and LabWindows/CVI instrument driver only if it finds the corresponding development software installed.
2. Close all other applications.

3. Insert the FieldPoint software CD into the CD-ROM drive on your computer.
4. Follow the onscreen instructions to complete the installation.



**Note** If the setup does not launch automatically, select **Start»Run** from Windows, enter *d*: \setup, where *d* is the letter of your CD-ROM drive, and select **OK**.

The hardware and software installation is now complete. Proceed to Chapter 3, *Hardware and Software Configuration*.

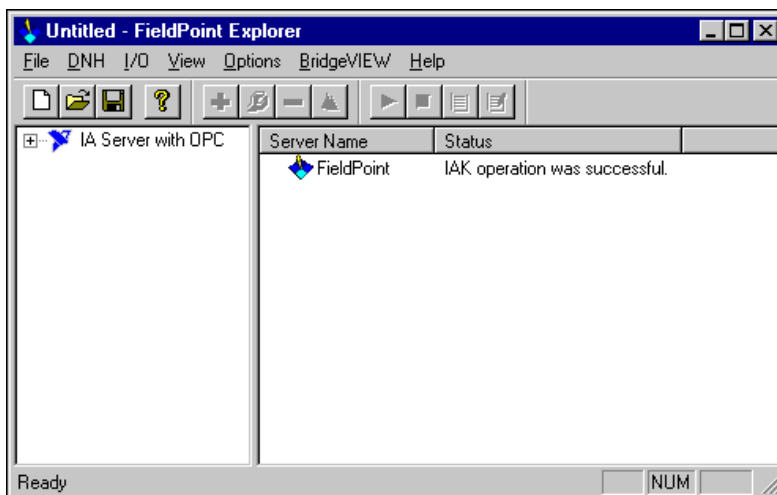
# Hardware and Software Configuration

This chapter describes the details of configuring FieldPoint hardware and software, verifying the configuration, and accessing the channels on the FP-20xx from other software running on the host PC.

## Configuring the FP-20xx in FieldPoint Explorer

To get started with FieldPoint Explorer, follow these steps:

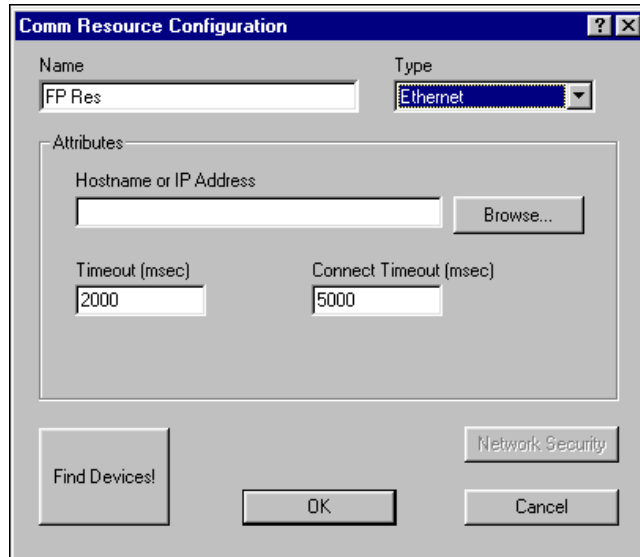
1. Make sure that LabVIEW RT and the FieldPoint hardware and software have been installed as explained in Chapter 2, *Installing the Hardware and Software*, and in the LabVIEW RT manual. Verify that the FieldPoint system is powered on.
2. From the Windows **Start** menu, select **Programs»National Instruments FieldPoint»FieldPoint Explorer** to launch FieldPoint Explorer, shown in the following figure.



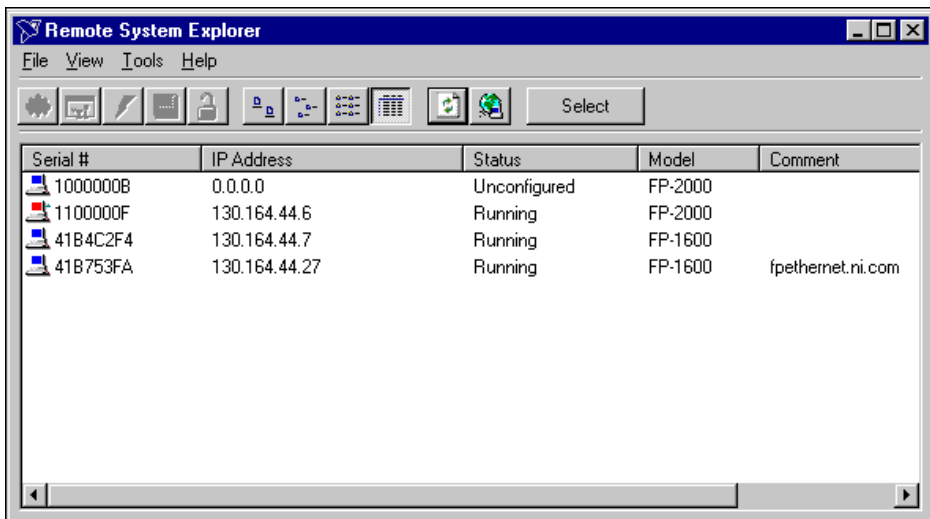
3. Click the + sign next to **IA Server with OPC** in the left pane to expand the view. Then right-click **FieldPoint** and select **Add a comm**

**resource to this server.** The Comm Resource Configuration dialog box appears.

4. To use the FP-20xx, set the **Type** to **Ethernet**, as shown in the following figure. Each Ethernet comm resource represents a single bank of FieldPoint modules on the network.

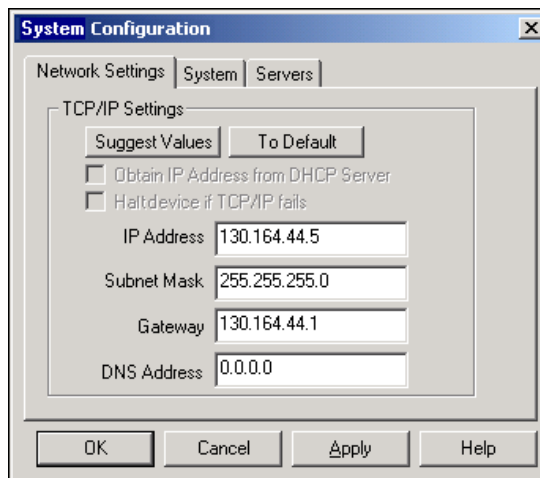


5. Click **Browse** to launch Remote System Explorer, shown in the following figure.



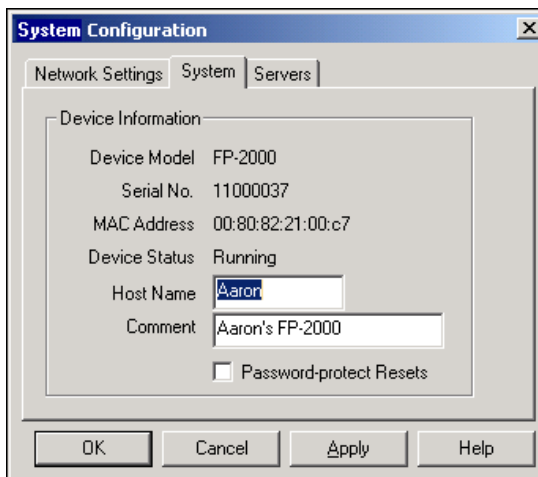
Remote System Explorer searches for any FP-20xx or other National Instruments Ethernet devices on the subnet. The serial number shown corresponds to the serial number of your FP-20xx. The status of the module is **Unconfigured** because you have not set an IP address for it.

6. Double-click the serial number of the FP-20xx you want to configure. Alternatively, you can right-click the network module and choose **Configure Device**.
7. Enter values on the **Network Settings** tab of the System Configuration dialog box, shown in the following figure. Refer to Appendix A, *Choosing Network Settings*, for more information about choosing appropriate addresses for these fields. You also can click **Suggest Values** to let the software provide default parameters. If your network does not have a gateway server or DNS server, you should set these parameters to 0.0.0.0.



- **IP Address**—The unique, computer-readable address of a device on your network. An IP address is typically represented as four numbers separated by periods (for example, 130.164.55.112) where the numbers can be between 0 and 255, inclusive.
- **Subnet Mask**—A code that helps the network device determine whether another device is on the same subnet or a different subnet. The most common subnet mask is 255.255.255.0.

- **Gateway**—The IP address of a device that acts as a gateway server, which is a connection between two networks.
  - **DNS Address**—The IP address of a network device that stores host names and translates them into IP addresses.
8. Enter values on the **System** tab of the System Configuration dialog box, shown in the following figure.

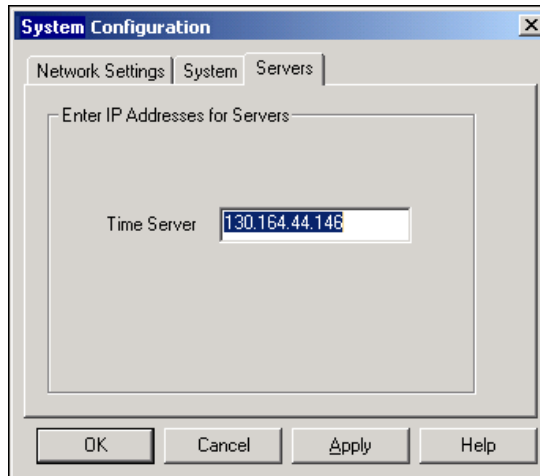


- **Host Name**—This is the name that appears for the device when you browse the network using Remote System Explorer. Refer to the [Giving Your FP-20xx a Host Name](#) section of Appendix A, [Choosing Network Settings](#), for more information about using this name on your network.
- **Comment**—To help you identify your FP-20xx.
- **Password-protect Resets**—Determines whether the user is allowed to reset the FieldPoint bank remotely. If this checkbox is selected, the user must provide the password in order to reset the system remotely. Refer to the [Locking/Unlocking Settings in Remote System Explorer](#) section for information about specifying a password. You must disable resets from FieldPoint Explorer separately by setting user access to Read Only or Deny Access. Refer to the [Setting Up Security for the FP-20xx](#) section for more information.



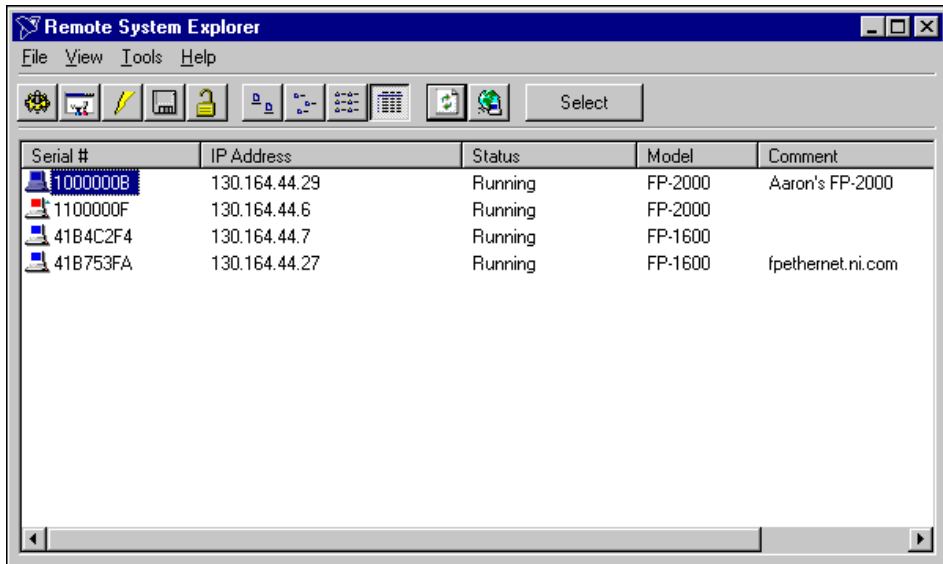
9. Enter an IP address for the **Time Server** on the **Servers** tab of the System Configuration dialog box, shown in the following figure.

The **Time Server** is a networked computer that runs the National Instruments Time Service. This is usually one of the computers that you run FieldPoint software on. **Time Server** is not a required parameter after the time has been set. The FP-20xx has an internal battery-backed clock that provides consistent timestamps in the absence of a **Time Server**.



10. Click **OK** in the System Configuration dialog box. Click **Yes** when prompted to reboot the FP-20xx.

After the FP-20xx has rebooted, it appears in Remote System Explorer with the updated IP address and comment, as shown in the following figure. If it does not appear, select **View»Refresh** or refer to the [FP-20xx Does Not Appear in Remote System Explorer Dialog Box When Browsing](#) section of Appendix C, *Troubleshooting*.



11. Highlight the module and click **Select**. When the new host name or IP address appears in the Comm Resource Configuration dialog box of FieldPoint Explorer, you can proceed to configuring your devices and channels.

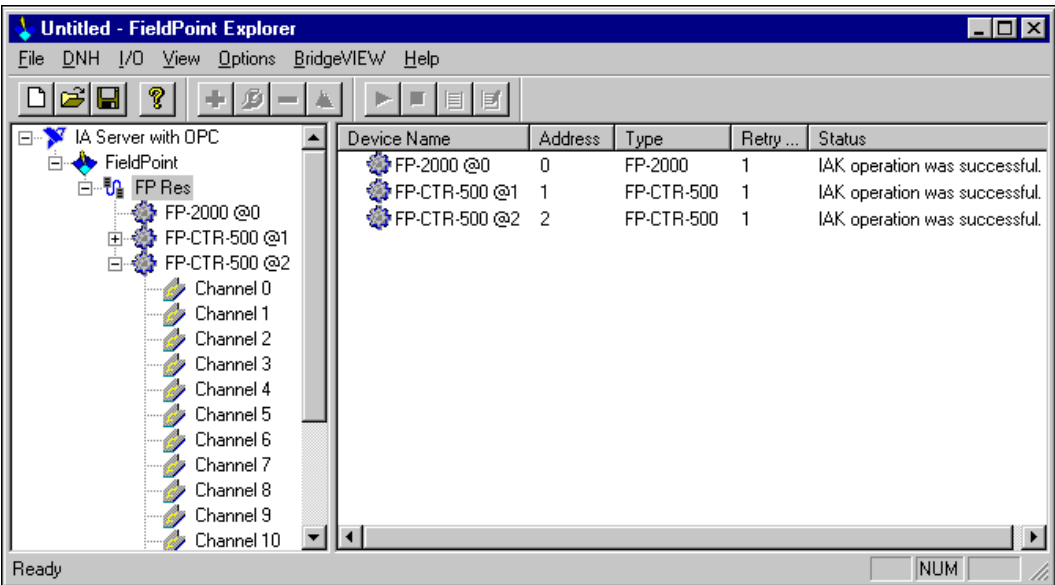
## Finding and Configuring Devices and Channels

After you have configured the FP-20xx in FieldPoint Explorer, follow these steps to configure your FieldPoint devices and channels.

1. In the Comm Resource Configuration dialog box, click **Find Devices** to search for all of the FieldPoint devices on this communications resource. If the Comm Resource Configuration dialog box is not already open, right-click the Comm Resource in FieldPoint Explorer and select **Edit this comm resource**.

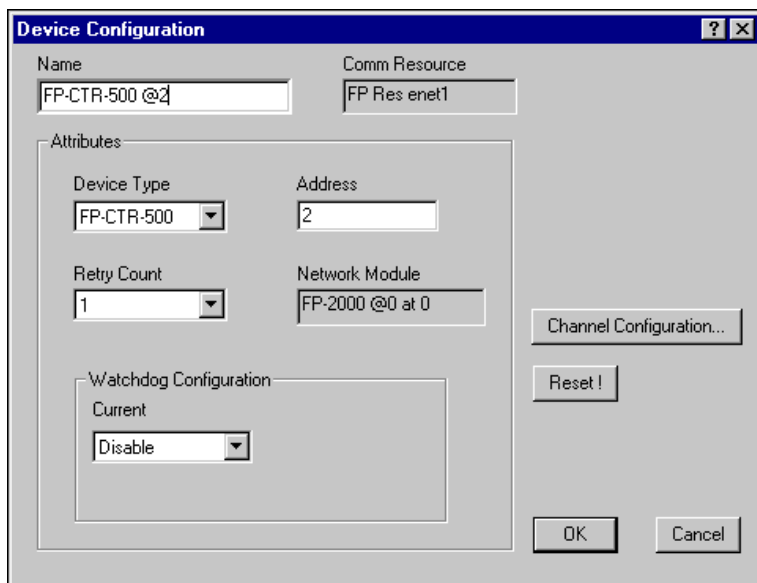
If no devices are found, refer to the *No Modules Found Error in FieldPoint Explorer* section of Appendix C, *Troubleshooting*.

- After the FieldPoint modules are found, click the + sign next to **FP Res** in the left pane to expand the device hierarchy and display the modules found on the network, as shown in the following figure.



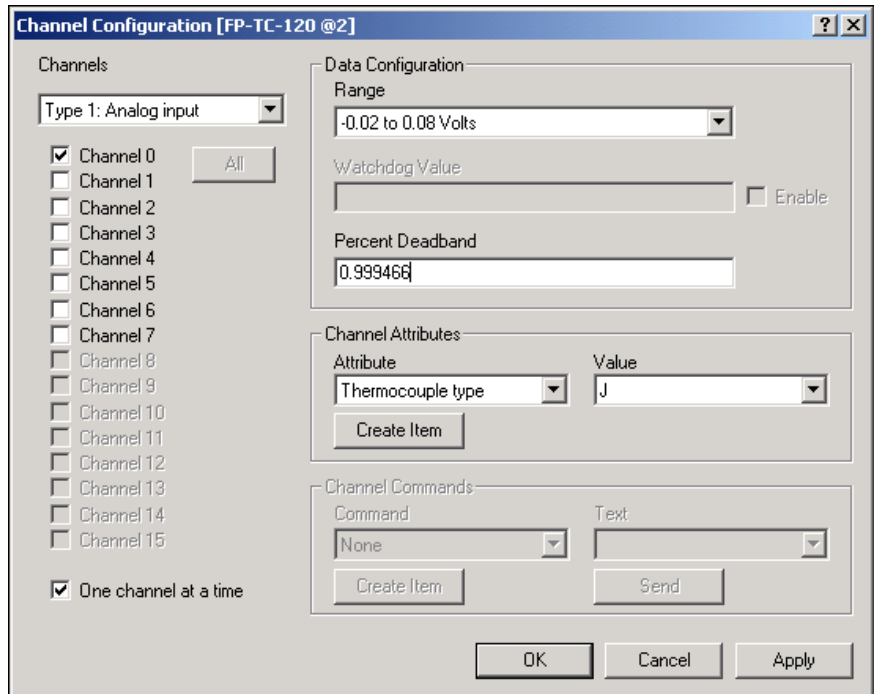
The hierarchy includes all of the modules connected to the FP-20xx. The default name of each device found includes the name of the FieldPoint module, followed by a space, the @ sign, and the address of the module (for example, FP-2000 @0). For each module found, one I/O Item is created for each channel on the module, and if all the channels are of the same type, one I/O Item is created to represent all the channels on that module collectively.

3. To configure the hardware settings of a particular I/O module, right-click the device name and select **Edit this device**. The Device Configuration dialog box appears, as shown in the following figure.



For output modules, you can choose settings for **Watchdog Configuration**. Refer to the [Guarding against Network Failures \(Network Watchdog\)](#) section of Chapter 4, *Feature Set Description*, for more information about the network watchdog feature.

- Click **Channel Configuration** to access the Channel Configuration dialog box. In the following figure, an FP-TC-120 thermocouple module is selected.



**Note** Configuration options are module dependent. The options listed here might not be available for your particular module.

Make your selections in this dialog box as follows:

- Select the type of channel to show, then select the channel(s) that you want to change. To select more than one channel, clear the **One channel at a time** checkbox.
- Set the range and output values of the selected channel(s).
- Set the deadband for data communication over the network. The deadband setting is a percentage of the full-scale range.



**Note** A deadband for analog or count channels is applied to the data in determining whether the data is transmitted to devices on the network. The deadband is not applied to embedded FieldPoint VIs accessing channels on I/O modules attached to the FP-20xx. However, using DataSocket to access channels on the attached I/O modules is considered a network transmission, and the deadband is applied.

- d. Set attributes for selected channel(s) by selecting the attribute and entering the desired value.
- e. Send commands to the selected channel(s) by choosing a command and value and clicking **Send**.
- f. Repeat this procedure for each channel you want to configure.
- g. Click **OK**, or click **Apply** to save the changes and continue to configure channels. When you click **OK** or **Apply**, the changes are immediately sent to the device and saved in its nonvolatile memory.

## Saving Hardware Configuration as Power-Up State

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When you are satisfied with the hardware configuration of your FieldPoint system, you can save this configuration as the new power-up state for the bank.

1. Right-click the FP-20xx network module in the left pane of FieldPoint Explorer, and select **Edit this device**.
2. Clear the **factory configuration** checkbox.
3. Specify the power-up settings with either of the following options:
  - If you want only the range and attribute settings you configured in the *Finding and Configuring Devices and Channels* section to be saved as power-up states, click **OK**. These settings are written to the nonvolatile memory of the network module.
  - If you want to save power-up values for the range and attribute settings and also all the current output states of the output channels, click **Snapshot**. This stores the current ranges, attributes, and output values of the bank to the nonvolatile memory of the network module. Click **OK** when you are finished.



**Caution** Using the Snapshot feature overwrites any power-up values you may have specified for individual channels in the Channel Configuration dialog box.

Refer to the *Storing a Custom Power-Up Configuration* section of Chapter 4, *Feature Set Description*, for more information about configuring and changing the power-up values. Refer to the *Guarding against Network Failures (Network Watchdog)* section of Chapter 4, *Feature Set Description*, for information about configuring a network watchdog to guard against network failures.

# Using Other Features and Options in Remote System Explorer

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You can access Remote System Explorer by right-clicking the Comm Resource in FieldPoint Explorer, selecting **Edit this comm resource**, then clicking **Browse**. You can use the Remote System Explorer toolbar buttons, **Tools** menu, or right-click menu to access the following features:

- **Configure Device**—Use to configure the IP address, comment, and other parameters for the selected FP-20xx.
- **Install/Upgrade Software**—Use to install or upgrade LabVIEW RT software on the selected FP-20xx.
- **Reboot Device**—Use to reboot the selected FP-20xx.
- **View Installed Software**—Use to view the LabVIEW RT and driver software versions installed on the selected FP-20xx.
- **Lock/Unlock Device**—Use to lock or unlock the system configuration with a password.
- **Device Location**—Use to change the search location for FP-20xx modules to the local subnet or to a specified IP address.
- **View Error Log**—Use to obtain detailed error information if you need to contact National Instruments technical support.

You can use the Remote System Explorer toolbar buttons or **View** menu to access the following features:

- **Large icon view**—Changes the view in the main window to large icons.
- **Small icon view**—Changes the view in the main window to small icons.
- **List view**—Changes the view in the main window to a list.
- **Detailed view**—Changes the view in the main window to a list with additional information such as serial number, IP address, status, model, and comment.
- **Refresh Browse List**—Refreshes the list of FP-20xx modules and other National Instruments Ethernet devices found on the local subnet or at the specified IP address. Changes to IP address, comment, and so on do not appear in Remote System Explorer until you reboot the selected system and click **Refresh Browse List**.

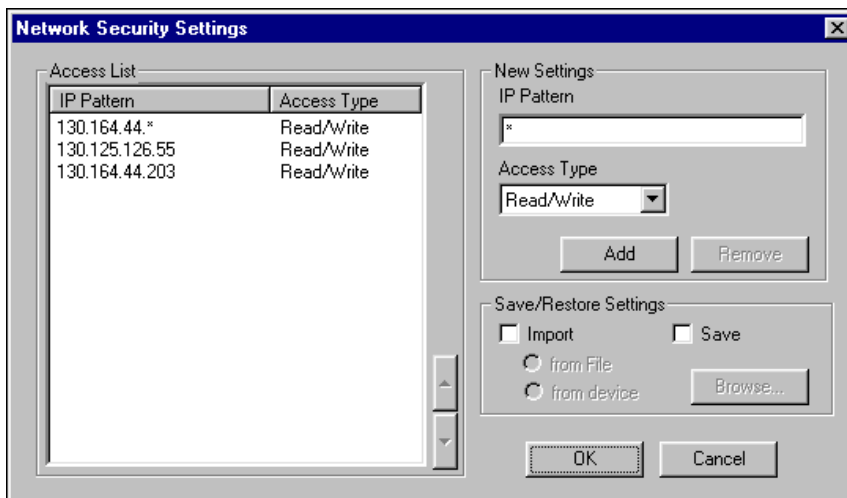
## Setting Up Security for the FP-20xx

You can set network security options to limit host access, and you can lock the settings made in Remote System Explorer.

### Configuring Network Security

You can limit host access to the FP-20xx by setting access permissions for different host machines. The default setting allows Read/Write access to all host machines. To change the network security settings, follow these steps.

1. Right-click the comm resource in FieldPoint Explorer and select **Edit this comm resource**. The Comm Resource Configuration dialog box appears with the **Network Security** button enabled.
2. Click **Network Security**. The Network Security Settings dialog box appears with the current settings, as shown in the following figure. If your host machine does not have access to the FP-20xx, the **Access List** is empty and dimmed.



3. Make your additions or changes in the dialog box, as follows:
  - If you have an **IP Access List** saved in a file or you want your FP-20xx security settings to match another FP-20xx unit, you can import those settings by selecting the **Import** checkbox. Then select the source (**from file** or **from device**). The settings read from the source are shown in the **Access List** for you to modify, if needed.



- To add a host machine to the list, enter its IP address in the **IP Pattern** edit box, select the desired access type (**Read/Write**, **Read Only**, or **Deny Access**) from the **Access Type** list, then click **Add**. You can use the \* wildcard when specifying the IP address. For example, to give Read/Write access to all hosts, enter \* in the **IP Pattern** edit box, or to deny access to all machines on the 111.222.333 subnet, enter 111.222.333.\* in the **IP Pattern** edit box.
- To remove a host machine from the list, either click the entry or type the entry in the **IP Pattern** edit box, then click **Remove** or press the <Del> key.



**Note** Once you modify the list, any IP Address that does not have any matching entry is denied access to the FP-20xx.

- To change the order of the entries in the list, select an entry and click the up arrow or down arrow button that is located next to the **Access List**. A new entry is always added to the end of the list. You can have multiple matching entries for a given IP address. In that case, the first entry that matches the IP address is used, starting from the bottom of the list.
  - To save the **IP Access List** to a file to be used for other FP-20xx modules, select the **Save** checkbox and enter a file name.
4. Once you are satisfied with the changes, click **OK**. A dialog box appears, prompting you for the password. After you enter the password and click **OK**, your changes are applied to the FP-20xx.

## Locking/Unlocking Settings in Remote System Explorer

After you configure the FP-20xx, you can lock the settings made in Remote System Explorer with a password to prevent others on your network from changing the configuration. In addition, a host PC on the network cannot target LabVIEW RT to the FP-20xx without a password unless the host is in the **RT Target: Access** list.

Complete the following steps to lock or unlock the settings made in Remote System Explorer:

1. Right-click the **Comm Resource** in FieldPoint Explorer, choose **Edit this comm resource**, and click **Browse** to launch Remote System Explorer.
2. Click the network module, then select **Tools»Lock/Unlock Device**. A checkmark by this menu item indicates that the device is locked.

3. In the Locking System Configuration dialog box, enter a password to lock or unlock the device.
4. Click **OK**.

If you need to unlock the device configuration and you do not know the password, you must reset the FP-20xx and reconfigure it. Refer to Appendix B, *Resetting the FP-20xx* for more information about resetting the FP-20xx.

## Downloading Item Information to the FP-20xx

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Every time you select **File»Save** in FieldPoint Explorer, the FieldPoint system configuration is saved in a .iak file. This file is used to access the configuration information, such as channel name, from other host applications like LabVIEW or LabWindows/CVI. To provide the same functionality for LabVIEW RT applications running on an FP-20xx, the item names pertaining to the network module bank are also downloaded to the network module whenever you select **File»Save**, assuming the network module is powered on and connected to the network.



**Note** To download the item names without saving the .iak file, right-click the **Comm Resource** and select **Download Configuration**. To disable a configuration download when you select **File»Save**, uncheck **Options»Download Configuration On Save**.

## Verifying the Configuration

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You can verify the installation and configuration by monitoring an I/O channel or writing to an output channel from FieldPoint Explorer.

### Monitoring an I/O Channel



You can monitor FieldPoint devices that you have configured. In the left pane of FieldPoint Explorer, select one of the devices, then click the green arrow icon in the toolbar to start monitoring the items of that device.

The tag symbols of the items in the list view pane turn blue to show that they are being monitored. As shown in Figure 3-1, the **Value** column shows the current value of the I/O channels defined by the I/O Items, and the **Status** column shows any error conditions received while communicating with the FieldPoint network. **Timestamp** is the time when the FP-20xx made the value available to the host PC.



Click the red square icon in the toolbar to stop monitoring the items.

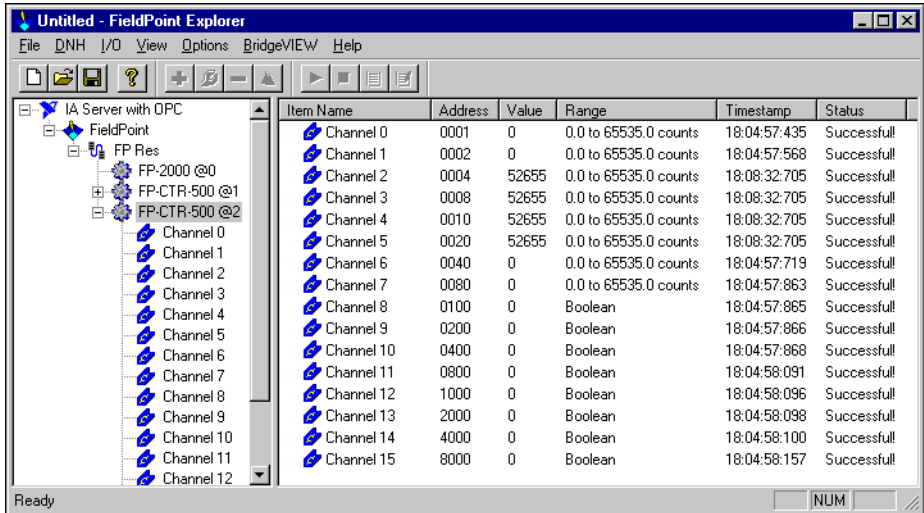
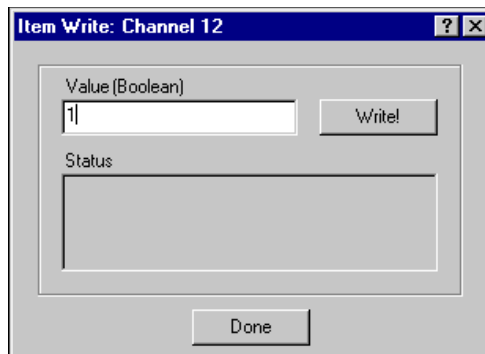


Figure 3-1. Using FieldPoint Explorer to Monitor I/O Channels

## Writing to an Output Channel

You can write to output channels of I/O Items that you have configured.

1. In the left pane of FieldPoint Explorer, select a device with output channels.
2. Select the I/O Item in the right pane that corresponds to the channel to which you want to write.
3. Click the pencil and paper icon in the toolbar to write to the I/O channel(s) represented by the I/O Item.



4. Enter the value you want to write in the **Value** field and click **Write** to write the value out. The value must be in the range of the channel that you configured in the *Finding and Configuring Devices and Channels* section. For example, if the channel was configured for a range of 0.0035 A to 0.021 A, and you want to write a value of 0.010 A (10 mA), enter 0.010 in the **Value** field. For discrete I/O channels with a Boolean range, enter 1 or 0 in the **Value** field.



**Note** If your PC is configured to use a comma as a decimal symbol, enter 0,010.

## Using the FP-20xx from Host Applications

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The primary intended use for the FP-20xx is to run LabVIEW RT, but you can use the module with other software on your host PC, even while you are using it to run LabVIEW RT. The following sections explain how to access the channels on the FP-20xx from software running on the host PC.

### Lookout and the FP-20xx

The FP-20xx network module integrates easily with National Instruments Lookout 4.0 and later. You can access the module the same way you would access another desktop computer running Lookout. You can access the channel data, ranges, attributes, and commands from Lookout, as well as several control variables, such as Reset and Snapshot.

To access the FP-20xx with Lookout 3.8 or earlier, use the FieldPoint OPC server. You cannot use the FieldPoint 3.8 Lookout driver class with the FP-20xx.

To use the FP-20xx with Lookout 4.0 or later, follow these steps:

1. Configure the FP-20xx in FieldPoint Explorer as described in the *Configuring the FP-20xx in FieldPoint Explorer* section.
2. Start Lookout, and create a new process or open an existing one.
3. Register the FP-20xx as a networked computer in Lookout. Select **Object»Object Explorer** or **Object»Connection Browser** from the menu bar and right-click **Network**. Choose **Register network computer** from the pop-up menu. Type the IP Address or host name of the FP-20xx in the **Computer name** field and click **OK**.
4. When you create a Lookout object or expression, you can connect it to data on the FP-20xx network module. In the Insert Expression dialog box, click **Network** to browse the registered computers and FP-20xx

modules. Click the IP address or host name of the network module and browse to the desired data.

An alternative method is to use the `fpoint.cbx` to access the channel data.

## LabVIEW VIs and the FP-20xx

When you install the FieldPoint software, a library of FieldPoint VIs is created if LabVIEW has already been installed on your computer. The FieldPoint VIs (FP Open, FP Get Configuration Info, FP Create Tag, FP Advise, FP Read, FP Write, and FP Close) directly access the I/O Items you configured in the FieldPoint Explorer program. For help using these VIs, refer to the examples in `LabVIEW\examples\FieldPoint` or use the FieldPoint LabVIEW Help, which is in the same program group as FieldPoint Explorer on the Windows taskbar. You can use this same set of VIs to access the FP-20xx from the host PC or to run an embedded application. For more information about programming embedded applications for the FP-20xx, refer to Chapter 5, *LabVIEW RT Programming*.

A simple FieldPoint application to read an I/O Item might only need to use four of the VIs. To create an example of such an application, complete the following steps.

1. Use FP Open to open the server. By default, the server opens with the configuration file you last saved with FieldPoint Explorer.
2. Use FP Create Tag to create a handle to an I/O Item that you defined in FieldPoint Explorer. You provide three string names to this VI to indicate which I/O Item you want access to. These three strings are the names given to the communications resource, the device, and the I/O Item.



**Note** The strings provided to the VI must *exactly* match the names in FieldPoint Explorer, including spaces and letter case.

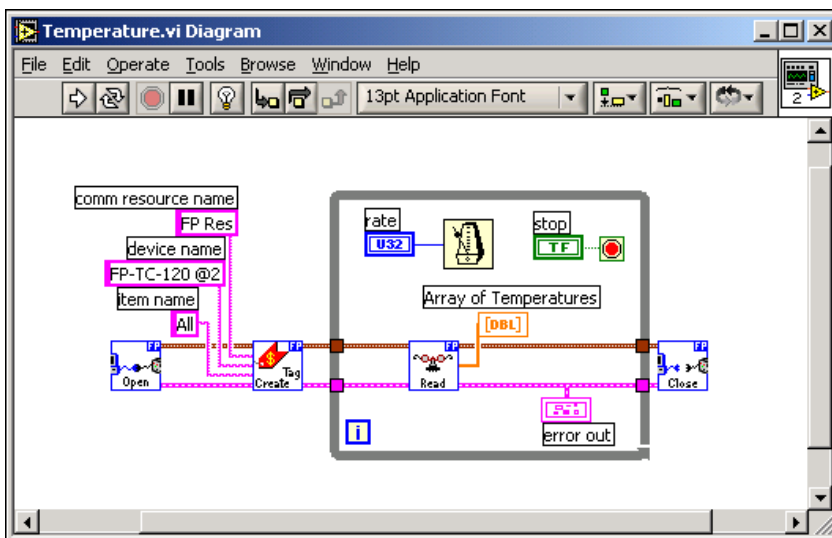
3. Use FP Read.vi to monitor an I/O Item. You should also add a delay into the loop so that the loop operates at your desired rate. Otherwise, it may load the processor at 100% and lock the software in the module. To write to an Output Item, use FP Write instead of FP Read.



**Note** You may use FP Advise in place of FP Read. However, it is best not to place anything else in a while loop with FP Advise. When using FP Advise, you can configure its timing as an input to the VI. Also, do not put more than one FP Advise VI in a loop. All VIs in a

loop execute only once each time a loop runs, and FP Advise VIs only complete at their advise rate. If you had more than one FP Advise VI in the loop, the loop (and therefore all of the FP Advise VIs in the loop) would only execute at the slowest rate of the Advises. The loop might not execute more than once if any of the Advises is set to complete “On Data Change” and the data of the corresponding I/O Item never changes.

4. Use FP Close to close the server. This action also stops all pending advise operations. Be sure to use only one FP Close.
5. The following figure gives an example of a LabVIEW diagram with FieldPoint items.



## LabWindows/CVI Functions and the FP-20xx

When you install the FieldPoint software, a LabWindows/CVI instrument driver for FieldPoint is installed if LabWindows/CVI has already been installed on your computer. This instrument driver includes function panels to call C functions that directly access the I/O Items you configured in the FieldPoint Explorer program. In addition, a set of sample projects is placed in your LabWindows/CVI Samples directory. Using these examples is the best way to get familiar with these functions. The *FieldPoint CVI Help* document is in the same program group on the Windows taskbar as FieldPoint Explorer. This help document describes each function in the instrument driver with a description of the C syntax, a description of each parameter, and a list of possible error codes.



**Note** FieldPoint CVI Interface Compatibility Modes—The FieldPoint software ships with object (.obj) files to support the different compiler compatibility modes that LabWindows/CVI supports (Microsoft Visual C/C++, Borland, Watcom, and Symantec). When the FieldPoint software is installed, the .obj file corresponding to the configured compatibility mode is installed.

## FieldPoint OPC Server and the FP-20xx

The FieldPoint OPC server conforms to the OPC Data Access 2.0 standard. OPC (OLE for Process Control) is an industry-standard device interface specification that provides interoperability between field devices such as FieldPoint and application software packages. The FieldPoint OPC server, like the other FieldPoint interfaces, imports the I/O Items that you configured in FieldPoint Explorer and makes them available as OPC Items to any *OPC client*. Therefore, if two computers are networked together, it is possible for an OPC client on one computer to access FieldPoint hardware connected to the OPC server on another computer.

OPC clients differ in the features they offer and their presentation of the OPC interface. However, the basic steps involved are similar for most OPC clients.

Follow these steps to use the FieldPoint OPC server:

1. Launch your OPC client.
2. Open the FieldPoint OPC server, `National Instruments.OPCFieldPoint`, from the OPC client.

This server was registered with Windows when you installed the FieldPoint software. OPC clients should be able to show you a list of available registered servers, but you might have to type this name in yourself. The OPC client might automatically connect to the server when you select it, but if you are given the option to explicitly connect to the FieldPoint OPC server, you should do so.

3. Create a group.
 

Groups are a collection of I/O Items. Some OPC clients might not give you the option of creating groups, or they might be created for you.
4. Select the I/O Items, which you configured in FieldPoint Explorer, that you want to read or write as a part of this group.

Many OPC clients can use the Browse Address Space feature of the FieldPoint OPC server to show you a list of all of the I/O Items you configured in FieldPoint Explorer. However, if the OPC client you are using does not support this feature, you might need to type the Item IDs of the I/O Items directly. The naming convention of the FieldPoint

Item IDs is *Comm resource name\Device Name\I/O Item name* where the Comm resource name, Device name, and I/O Item name are the names given in FieldPoint Explorer. For example, an Item ID associated with one of the I/O Items might be the following:

```
FP Res\FP-TC-120 @1\Channel 0
```

In most cases, the preceding steps are all that is required to configure an OPC client to read from I/O Items of the FieldPoint OPC server. In some cases, the OPC client might require more information about the FieldPoint OPC server. The following list contains additional information about the FieldPoint OPC server, which you may find helpful.

- The FieldPoint OPC server does not require an access path. Some OPC clients expect the access path to be included in the Item ID name or might request the access path when you select I/O Items. You should be able to leave the access path blank (empty string).
- The FieldPoint OPC interface is an out of process server.
- The FieldPoint OPC server supports both synchronous and asynchronous reads and writes.
- The FieldPoint OPC server uses the `GetErrorString` method to return error and diagnostic messages from the FieldPoint server and hardware. OPC clients that do not support this method might give you error messages like “Bad, non-specific” along with an error code. Some OPC clients that do not support this `GetErrorString` method still provide a way for you to manually look up the FieldPoint message corresponding to the error code using this method.

## Data Communications

The FP-20xx network module provides several methods for communicating and sharing data with other FieldPoint systems, computers, and devices. The most common methods are to use `DataSocket`, serial VIs, TCP VIs, UDP VIs, or Data Publishing VIs, as described in the following sections.

### DataSocket

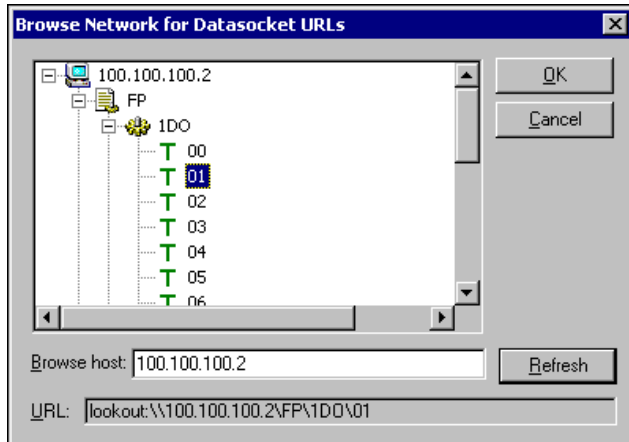
`DataSocket`, a programming technology based on industry-standard TCP/IP, simplifies live data exchange between different applications on one computer or between computers connected via a network. `DataSocket` was designed as an easy-to-use, high-performance programming interface for sharing and publishing live data in measurement and automation applications. You can use `DataSocket` VIs to obtain data from other



DataSocket servers, Lookout or LabVIEW DSC module applications, and data published by the Data Publishing VIs.

DataSocket uses uniform resource locators (URLs) to specify absolute paths to data items. A URL consists of three separate components: protocol, network address, and locator. You are probably most familiar with URLs from using a Web browser. For example, `http://www.ni.com/support/fieldpoint` is a URL in which `http` is the protocol, `www.ni.com` is the network address, and `support/fieldpoint` is the locator.

The FieldPoint software package installs a DataSocket URL browser in LabVIEW. To launch the browser, select **Tools»Browse Network for DataSocket URLs**. Enter the IP address of the FieldPoint device or computer you want to browse, and click **Refresh**. After a short pause, the available DataSocket servers appear in the window. Open each server to access an item on that server, as shown in the following figure. Once an item has been highlighted, its URL is displayed in the URL field. You can use copy <Ctrl-C> and paste <Ctrl-V> to insert the URLs into the DataSocket read and write VIs.



## DataSocket URLs for FieldPoint I/O Modules

The following is an example of a DataSocket URL that points to a specific channel of a FieldPoint I/O Module:

```
lookout:\\130.164.44.8\FP\1AI\01
```

In this URL, `lookout` is the protocol, `130.164.44.8` is the IP address of the FieldPoint Ethernet network module, and `FP\1AI\01` is the locator.

The FieldPoint Process part of a URL provides the parent folder from which you access all data items in a FieldPoint bank. The FieldPoint Process part of a URL has the following format:

```
\\[machine]\FP
```

where `[machine]` is the IP address or hostname of the FieldPoint Ethernet network module.

The I/O Module Folder part of a URL provides the sub-folder from which you access all data items from a specific FieldPoint I/O module. The I/O Module Folder part of a URL has the following format:

```
\\[machine]\FP\[n]
```

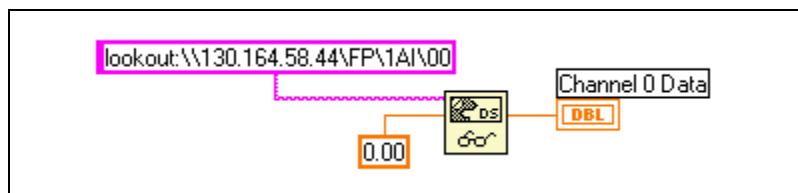
where `[n]` consists of the numeric address and name of the I/O module. The address of the I/O module is an integer from 1 to 9, where 1 represents the I/O module closest to the network module and 9 represents the I/O module farthest from the network module. The folder `\\130.164.44.8\FP\1AI` indicates the I/O module closest to the network module, and the AI means that it is an analog input module.

The Channel Data part of a URL provides the scaled data value of the input or output value for a specific channel. The Channel Data part of a URL has the following format:

```
\\[machine]\FP\[n]\[channel]
```

where `[channel]` is a two-digit decimal number between 00 and 15.

The following figure shows a DataSocket URL with Channel Data.



The locator is read as channel 0 (00) of the analog input module in position one (the first position to the right of the network module) on the bank.



**Note** If you are making only one connection to the FP-20xx, the Lookout protocol performs better than OPC or DSTP (DataSocket Transfer Protocol).

## Publish Data VI

You can use the Publish Data VI on the FieldPoint palette to create items and groups that are published using the National Instruments Ethernet (Lookout) protocol. A host computer or FP-20xx can link to these items using DataSocket or using the native connection capabilities of Lookout or the LabVIEW DSC module. The Publish Data VI creates data that other VIs and applications can browse and read, write, or read/write from the FP-20xx. These items will also be accessible in FieldPoint Explorer and the FieldPoint OPC server.

## Serial VIs

You can use the LabVIEW Serial VIs to communicate with other serial devices through the RS-232 port on the FP-20xx. For example, you can use the supplied FieldPoint Optomux library to communicate with an FP-1000 connected to the FP-20xx. Refer to the *FP-1000/1001 Programmer Reference Manual* for more information about the Optomux VIs.



**Note** The FP-20xx does not support VISA.

## TCP and UDP VIs

You can use the LabVIEW TCP VIs to publish data from the FP-20xx to computers or devices on the network using TCP-based protocols. You can use the LabVIEW UDP VIs to publish data from the FP-20xx to computers on the network using UDP (User Datagram Protocol).



**Note** The TCP and UDP VIs provide low-level access to your network. Use them only when the supplied protocols do not fit into your application.

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# Feature Set Description

This chapter describes the feature set for the FP-20xx network module.

## Guarding against Network Failures (Network Watchdog)

---

The network watchdog feature of the FP-20xx enables you to guard your system against failures in the network connection, cables, or host computer. If the network watchdog is enabled and the FP-20xx loses communication with all hosts or clients over the network, the FP-20xx sets its output channels to predefined values (the watchdog state).



**Note** National Instruments recommends leaving the network watchdog disabled when you are running embedded applications on the FP-20xx.

Network watchdog output values can be different than power-up output values. For example, you may want to turn on an output value when you power up, but turn it off if network communication is lost.

The network watchdog for the bank is disabled by default. Follow these steps to enable it:

1. In FieldPoint Explorer, right-click an output module and select **Edit this device**.
2. Select **Enable** or **Enable on Use** for the current watchdog configuration.
3. Click **Channel Configuration**, then configure these settings:
  - Enable/disable the watchdog for each channel.
  - Enter a watchdog data value for each channel.
4. Click **OK**.

5. In the left pane of FieldPoint Explorer, right-click the FP-20xx, select **Edit this device**, and configure these settings:
  - Clear the **factory configuration** checkbox.
  - Enable network watchdog for the bank.
  - Enter a network watchdog timer value for the bank, a value that specifies the maximum allowable period of lost communication with hosts or clients over the network.
6. Click **OK**.
7. Select **File»Save**.

In addition to the network watchdog, the FP-20xx network modules support a hardware watchdog that you can set up in LabVIEW RT. The VIs to control the hardware watchdog are on the FieldPoint palette. Refer to the [Hardware Watchdog](#) section of Chapter 5, *LabVIEW RT Programming*, or to the examples in `labview\examples\rt\RT_watchdog`, for more information about the hardware watchdog.

## Storing a Custom Power-Up Configuration

---

### Setting a Power-Up State with the Snapshot Method

The Snapshot feature provides a single-step method for storing the current state of your FieldPoint hardware for use as the power-up state of the bank.



**Caution** Using the Snapshot feature overwrites any power-up values you have specified for individual channels in the Channel Configuration dialog box.

1. Set the hardware to the state you want to use as a power-up state, including output values, ranges, and attributes.
2. Right-click the FP-20xx in the left pane of FieldPoint Explorer, and select **Edit this device**.
3. Clear the **factory configuration** checkbox.
4. Click **Snapshot**. Click **Yes** and **OK** to approve the change.
5. Click **OK** in the Device Configuration dialog box.
6. Select **File»Save**.

To make incremental changes to the power-up values of individual channels, use the procedure described in the [Configurable Power-Up Method](#) section.

## Configurable Power-Up Method

With the configurable power-up state feature, you can define the power-up configuration on a module-by-module basis. You do not need to set any of the channels to the desired power-up state, as you would with the Snapshot feature. But you could use the configurable power-up method to adjust previously stored Snapshot information.

1. In FieldPoint Explorer, right-click an I/O module and select **Edit this device**.
2. Click **Channel Configuration**, then enter range, attribute, and output values for each channel.
3. Click **OK** twice.
4. Right-click the FP-20xx in the left pane of FieldPoint Explorer, and select **Edit this device**.
5. Clear the **factory configuration** checkbox and click **OK**.
6. Select **File»Save**.

## Inserting, Removing, and Replacing I/O Modules (HotPnP)

---

The HotPnP feature simplifies system installation, configuration, and maintenance. You can remove I/O modules and insert I/O modules into empty terminal bases even while the system is engaged in network activity. You do not need to power down the bank or the system. In addition, you do not need to change the operation of the host computer or software in order to use the HotPnP feature. I/O modules already working in the bank remain fully operational and accessible on the network.

When you insert an I/O module with the power on, it is automatically recognized and made available on the network with the appropriate configuration. To see the new module in FieldPoint Explorer, click **Find Devices** in the Comm Resource Configuration dialog box, and select **File»Save**.



**Note** Clicking **Find Devices** removes any tags that have been renamed or added manually. To avoid losing tags, add the new I/O module manually.



**Caution** Do *not* add or remove terminal bases while power is applied to the bank.

Commands sent to a missing module return an error response, but the FP-20xx stores the commands and applies the effects of these commands if a suitable replacement module is inserted.

When a new I/O module is connected in place of one that was removed, the FP-20xx first verifies that the replacement I/O module is compatible with the one that was removed. If the I/O module is the same as, or is compatible with, the one removed, the FP-20xx configures the replacement I/O module with its predecessor's configuration and output value settings.

Table 4-1 shows how modules are configured after HotPnP replacement.

**Table 4-1.** Module Configuration Results after HotPnP Replacement

| Replacement Module   | Start in Factory Default   | Replacement Module Configuration after HotPnP       |
|--|----------------------------|---|
| Compatible with the removed module   | Either Enabled or Disabled | Same as the configuration of the removed module     |
| Incompatible with the removed module but compatible with the stored Snapshot information   | Disabled                   | Same as the configuration stored in the Snapshot    |
|  | Enabled                    | Factory default configuration of replacement module |
| Incompatible with the removed module and incompatible with the stored Snapshot information | Either Enabled or Disabled | Factory default configuration of replacement module |

## LED Indicators

The FP-20xx has several LEDs to convey status information.

### POWER LED

The green **POWER** LED is lit while the FP-20xx is powered up. This LED indicates that the power supply connected to the FP-20xx is acceptable, and that the FP-20xx is supplying power to the I/O modules.

### STATUS LED

The red **STATUS** LED is off in normal operation mode. The FP-20xx indicates specific error conditions by flashing **STATUS** a specific number of times. Refer to the [STATUS LED Error Indications](#) section of

Appendix C, [Troubleshooting](#), for more information about **STATUS** LED error indications.

## LINK LED

The green **LINK** LED is lit when the FP-20xx is connected to a functioning Ethernet segment.

## ACTIVE LED

The green **ACTIVE** LED is lit when the FP-20xx receives data from or transmits to the Ethernet. Because of unrelated network activity, this LED blinks occasionally even when the FP-20xx is inactive.

## 100 Mbps LED

The yellow **100 Mbps** LED is lit when the FP-20xx is communicating at 100 megabits per second. If the **100 Mbps** LED does not light, all communications with the FP-20xx will be at 10 megabits per second.

## User-Configurable LEDs A–D (for Count-Output Channels 5–8)

LEDs **A**, **B**, **C**, and **D** correspond to count-output channels 5, 6, 7, and 8, respectively, on the network module. LEDs **B**, **C**, and **D** can be sent values of 0, 1, or 2. LED **A** should be sent only 0 or 1. LED **A** handles a 2 as a 1. The values sent to these LEDs manifest as 0 = off, 1 = green, and 2 = red.

## Power-On Self Test (POST)

The FP-20xx runs a power-on self test (POST) at power-up to verify its own operational status. The test takes several seconds, does not affect the operation of the network, and does not affect any of the field wiring connected to the terminal bases in the bank.

If the power-on self test fails, the FP-20xx does not participate in network communication, eliminating potential conflicts with the other banks in the network.

When you power up the FP-20xx and it has already been configured for use, the **POWER** and **STATUS** LEDs come on for about five seconds, then the **STATUS** LED turns off. The **A**, **B**, **C**, and **D** LEDs come on for about 15 seconds as LabVIEW RT starts up. When they turn off, the I/O module **READY** LEDs turn on and the network module is ready for use.

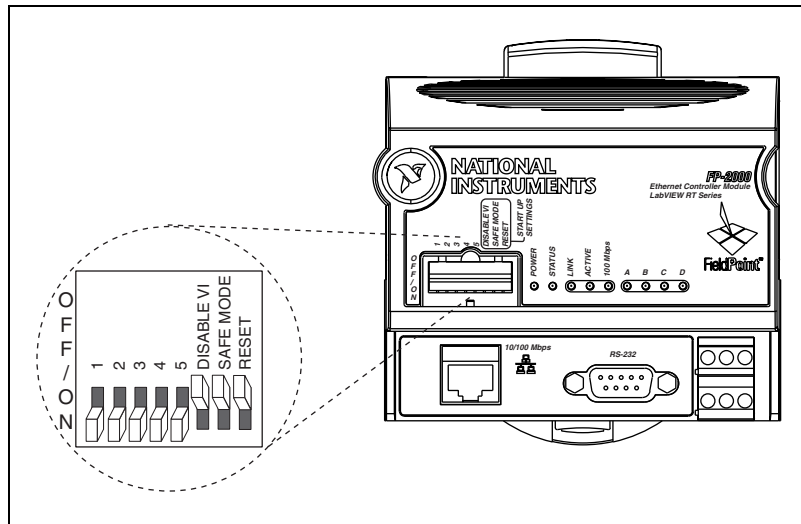
The FP-20xx indicates POST failure through the **STATUS** LED. If the LEDs do not follow the sequence described here, refer to the [STATUS LED](#)



[Error Indications](#) section of Appendix C, [Troubleshooting](#), for information about possible reasons.

## DIP Switches

The following figure shows the DIP switches on the front of the FP-20xx.



Switches 1, 2, 3, 4, and 5 are user-configurable DIP switches. FieldPoint LabVIEW VIs, CVI, OPC, Lookout, and other applications can read these switches, but the switches have no default functionality.

The DISABLE VI, SAFE MODE, and RESET DIP switches are read only when you power up or reboot the FP-20xx network module. You must reboot the module with one of these switches ON for its setting to take effect. If you reboot the system with more than one of these switches ON, only the left-most switch is read, and the others are ignored.

### DISABLE VI Switch

The position of the DISABLE VI switch determines whether any VIs run at startup. You can instruct the FP-20xx network module to run a VI when it starts up, but if this VI consumes all of the FP-20xx CPU for any reason, it can make the module inaccessible on the network. If you reboot the FP-20xx with the DISABLE VI switch in the ON position, the module does not run any VIs at startup unless you have enabled them through LabVIEW RT.

## SAFE MODE Switch

The position of the SAFE MODE switch determines whether the FP-20xx network module starts up in safe mode. If the software or configuration information on the module becomes corrupt or cannot be correctly read, the system may hang after being rebooted or become inaccessible over the network. All LabVIEW functions are disabled in safe mode, and I/O module data is not accessible.

If you reboot the FP-20xx with the SAFE MODE switch in the ON position, the embedded LabVIEW RT engine does not start; the module starts up in safe mode. Now you can reconfigure the TCP/IP settings, download new software using Remote System Explorer, and reboot the FP-20xx with the SAFE MODE switch in the OFF position.

## RESET Switch

The position of the RESET switch determines whether the IP settings of the FP-20xx network module are reset at startup. Reset the TCP/IP settings if you are moving the module from one subnet to another or if you suspect that the current TCP/IP settings are bad. Refer to Appendix B, [Resetting the FP-20xx](#), for more information about the procedure for resetting the FP-20xx.

## User-Configurable DIP Switches 1–5 (for Discrete Input Channels 0–4)

DIP switches 1–5 can be read as discrete input channels 0–4 on the network module.

## Serial Port

---

The RS-232 serial port can be accessed using the Serial Port VIs. The RS-232 port is considered port 0 and is a DTE port. Refer to the [FP-20xx Hardware Overview](#) section of Chapter 1, [Overview of the FP-20xx Network Module](#), for the location of this port. If you are not running an embedded application, you must target the FP-20xx in order to access the serial port. Refer to Chapter 5, [LabVIEW RT Programming](#), for more information about targeting the FP-20xx.

## Isolated Power Connector (Channel 9)

---

The FP-20xx power connector is a 6-pin screw-terminal connector that accommodates both primary and backup power supplies. The FP-20xx uses the power supply with the higher voltage level, indicating which supply it is using on channel 9. A value of 0 indicates the primary supply, and a value of 1 indicates the backup supply.

---

# LabVIEW RT Programming

This chapter contains specific information about targeting LabVIEW Real-Time (RT) to the FP-20xx module, network options for restricting access to your module, embedding LabVIEW RT applications on your module, and launching embedded applications when your module starts up. For general LabVIEW RT programming information, refer to the *LabVIEW RT User Manual*.

---

## Targeting LabVIEW RT to a Platform

You can target LabVIEW RT to your FP-20xx or the host PC. When you select a target platform other than the host PC, the RT Development System downloads any LabVIEW RT application you subsequently run to the selected target platform. Refer to Chapter 1, *Introduction*, and to Chapter 3, *Software Overview*, of the *LabVIEW RT User Manual* for more information about the RT Development System.

### Targeting LabVIEW RT to the FP-20xx

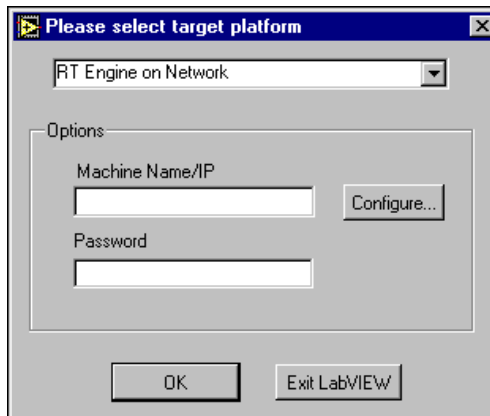
When you target LabVIEW RT to your FP-20xx, you can run LabVIEW RT applications on the controller. However, when targeted to your FP-20xx, LabVIEW RT lacks some features found in LabVIEW for Windows because the controller does not have all the software of a PC. The following LabVIEW functions are *not* supported in LabVIEW RT when targeted to your FP-20xx:

- ActiveX
- Front panel datalogging
- Dialog boxes
- Printing
- Programmatic menus
- VISA
- Front panel Web publishing
- NI-DAQ

LabVIEW RT applications that have any of the unsupported functionality listed above may or may not work as expected on the FP-20xx.

Complete the following steps on the host PC to target LabVIEW RT to your FP-20xx:

1. Start LabVIEW.
2. Open a new VI.
3. Select **Operate»Switch Execution Target** to open the Select Target Platform dialog box, shown in the following figure.



4. Select your target platform from the pull-down menu.
5. Select **RT Engine on Network** to target your FP-20xx.



**Note** When targeting LabVIEW RT to an FP-20xx network module, the module does not need to reside on the same subnet as the host PC.

6. Enter the IP address and password you specified for the FP-20xx in Remote System Explorer. If no password is specified for the FP-20xx, leave the password field blank.

If the IP address of the host PC appears in the **RT Target: Access** list of the FP-20xx, you do not need to enter the password. Refer to the [RT Target: Access](#) section for more information about **RT Target: Access**.

7. Click **OK**.

## Targeting LabVIEW RT to the Host PC

When you target LabVIEW RT to the host PC, you can use LabVIEW RT like LabVIEW for Windows.

Perform the following steps to target LabVIEW RT to the host PC:

1. Perform steps 1 through 4 of the *Targeting LabVIEW RT to the FP-20xx* section.
2. Select **Host PC (LabVIEW for Windows)**.
3. Click **OK**.



**Note** Applications running on the host PC communicate to FieldPoint I/O channels. However, serial communication will be routed to the host PC serial port rather than the FP-20xx serial port. In this case, VIs that use the serial port will communicate via the host PC serial port. Also, when running on a host, deadbands apply to FieldPoint I/O channels.

## Network Options

---

When you target LabVIEW RT to a networked FP-20xx, select **Tools»Options** to access LabVIEW options. The options in the **Options** menu only apply to the RT Development System running on the host PC.

You also can set options for the RT Engine on the FP-20xx when you target LabVIEW RT to the controller. With LabVIEW RT targeted to your FP-20xx, select **Tools»Network Options** to access RT Engine options. RT Engine options apply to LabVIEW RT applications running on the FP-20xx. The **Performance and Disk**, **VI Server**, and **Web Server** option dialog boxes are identical to the normal LabVIEW option dialog boxes. However, the settings are applied to the FP-20xx. Refer to the *LabVIEW Help* for more information about **Performance and Disk**, **VI Server**, and **Web Server** options.

You also can use the following two additional groups of options for LabVIEW RT applications on networked FP-20xx modules:

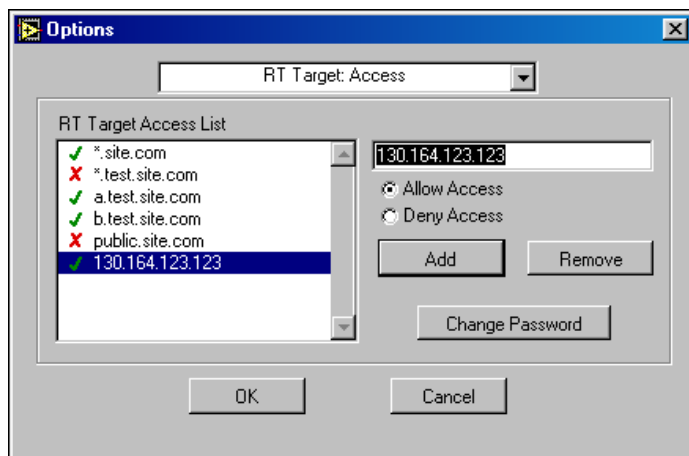
**RT Target: Access** and **RT Target: Miscellaneous**.

## RT Target: Access

Use **RT Target: Access** options to limit which host PCs can target the RT Engine on the FP-20xx.

Complete the following steps to open the RT Target: Access dialog box:

1. Target LabVIEW RT to your FP-20xx. Refer to the [Targeting LabVIEW RT to the FP-20xx](#) section for more information.
2. Select **Tools»Network Options**.
3. Select **RT Target: Access** from the pull-down menu to see the following dialog box.



If the IP address of your host PC matches an entry that allows access, you can target the FP-20xx without providing a password, even if the module configuration is locked. If your host IP address does not match any entry or matches an entry that denies access, you must provide the correct password to target the FP-20xx.

When you try to target the RT Engine on an FP-20xx from a host PC through the RT Development System, the RT Engine compares the host PC's IP address to the entries in the RT Target Access List to determine if the host PC is permitted access. You define the RT Target Access List entries to indicate whether or not a host PC is permitted or denied access. If an entry in the list matches the host PC address, the RT Engine either allows or denies access based on what you define for the entry. If a subsequent entry also matches the host PC address, that permission is used in place of the previous permission. For example, in the RT Target: Access dialog box shown, `a.test.site.com` and `b.test.site.com` are

permitted access even though the list indicates by the \* wildcard that all addresses ending in `.test.site.com` are denied access. A checkmark next to a list entry denotes that access is permitted, while an X denotes that access is denied. If no entry matches the host PC address, access is denied unless you supply a password.

Table 5-1 shows examples of RT Target Access List entries and provides information about the \* wildcard and permitting matching access entries.

To specify an Internet host address, enter its domain name or IP address. Use the \* wildcard when specifying Internet host addresses. For example, you can specify all hosts within the domain `site.com` with the entry `*.site.com`. You can specify all hosts in the subnet whose first two numbers are 130.164 with the entry `130.164.*`. The entry \* matches all addresses.

**Table 5-1.** Example RT Target Access List Entries

| Access String                | Matches  |
|------------------------------|--|
| *                            | All hosts  |
| <code>test.site.com</code>   | The host whose domain name is <code>test.site.com</code>         |
| <code>*.site.com</code>      | All hosts whose domain names end with <code>.site.com</code>     |
| <code>130.164.123.123</code> | The host with the IP address <code>130.164.123.123</code>        |
| <code>130.164.123.*</code>   | All hosts whose IP addresses start with <code>130.164.123</code> |

In the RT Target: Access dialog box previously shown, all hosts in the `site.com` domain can target the RT Engine, with the exception of all hosts in the `test.site.com` domain. Additionally, the hosts `a.test.site.com`, `b.test.site.com`, and `130.164.123.123` also can target the RT Engine. The host `public.site.com` does not have access, even though it is in the `site.com` domain.

The default RT Target: Access settings permit any host machine to target the RT Engine on the FP-20xx without a password.



**Note** If the FP-20xx does not have access to a Domain Name Server (DNS), do not use domain name entries in the RT Target Access List. Requests to resolve the domain name



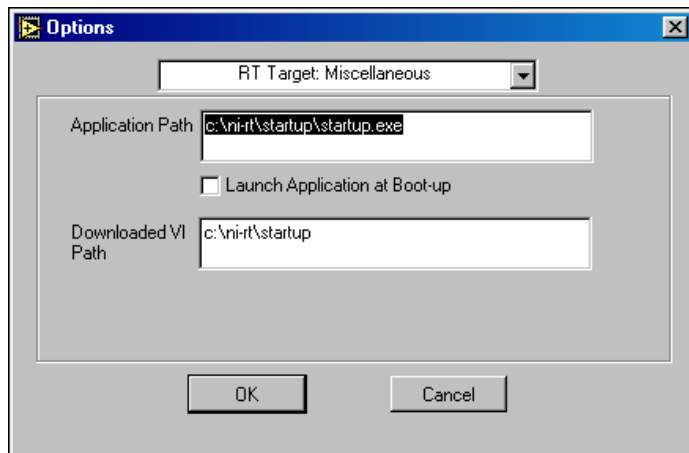
or an IP address fail and slow down the system. Place frequently matched entries toward the bottom of the RT Target Access List to improve system performance.

## RT Target: Miscellaneous

Use **RT Target: Miscellaneous** options to launch LabVIEW RT applications at system startup and to specify the **Downloaded VI Path**.

Complete the following steps to open the RT Target: Miscellaneous dialog box:

1. Target LabVIEW RT to the FP-20xx. Refer to the [Targeting LabVIEW RT to the FP-20xx](#) section for more information.
2. Select **Tools»Network Options**.
3. Select **RT Target: Miscellaneous** from the pull-down menu to see the following dialog box.



Use the **Application Path** and **Launch Application at Boot-up** settings to automatically launch a built LabVIEW RT application when you start up the FP-20xx. The LabVIEW RT Engine launches the built application specified by **Application Path** when you start up the FP-20xx. The specified path also determines the path and application name that appear when you target LabVIEW RT to the FP-20xx and create an embedded LabVIEW RT application. Refer to the [Embedding Applications on the FP-20xx](#) and [Launching Embedded Applications at Startup](#) sections for more information about embedding and launching LabVIEW RT applications on the FP-20xx.

Select **Launch Application at Boot-up** to launch the application specified in **Application Path** when you start up the FP-20xx. You must first create the application using the Application Builder before you select this option. Refer to the *LabVIEW Application Builder Release Notes* and to the *LabVIEW Help* for more information about the Application Builder. Refer to the *Embedding Applications on the FP-20xx* section for more information about creating LabVIEW RT applications.

By changing the **Application Path**, you can create multiple LabVIEW RT applications on the FP-20xx. However, only the application you specify in the **Application Path** launches at startup, if you select **Launch Application at Boot-up**.

Use **Downloaded VI Path** to specify the default path for the RT Engine VIs downloaded by the RT Development System. VIs are stored on the host PC hard drive and are opened in the host RT Development System. Therefore, the RT Engine does not know the actual path of the downloaded VIs. The RT Engine uses the path specified in **Downloaded VI Path** for operations that require the VI path. For example, the file constant **Current VI's Path** normally returns the path of the VI in which the constant is used. This constant may be used in a VI that reads or writes data to a file on the disk. When you run this VI in the LabVIEW RT Engine on the FP-20xx, **Current VI's Path** returns the path specified in the **Downloaded VI Path** option, appended with the name of the VI.

## Embedding Applications on the FP-20xx

---

LabVIEW RT applications built on the host PC with the Application Builder can be embedded on your FP-20xx. This section explains how to embed LabVIEW RT applications on your FP-20xx by using the Application Builder while LabVIEW RT is targeted to the controller.

Refer to Chapter 3, *Software Overview*, of the *LabVIEW RT User Manual* for more information about building LabVIEW RT applications on the host PC. Refer to the *LabVIEW Application Builder Release Notes* and to the *LabVIEW Help* for more information about using the Application Builder on the host PC.

## Command Line Arguments

Use command line arguments for applications built on the host PC to disable the Select Target Platform dialog box and explicitly specify a target for the application. You can use these command line arguments in a shortcut from your Windows Startup folder to automatically launch

RT Engine applications and/or host PC applications when you start up your host PC.

For example, create a shortcut with the following shortcut target:

```
c:\mybuiltapp.exe -target 127.127.44.108 -quithost
```

To disable the Select Target Platform dialog box, specify a target, such as the IP address of the FP-20xx, in the command line argument of your built application using `-target`. For example,

```
c:\mybuiltapp_rtengine.exe -target 127.127.44.108
```

or

```
c:\mybuiltapp_host.exe -target host
```

To disconnect the host PC from the RT Engine after all applications are downloaded, use `-quithost`. For example,

```
c:\mybuiltapp_rtengine.exe -target 127.127.44.108  
-quithost
```

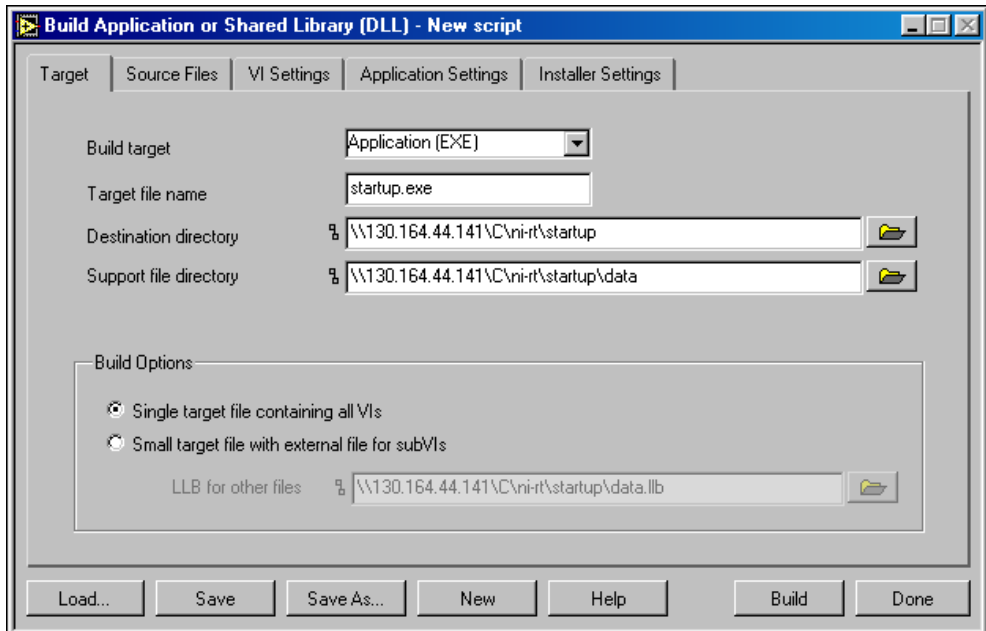
## Using Application Builder

When you target LabVIEW RT to your FP-20xx, use the Application Builder to embed LabVIEW RT applications on your FP-20xx.

Complete the following steps to embed LabVIEW RT applications on your FP-20xx using the Application Builder:

1. Target LabVIEW RT to your FP-20xx. Refer to the [Targeting LabVIEW RT to the FP-20xx](#) section for more information.
2. Open a new VI.

3. Select **Tools»Build Application or Shared Library (DLL)** to open the Build Application or Shared Library (DLL) dialog box, shown in the following figure.



4. Select **Application (EXE)** from the **Build target** pull-down menu.
5. Click the **Source Files** tab.
6. Click **Add Top-Level VI**.
7. Navigate to the location of the VI to be added.
8. Select the VI to be added.
9. Click **OK**.
10. Click **Build**.

## Target Tab

On the **Target** tab, the Application Builder determines the Target file name, Destination directory, and Support file directory from the **Application Path** setting in **Network Options**. You cannot change the Application name, Destination directory, and Support file directory settings in the Application Builder when you target LabVIEW RT to the FP-20xx. Refer to the [Network Options](#) section for more information about accessing and using **Network Options**.

If you select **Small target with external file for subVIs** in the **Build Options** pane, you cannot change the **LLB for other files** path because this path is determined from the **Application Path** setting in **Network Options**. Refer to the *LabVIEW Help* for more information about the **Small target with external file for subVIs** option. Refer to the [Network Options](#) section for more information about accessing and using **Network Options**.

## Source Files and VI Settings Tabs

Use the **Source Files** and **VI Settings** tabs the same way you do to build a LabVIEW RT application when LabVIEW RT is targeted to the host PC. Refer to the *LabVIEW Help* for more information about the **Source Files** and **VI Settings** tabs.



**Caution** Do *not* add the file `serpdrv` to your application in the **Source Files** tab. The serial port driver is installed on the FP-20xx with the RT Engine. Manually adding `serpdrv` to your application adds the Windows driver, which is not compatible with the LabVIEW RT Engine on the FP-20xx.

## Application Settings and Installer Settings Tabs

The **Application Settings** and **Installer Settings** tabs are disabled when you target LabVIEW RT to the FP-20xx because these settings do not apply to applications embedded on the controller.

# Launching Embedded Applications at Startup

---

The RT Engine can launch your embedded application each time you start up your FP-20xx. Complete the following steps to launch your embedded application each time the FP-20xx starts up:

1. Target LabVIEW RT to the FP-20xx. Refer to the [Targeting LabVIEW RT to the FP-20xx](#) section for more information.
2. Select **Tools»Network Options**.
3. Select **RT Target: Miscellaneous** from the pull-down menu.
4. Select **Launch Application at Boot-up**.
5. Click **OK**.

## File Transfer Capability

---

When running on an FP-20xx, the RT Engine has a File Transfer Protocol (FTP) server. The FTP server gives you the ability to use any standard FTP utility for transferring files to and from the hard drive of the FP-20xx. You must provide the correct password when opening a connection to the FP-20xx if the configuration is locked in Remote System Explorer.



**Note** Transferred files must use the 8.3 file naming convention.

For programmatic file transfer control in LabVIEW or LabVIEW RT, use the Internet Developers Toolkit, included in the LabVIEW Enterprise Connectivity Toolset. Refer to the National Instruments Web site at [ni.com](http://ni.com) for more information about purchasing and using the LabVIEW Enterprise Connectivity Toolset.



**Note** Contact NI to determine whether the toolkit version you are using can be downloaded onto the FP-20xx.

## Hardware Watchdog

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In addition to the network watchdog described in Chapter 4, *Feature Set Description*, the FP-20xx network modules support the hardware watchdog available in LabVIEW RT. You can use the hardware watchdog to verify programmatically that the FP-20xx is responding within a given time period. If the module stops responding because of a problem in the program, it can be configured to reset the FP-20xx or generate an occurrence in LabVIEW.

The hardware watchdog VIs are on the FieldPoint palette at **FieldPoint»FieldPoint RT»FieldPoint Watchdog**. For examples that show how to use the hardware watchdog, refer to the RT Watchdog (PXI-8156B).11b file installed under `\\examples\rt\`. For additional information, refer to the help for the watchdog VIs.



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# Choosing Network Settings

This appendix describes how to choose appropriate network settings.

## Choosing an IP Address

---

The way you choose an IP address for your FP-20xx may depend on whether your network has a system administrator.

### Choosing an IP Address with a Network Administrator

If you are adding the FP-20xx to an existing Ethernet network, you must choose IP addresses carefully. Consult with your network administrator to obtain appropriate values:

- Ask the administrator to provide static IP addresses to your FP-20xx and to the computer running the National Instruments Time Service. Time Service is installed along with the FieldPoint software and runs automatically.
- Ask the network administrator to provide the proper subnet mask, gateway, and DNS server addresses.

### Choosing an IP Address without a Network Administrator

If you are assembling your own small Ethernet network, you can choose your own IP address. The following guidelines may help you choose appropriate values:

- IP Addresses are generally in the form of  $w.x.y.z$  where  $w$ ,  $x$ , and  $y$  are numbers between 0 and 255 (inclusive) and  $z$  is between 1 and 254; however, a  $z$  value of 1 is usually reserved for the IP address of a gateway.
- Local networks (those that will not be connected to the Internet) should have IP addresses assigned from the following ranges:
  - 10.0.0.0 through 10.255.255.255
  - 172.16.0.0 through 172.31.255.255
  - 192.168.0.0 through 192.168.255.255

- To determine whether an IP address is already used by another device on the network, select **Start»Run**, type `ping x.x.x.x` where `x.x.x.x` is the IP address you want to test, and click **OK**. If `ping` returns a timeout, the IP address is not used. If it returns a reply from a device, the IP address is already in use.
- A subnet is a set of systems whose IP addresses are configured such that they can communicate directly with one another. Data does not flow through an intermediate router. The most common subnet mask is `255.255.255.0`.
- Appropriate subnet masks should be chosen to divide your system into smaller subnets, as desired. The method for determining the subnet is as follows:

The IP Address is combined in a logical AND with the subnet mask to determine the subnet. For example, a system with an IP address of `10.10.10.10` and a subnet mask of `255.255.255.0` is on the subnet of `10.10.10.x`. Thus, all systems with an IP of `10.10.10.x` and a subnet mask of `255.255.255.0` are considered to be on the same subnet. Likewise, if the systems have a subnet mask of `255.255.0.0`, all systems with an IP of `10.10.x.x` are considered part of the same subnet.

- Using the **Suggest Values** button when configuring a network module's IP address in FieldPoint Explorer should result in values that work on your network.
- The Time Server is the address of the computer where you have installed the National Instruments Time Service. This service is installed along with the FieldPoint software, Lookout 4.0 or later, and the LabVIEW Datalogging and Supervisory Control module.
- If you are setting up your own network, you probably do not have a gateway or DNS server, so you should set these values to `0.0.0.0`.
- To find out the network settings for your computer, run `ipconfig` on Windows 2000/NT/XP or `windowsipcfg` on Windows 98/95.

To run `windowsipcfg`, select **Start»Run**, type `windowsipcfg` in the **Open** field, and click **OK**. The IP Configuration window appears, which gives you information about the network setup for your computer. Make sure that the correct Ethernet adapter appears in the field at the top of the window.

To run `ipconfig`, open a Command window, type `ipconfig` at the prompt, and press <Enter>. If you need more information, you can run `ipconfig` with the `/all` option by typing `ipconfig /all`. Make sure you use the settings for the correct Ethernet adapter to configure your FP-20xx.



## Giving Your FP-20xx a Host Name

---

Follow these steps to give your FP-20xx a hostname:

1. Right-click the Comm Resource in FieldPoint Explorer, and choose **Edit this comm resource**.
2. Click **Browse** to launch Remote System Explorer.
3. Double-click the serial number of the module for which you want to enter a host name.
4. On the **System** tab of the System Configuration dialog box, enter a name in the **Host Name** field.
5. On the **Network Settings** tab of the System Configuration dialog box, make sure the **DNS Address** value points to correct location.
6. If your network has a DNS server, ask your network administrator to add a table entry for your host name.

If your network does not have a DNS server, you need to set up the `hosts` files on each networked computer. A `hosts` file allows a networked computer to use host names when no DNS server is available. Each computer on the network that needs to access the FP-20xx should have a properly configured `hosts` file.

### Setting up a Hosts File Under Windows 2000/NT/XP

1. Log on as an administrator to the local machine (not onto a domain).
2. Create a text file called `hosts`. This file has to be placed in the `system32\drivers\etc` directory of the system root, for example: `c:\winnt\system32\drivers\etc\hosts`
3. The file should include the following lines, where `hostname` is the host name of the FP-20xx and `12.34.56.78` is its IP address:
 

```
127.0.0.1 localhost
12.34.56.78 hostname
```

### Setting Up a Hosts File Under Windows 98/95

1. Create a text file called `hosts`. This file has to be placed in the `windows` directory, for example `c:\windows\hosts`
2. The file should include the following lines, where `fp` is the host name of the FP-20xx and `12.34.56.78` is its IP address:
 

```
127.0.0.1 localhost
12.34.56.78 fp
```

## Viewing and Editing the FP-20xx TCP/IP Settings

---

Follow these steps to view the TCP/IP settings:

1. In FieldPoint Explorer, right-click the Comm Resource and select **Edit this comm resource**.
2. Click **Browse** to launch Remote System Explorer.
3. In Remote System Explorer, double-click the serial number of the FP-20xx whose settings you would like to view or change.
4. When you are done, click **OK**. Click **Cancel** to discard any changes you have made.

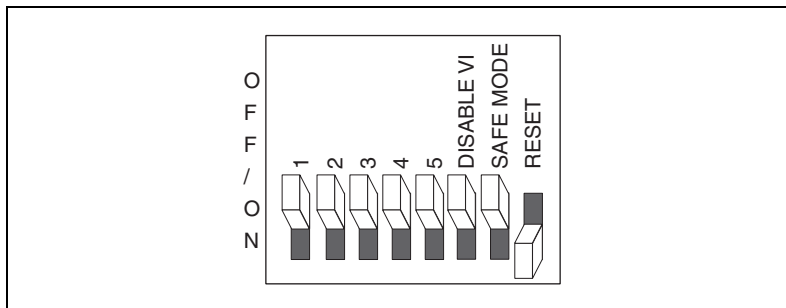
## Resetting the FP-20xx

If the FP-20xx is not able to communicate with the network, you can manually reset the unit to its factory settings. In this state, you should always be able to browse for the FP-20xx using Remote System Explorer, if it is on the same physical subnet as your host computer. When you reset the FP-20xx, the following actions occur:

- The IP address, subnet mask, DNS address, gateway, and Time Server IP are set to 0 . 0 . 0 . 0.
- The normal I/O services are suspended until the FP-20xx is reconfigured, but I/O module configuration is preserved. Send a Reset command in FieldPoint Explorer to reset an individual I/O module.
- The device appears as *Unconfigured* in Remote System Explorer.
- The system is unlocked, and any password protection is removed for configuration settings, data points, and LabVIEW remote access.
- Resetting does not affect power-up defaults, watchdog settings, or VIs.

Follow these instructions to reset the unit:

1. Power down the FP-20xx.
2. Move the RESET DIP switch on the front of the module to the ON position, as shown in the following figure.



3. Power up the FP-20xx and wait for the red **STATUS** LED to start flashing. When it flashes, the FP-20xx is in reset mode.
4. Move the RESET switch back to the OFF position.
5. Power down the FP-20xx and power it up again.



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# Troubleshooting

This appendix gives troubleshooting instructions for the FP-20xx and FieldPoint software.

## Software Configuration Problems

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### Error when Browsing in Comm Resource Configuration Dialog Box

Possible causes and solutions:

- Your Ethernet adapter is not installed properly. To install your Ethernet adapter, select **Start»Settings»Control Panel** and double-click **Network**. Your Ethernet adapter should appear in the list of installed components. If it does not appear, reinstall the software that came with your Ethernet adapter. If you do not have this software, contact the Ethernet adapter manufacturer.
- Your Ethernet adapter is installed, but TCP/IP protocol is not. TCP/IP is the network protocol used to communicate over Ethernet to the FP-20xx. Select **Start»Settings»Control Panel** and double-click **Network**. TCP/IP should appear in the list of installed network components. If it does not appear, select **Protocol** from the Network Component Type dialog box and click **Add**. In the Select Network Protocol dialog box that appears, select **Microsoft** as the manufacturer and **TCP/IP** from the **Network protocol** list. Click **OK**. You may need the Microsoft Windows diskettes or CD that came with your computer, and you may have to restart your computer after closing the **Network** control panel.

### FP-20xx Does Not Appear in Remote System Explorer Dialog Box When Browsing

Possible causes and solutions:

- Verify that there is power to the FP-20xx, and that both the module and the computer are properly connected to the Ethernet network. The module's **POWER** and **LINK** LED indicators should be lit. When you click **Browse**, the **ACTIVE** LED on the FP-20xx should flash to indicate that communications are taking place.

- Certain network devices, such as switches and routers, may filter out the directed UDP broadcast packets which FieldPoint Explorer uses to communicate with unconfigured FP-20xx modules, even if they are on the same subnet as the computer running FieldPoint Explorer. You can test this by connecting the computer running FieldPoint Explorer and the FP-20xx directly to a simple Ethernet hub or by using a crossover cable between the FP-20xx and the host PC. If the FP-20xx appears in the Remote System Explorer window using this configuration, but not when connected to the larger network, it is likely that there is a problem of this type. Consult your network administrator.
- The FP-20xx may have been configured on another network and then moved to the current network. Refer to Appendix B, [Resetting the FP-20xx](#), for instructions on resetting the FP-20xx.
- You may be using the wrong type of Ethernet cable.
- You may have assigned an IP address to your FP-20xx that is already used by another device on the network. Either remove or reconfigure the other device, or reconfigure the FP-20xx IP address. Refer to Appendix A, [Choosing Network Settings](#), for information on choosing IP settings.

## Error when Configuring IP Settings for the FP-20xx

Possible causes and solutions: Make sure you are entering valid values for all network parameters. If the subnet mask or IP address is not compatible with the network settings, an error is returned and the FP-20xx is not configured.

## FP-20xx Returns Invalid Timestamp Values

Possible causes and solutions:

- Verify that the IP address entered in Remote System Explorer points to a computer running National Instruments Time Service.
- Verify that the time zone settings are set correctly on the host PC and Time Server PC.

- Verify that National Instruments Time Service was installed on the computer you have specified as the Time Server. If Time Service is installed but is not running, restart it either using the service manager or using the following commands.
  - Under Windows 2000/NT/XP—Open a Command Prompt and enter `c:\winnt\system32\lktsrv -start` or use the Services manager available through the Control Panel.
  - Under Windows Me/98/95—Open an MS-DOS prompt and enter `c:\windows\system\lktsrv -start` or right-click the lighthouse icon in the PC's system task tray.

If Time Service is not installed, refer to Chapter 2, *Installing the Hardware and Software*, for instructions on installing the FieldPoint software, which includes Time Services.

## No Modules Found Error in FieldPoint Explorer

Possible causes and solutions:

- Make sure that the FieldPoint hardware is powered on. Make sure terminal bases are firmly mated, I/O modules are firmly seated on the terminal bases, and the cable connections are secure. The I/O module **READY** LEDs should be lit if all these connections are good.
- You may have assigned an IP address to your FP-20xx that is already used by another device on the network. Either remove or reconfigure the other device, or reconfigure the FP-20xx IP address. Refer to Appendix A, *Choosing Network Settings*, for information on choosing IP settings.
- The timeout value might be too small. Increase it and try again.

## Status of FP-20xx in Remote System Explorer is No Software Installed

You need to install LabVIEW RT and the FieldPoint software on the FP-20xx as described in Appendix D, *Installing LabVIEW RT Software*.

## Runaway Start-Up Application

If a runaway startup application causes the FP-20xx to become unresponsive, you must power down the FP-20xx, then reboot it with either the DISABLE VI switch or SAFE MODE switch in the ON position. Restarting the module with the DISABLE VI switch ON prevents any VIs from running at startup. Restarting it with the SAFE MODE switch ON starts the FP-20xx in safe mode, and the embedded LabVIEW RT engine is not launched. Refer to the *DIP Switches* section of Chapter 4, *Feature Set Description*, for more information about these DIP switches.

## STATUS LED Error Indications

The FP-20xx indicates specific error conditions by flashing the red STATUS LED a specific number of times. The following table describes the STATUS LED flashing sequences and the corresponding error condition.

**Table C-1.** STATUS LED Flashes and Corresponding Error Conditions

| Number of Flashes | Error Condition  |
|-------------------|--|
| 0 (stays lit)     | The FP-20xx did not power on correctly. Contact National Instruments for assistance.   |
| 1                 | The FP-20xx is in reset mode or is unconfigured. Refer to Appendix B, <i>Resetting the FP-20xx</i> for more information about reset mode. Refer to Chapter 3, <i>Hardware and Software Configuration</i> , for more information about configuration. |
| 2                 | The FP-20xx has detected an error in its firmware. This usually occurs when an attempt to upgrade the firmware is interrupted. Repeat the firmware upgrade process.  |
| 3                 | The FP-20xx is in safe mode. Download the software as described in Appendix D, <i>Installing LabVIEW RT Software</i> .   |
| 4 (or more)       | The FP-20xx has detected an unrecoverable error. Contact National Instruments for assistance.  |

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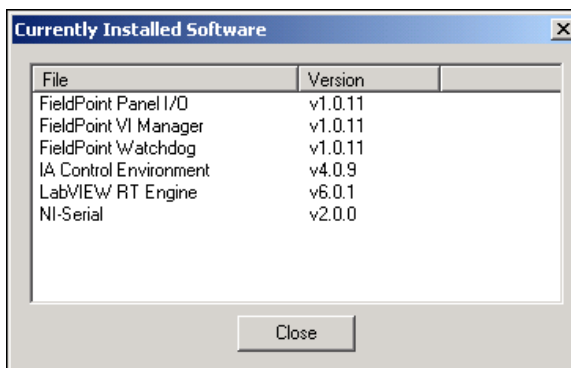
# Installing LabVIEW RT Software

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## Viewing Information about Installed Software

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To view the software installed on your FP-20xx, right-click the FP-20xx in Remote System Explorer and select **View Installed Software**. If your FP-20xx has LabVIEW RT installed, the Currently Installed Software dialog box displays the software and version numbers, as shown in the following figure.



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## Installing or Upgrading LabVIEW RT on the FP-20xx

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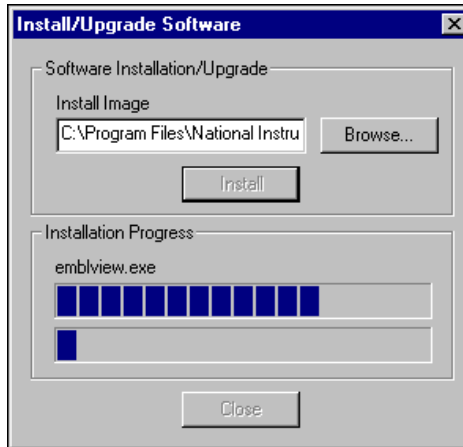
Your FP-20xx has LabVIEW RT pre-installed. However, if the FP-20xx **STATUS** LED flashes three times, and its status in Remote System Explorer is **No software installed**, the FP-20xx is in safe mode. In this case, you should re-install or upgrade the LabVIEW RT software.

Complete the following steps to install or upgrade the LabVIEW RT software on your FP-20xx:

1. Run Remote System Explorer: right-click the Comm Resource in FieldPoint Explorer, choose **Edit this comm resource**, and click **Browse**.



2. Right-click the FP-20xx and select **Install/Upgrade Software**. The Install/Upgrade Software dialog box appears, shown in the following figure.



3. Click **Install** to begin installation of LabVIEW RT files. A list of software to be installed appears.
4. Click **OK** in the Select Version dialog box.
5. Another dialog box appears asking if you want to delete. Click **OK**.
6. Click **Proceed**.
7. When installation is complete, click **Close** to exit the Install/Upgrade Software dialog box. Click **Yes** when prompted to reboot the system.
8. After the FP-20xx has rebooted, select **View»Refresh** to view the system configuration. The status should now be *Running*.

Once you assign the IP address and install the LabVIEW RT software, the FP-20xx is configured for use with LabVIEW RT on the host PC. Refer to Chapter 5, *LabVIEW RT Programming*, for more information about targeting the FP-20xx and running LabVIEW RT applications.

---

# Specifications

## Network

|   |                                       |
|---|---------------------------------------|
| Network interface.....                            | 10BaseT and 100BaseTX<br>Ethernet     |
| Compatibility .....                               | IEEE802.3                             |
| Communication rates .....                         | 10 Mbps, 100 Mbps,<br>auto-negotiated |
| Maximum cabling distance .....                    | 100 m/segment                         |
| Maximum power to connected<br>terminal bases..... | 9 W                                   |
| Maximum number of banks .....                     | Determined by network topology        |

## Memory

|               |                                  |
|---------------|----------------------------------|
| FP-2000 ..... | 16 MB nonvolatile<br>16 MB DRAM  |
| FP-2010 ..... | 32 MB nonvolatile<br>32 MB DRAM  |
| FP-2015 ..... | 512 MB nonvolatile<br>32 MB DRAM |

## Power Requirement

|                         |   |
|-------------------------|---|
| Power supply range..... | 11 to 30 VDC  |
| Power consumption.....  | $4.5 \text{ W} + 1.1 * \sum(\text{I/O Module Consumption})$ |

## Physical Characteristics

|                                  |  |
|----------------------------------|--|
| Screw-terminal wiring .....      | 16–26 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end |
| Torque for screw terminals ..... | 0.5–0.6 N · m (4.4–5.3 lb · in.)   |
| Weight .....                     | 278 g (9.8 oz)   |

## Environmental

FieldPoint modules are intended for indoor use only.

Operating temperature .....–25 to 55 °C

Storage temperature .....–40 to 85 °C

Humidity .....10 to 90% RH, noncondensing

Maximum altitude .....2,000 m

Pollution Degree .....2

## Safety

The FP-20xx meets the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use:

- EN 61010-1:1993/A2:1995, IEC 61010-1:1990/A2:1995
- UL 3101-1:1993, UL 3111-1:1994, UL 3121:1998
- CAN/CSA c22.2 no. 1010.1:1992/A2:1997

## Electromagnetic Compatibility

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

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

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



**Note** For full EMC compliance, you must operate this device with shielded cabling. In addition, all cover and filler panels must be installed. 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/).

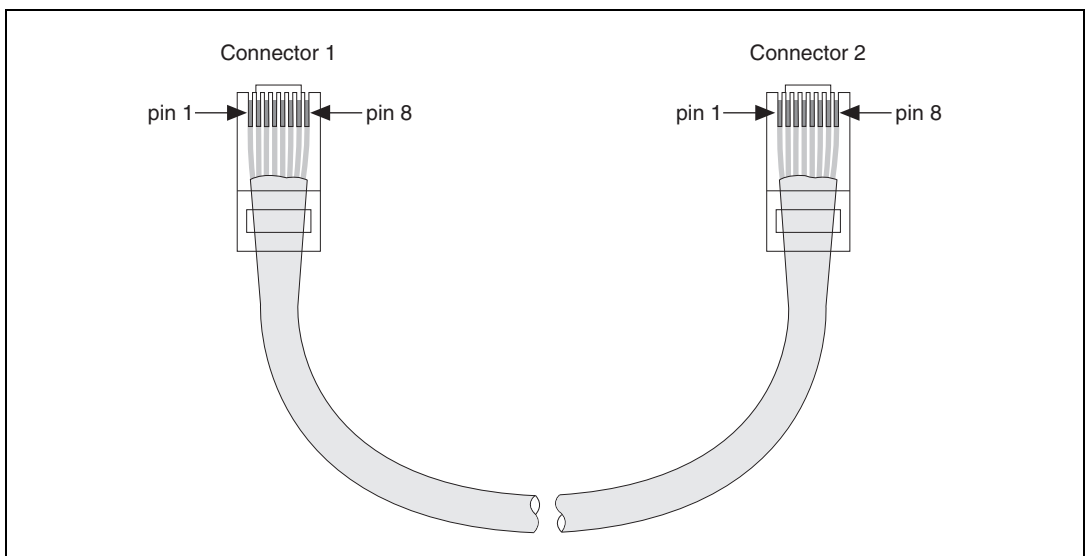
## Cabling

Table E-1 shows the standard Ethernet cable wiring connections for both normal and crossover cables.

**Table E-1.** Ethernet Cable Wiring Connections

| Pin | Connector 1  | Connector 2 (Normal) | Connector 2 (Crossover) |
|-----|--------------|----------------------|-------------------------|
| 1   | white/orange | white/orange         | white/green             |
| 2   | orange       | orange               | green                   |
| 3   | white/green  | white/green          | white/orange            |
| 4   | blue         | blue                 | blue                    |
| 5   | white/blue   | white/blue           | white/blue              |
| 6   | green        | green                | orange                  |
| 7   | white/brown  | white/brown          | white/brown             |
| 8   | brown        | brown                | brown                   |

The following figure shows the connector pinouts for FieldPoint Ethernet cables.



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# Technical Support and Professional Services

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can obtain the DoC for your product by visiting  
[ni.com/hardref.nsf](http://ni.com/hardref.nsf).

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# Glossary

---

| Symbol | Prefix | Value     |
|--------|--------|-----------|
| m      | milli  | $10^{-3}$ |
| k      | kilo   | $10^3$    |
| M      | mega   | $10^6$    |

|            |  |
|------------|--|
| %          | Percent.   |
| °          | Degrees.   |
| 0x         | Precedes a hexadecimal number.   |
| Ω          | Ohms.  |
| b          | Bits.  |
| B          | Bytes.   |
| bank       | The combination of one FieldPoint network module and one or more terminal bases and I/O modules. |
| C          | Celsius.   |
| DIP switch | Dual Inline Package switch.  |
| DNS        | Domain Name System.  |
| FTP        | File Transfer Protocol.  |
| HotPnP     | Hot Plug and Play.   |
| I/O        | Input/Output.  |
| IEC        | International Electrotechnical Commission.   |
| LED        | Light-emitting diode.  |
| m          | Meters.  |
| OPC        | OLE for Process Control.   |
| PG         | Pulse Generation.  |
| POST       | Power-On Self Test.  |

|        |  |
|--------|--|
| PWM    | Pulse-Width Modulation. Generation of a pulse waveform with fixed frequency and variable pulse width (duty cycle). PWM is used to control discrete devices such as DC motors and heaters by varying the pulse width (the ration of on time to off time). |
| subnet | A set of systems whose IP addresses are configured such that they can communicate directly with one another. Data will not flow through an intermediate router.  |
| TCP    | Transmission Control Protocol. A set of standard protocols for communicating across a single network or interconnected set of networks. TCP is for high-reliability transmissions.   |
| UDP    | User Datagram Protocol. A set of standard protocols for communicating across a single network or interconnected set of networks. UDP is for low-overhead transmissions.  |
| V      | Volts.   |
| VDC    | Volts direct current.  |
| VI     | Virtual Instrument. A combination of hardware and/or software elements, typically used with a PC, that has the functionality of a classic stand-alone instrument.  |
| W      | Watts.   |



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