

20

Mini FX/PL Hardware Guide



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Table of Contents

Welcome	iv
Purpose.....	iv
Audience.....	iv
Box Contents.....	iv
Hardware Requirements	v
Content.....	vi
Related Manuals	vi
For More Information and Technical Support	vii
Connecting the Mini FX/PL Hardware	1
Connection Instructions.....	2
Mini FX/PL Hardware Details.....	7
Introduction to PL 3150/PL 3170 EVB Hardware Details	8
PL 3150 and PL 3170 Evaluation Boards.....	8
Service Pin and Reset Buttons.....	8
Jumper Settings	9
Stand-alone Power Line Coupler Connector.....	12
I/O Connector	14
MiniGizmo I/O Board.....	14
MiniGizmo Push Buttons and LEDs	15
MiniGizmo Temperature Sensor	15
MiniGizmo Piezo Buzzer.....	15
Design and Test for Electromagnetic Compatibility	16

Welcome

The Mini FX/PL Evaluation Kit is a complete hardware and software platform for evaluating the LONWORKS® 2.0 platform and developing LONWORKS devices based on PL 3150® and PL 3170 Smart Transceivers. The Mini kit lets you build Neuron® C applications and download them to LONWORKS devices, and test LONWORKS devices.

You can use the Mini kit to develop prototype or production devices, particularly in the rapidly growing, price-sensitive mass markets of smart light switches, thermostats, and other simple devices and sensors.

Purpose

This document describes the hardware included with the Mini FX/PL Evaluation Kit, including assembly instructions and other information you will need when using the Mini FX/PL Evaluation Kit.

Audience

This guide is intended for device and system designers with an understanding of control networks.

Box Contents

The Mini FX/PL Evaluation Kit ships with the following material:

- PL 3150 and PL 3170 EVB Evaluation Boards. You can connect the PL 3150 and PL 3170 EVBs to a PL-20 (ISO/IEC 14908-3) LONWORKS channel
- Mini Gizmo I/O Boards. You can attach the Mini Gizmo I/O Boards to the PL 3150/PL 3170 EVBs, and use the I/O devices on the Mini Gizmo I/O Boards to test your device applications and the example applications included with the Mini FX/PL Evaluation Kit when they are running on the PL 3150 and PL 3170 EVBs.
- Mini FX CD. You can use the Mini FX software to build Neuron C device applications and download them to the PL 3150 and PL 3170 EVBs.
- LonScanner™ Protocol Analyzer Demo Edition CD. The LonScanner Protocol Analyzer lets you observe, analyze, and diagnose the behavior of the PL-20 channel to which the PL 3150 and PL 3170 EVBs are connected.
- Quick Start Guide. This document describes how to install the software included with your Mini FX software; connect the PL 3150 and PL 3170 EVBs and your development computer to a LONWORKS PL-20 channel; and create a simple self-installed LONWORKS network using the Neuron C example applications pre-loaded on the PL 3150 and PL 3170 EVBs.
- Three power supplies (90–240VAC 50/60Hz) with power cords (US/Japan and Continental European) and integrated couplers. Two power supplies are provided for the PL EVBs; the other power supply is provided for the U20 USB Network Interface.
- U20 USB Network Interface and USB Extension Cable. The U20 USB Network Interface lets you directly connect the Mini FX Application running on your computer to your PL 3150 and PL 3170 EVBs over a LONWORKS PL-20 channel.

Hardware Requirements

Requirements for computers running the Mini FX/PL Evaluation Kit are listed below:

- Microsoft® Windows Vista® or Microsoft Windows® XP. Echelon recommends that you install the latest service pack available from Microsoft for your version of Windows.
- Intel® Pentium® III 600MHz processor or faster, and meeting the minimum Windows requirements for the selected version of Windows.
- 120 to 350 megabytes (MB) free hard-disk space, plus the minimum Windows requirements for the selected version of Windows.
 - The Mini FX Application requires 90 MB of free space.
 - Microsoft .NET Framework 3.5 SP1, which is required to run the Mini kit, requires 30 MB of free space.
 - The LonScanner™ Protocol Analyzer (Demo Edition), which is included with the Mini kit software, requires 26 MB of free space.
 - If you install Adobe® Reader 9.1 from the Mini FX Evaluation Kit CD, you need an additional 204 MB of free space. You need Adobe Reader or another PDF viewer to view the Mini FX/PL Evaluation Kit documentation.
- 512 MB RAM minimum.

Note: Windows Vista testing for the Mini FX Application has been performed on computers that have a minimum of 2 GB of RAM. For complete Windows Vista requirements, refer to www.microsoft.com/windows/windows-vista/get/system-requirements.aspx. You can use Microsoft's Vista Upgrade Advisor to determine upgrade requirements for a particular computer. To download this tool, go to the Microsoft Web site at www.microsoft.com/windows/windows-vista/get/upgrade-advisor.aspx.

- CD-ROM drive.
- 1024x768 or higher-resolution display with at least 256 colors.
- Mouse or compatible pointing device.
- LNS® network interface or IP-852 router. If an LNS network interface is used, it may be a local or remote interface.
 - Compatible local network interfaces include the U20 USB network interface (included with the Mini FX/PL Evaluation Kit); PCC-10, PCLTA-20, or PCLTA-21 network interfaces; and the SLTA-10 Serial LonTalk Adapter.
 - Compatible remote network interfaces include the *i.LON*® SmartServer, *i.LON* 100 *e3* Internet Server, *i.LON* 600 LONWORKS-IP Server, or *i.LON* 10 Ethernet Adapter.
 - Compatible IP-852 routers include the *i.LON* SmartServer with IP-852 routing, *i.LON* 100 *e3* Internet Server with IP-852 routing, or an *i.LON* 600 LONWORKS-IP Server. If you are using an IP-852 router, your computer must have an IP network interface such as an Ethernet card or modem with PPP software. In addition, the *i.LON* software must be installed on your computer, and the IP-852 channel must be configured using the LONWORKS-IP Configuration Server application software.

Content

This guide includes the following content:

- *Connecting the Mini FX/PL Hardware.* Describes how to power your PL 3150 and PL 3170 EVBs and connect them to a LONWORKS PL-20 channel and to your development computer.
- *Mini FX/PL Hardware Details.* Describes the service pin and reset buttons and LEDs, jumper settings, stand-alone power line coupler connector, and I/O connector on the PL 3150/PL 3170 EVBs. Describes the I/O devices on the Mini Gizmo I/O Board.

Related Manuals

The documentation related to the Mini kit is provided as Adobe PDF files and online help files. The PDF files are installed in the **Echelon Mini** program folder when you install the Mini kit. You can download the latest Mini FX documentation, including the latest version of this guide, from Echelon's Web site at www.echelon.com/docs.

The following manuals provide supplemental information to the material in this guide. You can download these documents from Echelon's Web site at www.echelon.com.

<i>EIA-232C Serial Interfacing with the Neuron[®] Chip</i>	Describes a simple level conversion circuit to allow the Neuron Chip to communicate with EIA-232C devices. Also includes Neuron C software to drive an RS232C CRT terminal.
<i>Introduction to the LONWORKS[®] Platform</i>	Provides a high-level introduction to LONWORKS networks and the tools and components that are used for developing, installing, operating, and maintaining them.
<i>I/O Model Reference for Smart Transceivers and Neuron Chips</i>	Describes the many different I/O models that are available for use with the Neuron Chips and Smart Transceivers.
<i>LONWORKS[®] USB Network Interface User's Guide</i>	Describes how to install and use the U20 USB Network Interface, which is included with the Mini FX/PL Evaluation Kit.
<i>Mini FX/PL Examples Guide</i>	Describes how to run the Neuron C example application included with the Mini FX/PL Evaluation Kit on PL 3150 and PL 3170 EVBs.
<i>Mini FX User's Guide</i>	Describes how to use the Mini FX Evaluation Kit to develop and build simple Neuron C device applications, download the device applications to LONWORKS devices, and test the LONWORKS devices
<i>PL 3120[®] / PL 3150[®] / PL 3170[™] Smart Transceiver Data Book</i>	Provides detailed technical specifications on the electrical interfaces, mechanical interfaces, and operating environment characteristics for the PL 3120, PL 3150, and PL 3170 Power Line Smart Transceivers.

ShortStack® User's Guide Release 2.1 Describes how to develop an application for a LONWORKS device using Echelon's ShortStack 2.1 Micro Server. It describes the architecture of a ShortStack device and how to develop a ShortStack device.

For More Information and Technical Support

The **Mini FX ReadMe** document provides descriptions of known problems, if any, and their workarounds. To view the **Mini FX ReadMe**, click **Start**, point to **Programs**, point to **Echelon Mini**, and then select **Mini FX ReadMe First**. You can also find additional information about the Mini kit at the Mini FX Web page at www.echelon.com/mini.

If you have technical questions that are not answered by this document, the Mini FX online help, or the Mini FX ReadMe file, you can contact technical support. Free e-mail support is available or you can purchase phone support from Echelon or an Echelon support partner. See www.echelon.com/support for more information on Echelon support and training services.

You can also view free online training or enroll in training classes at Echelon or an Echelon training center to learn more about developing devices. You can find additional information about device development training at www.echelon.com/training.

You can obtain technical support via phone, fax, or e-mail from your closest Echelon support center. The contact information is as follows (check www.echelon.com/support for updates to this information):

Region	Languages Supported	Contact Information
The Americas	English Japanese	Echelon Corporation Attn. Customer Support 550 Meridian Avenue San Jose, CA 95126 Phone (toll-free): 1.800-258-4LON (258-4566) Phone: +1.408-938-5200 Fax: +1.408-790-3801 lonsupport@echelon.com
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Japan	Japanese	Echelon Japan Holland Hills Mori Tower, 18F 5-11.2 Toranomom, Minato-ku Tokyo 105-0001 Japan Phone: +81.3-5733-3320 Fax: +81.3-5733-3321 lonsupport@echelon.co.jp
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Other Regions	English Japanese	Phone: +1.408-938-5200 Fax: +1.408-328-3801 lonsupport@echelon.com

1

Connecting the Mini FX/PL Hardware

This chapter introduces the hardware components included with the Mini FX/PL Evaluation Kit, and it describes how to assemble the PL 3150 and PL 3170EVBs.

Connection Instructions

To connect the Mini FX/PL hardware, follow these steps:

1. Unpack the equipment from the shipping carton. Avoid touching areas of integrated circuitry, as static discharge could damage circuits.
2. Verify that all of the following hardware and software items listed in Table 1.1 are present.

Table 1.1 **Mini FX/PL Evaluation Kit Hardware and Software Items**

Item	Qty
PL 3150 EVB	1
PL 3170 EVB	1
Power supplies (90–240VAC 50/60Hz) with power cords (US/Japan and Continental European) and integrated couplers	3
MiniGizmo	2
MiniGizmo Cables	2
U20 USB Network Interface	1
USB Extension Cable	1
Mini FX CD	1
LonScanner CD (Demo Edition)	1

3. Install the software included with the Mini kit on your computer. The Mini kit includes the Mini FX CD and LonScanner Protocol Analyzer Demo Edition CD. See the *Mini FX User's Guide* for more information on installing the Mini kit software.
4. Connect the PL 3150 and PL 3170 EVBs to the MiniGizmo I/O Boards using the included MiniGizmo ribbon cables.
5. Connect the barrel connectors of the included power supplies into the barrel jacks on the PL 3150 and PL 3170 EVBs, connect the power supplies to the included power cords that are appropriate for you region (US/Japan or Continental European), and then plug the power cords into a power outlet.

This connects the PL EVBs to the power line channel. The Mini FX/PL power supplies include internal coupling to enable the evaluation boards to communicate through the power supply. You cannot substitute another power supply for the Mini kit power supplies, unless your alternative power supply provides equivalent coupling.

Figure 1.1 demonstrates how to connect your PL 3150/PL 3170 EVBs to the included MiniGizmo I/O Boards and power supplies.

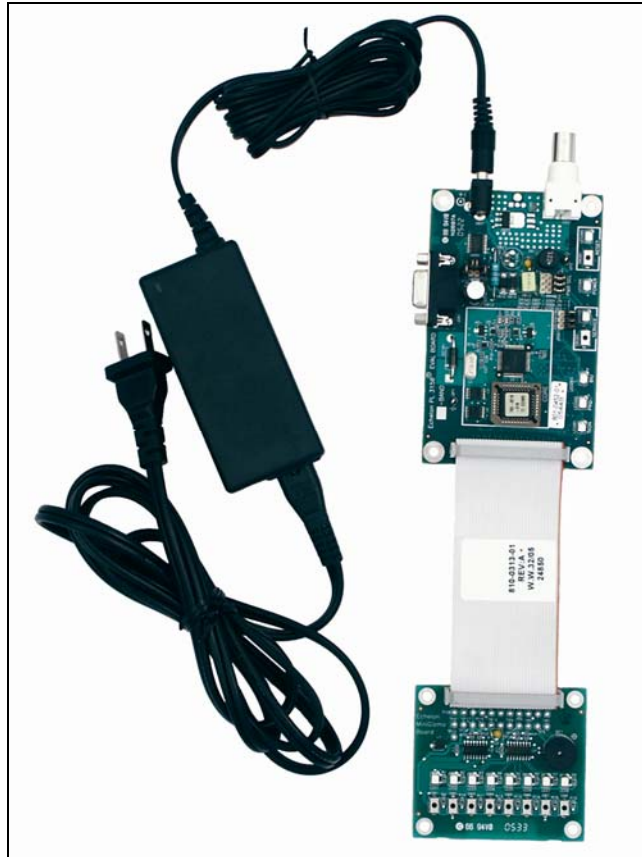


Figure 1.1 PL 3150/PL 3170 EVB Connections

After you plug in the power supplies, **LED1** will begin flashing, indicating that the PL Evaluation Board has entered CENELEC configuration mode. If **LED8** is on, then the CENELEC access protocol is enabled. If **LED8** is off, CENELEC is disabled. By default, CENELEC is enabled.

You must enable the CENELEC access protocol when operating within one of the CENELEC member states. When operating outside the CENELEC member states, disable the CENELEC access protocol for optimum performance and reliable communications.

If you want to change the current setting, you can press the **SW8** button on the MiniGizmo I/O Board to toggle CENELEC support. When you have made a selection, press the **SW1** button to confirm your selection and exit CENELEC configuration mode. Make sure that **LED8** is on before pressing **SW1** if you want CENELEC enabled, or off if you want CENELEC disabled. You will not be able to perform any network operations with the PL EVB until you have made a selection and exited CENELEC configuration mode.

The CENELEC EN 50065-1 standard specifies an access protocol for C-band channels to allow multiple power line signaling devices from different manufacturers to operate on a common AC-mains circuit. See Chapter 8 of the *PL 3120 / PL 3150 / PL 3170 Smart Transceiver Data Book* for more information on the CENELEC protocol. To view this book, click **Start**, point to **Programs**, point to **Echelon Mini**, point to **Smart Transceiver Data Books**, and then click it.

6. Insert the barrel connector of the included power supply into the barrel jack of the included U20 USB network interface, connect the power supply to the included power cord that is appropriate for your region (US/Japan or Continental European), plug the power cord into a power outlet, and then plug the U20 USB network interface into an available USB port on your computer. For more information on installing and using the U20 USB Network Interface, see the *LonWorks USB Network Interface User's Guide*.

Figure 1.2 demonstrates how to connect the included U20 USB network interface to the included power supply and to your development computer.



Figure 1.2 USB 20 Network Interface Connection

Note: You can use a different network interface such as remote network interface (*i.LON SmartServer* or *i.LON 100 e3 plus Internet Server*), or an IP-852 interface (*i.LON SmartServer* with IP-852 routing or *i.LON 100 e3 plus Internet Server* with IP-852 routing, or *i.LON 600 LONWORKS-IP Server*).

7. Complete the quick-start exercise in Chapter 3 of the *Mini FX User's Guide*. In the quick-start exercise, you will develop a device with one sensor and one actuator. The sensor is a simple sensor that monitors the push buttons on the PL 3150/PL 3170 EVB. The actuator drives the state of the LEDs on the PL 3150/PL 3170 EVB based on the state of the buttons.

This quick-start guides you through all the steps of creating a device with the Mini kit, including writing the Neuron C code that implements your device functionality; building the device application; downloading the device application; and testing the device.

8. Run the *MGDemo*, *MGSwitch*, *MGLight*, and *MGKeyboard* Neuron C example applications included with the Mini kit on your PL 3150 and PL 3170 EVBs. You can use the example applications to test the I/O devices on the EVBs, and create a simple managed LONWORKS network. The PL 3150 EVB comes pre-loaded with the *MGDemo* example application; the PL 3170 EVB comes pre-loaded with the *MGSwitch* example application.

With these pre-loaded example applications, you can create a simple self-installed LONWORKS network where the push buttons on the PL 3170 EVB are connected to the LEDs on the PL 3150 EVB.

For more information on using the Mini FX/PL example applications, see the *Mini FX/PL Examples Guide*.

Note: Echelon power line technology provides virtual plug and play communication in a single-family home environment. Mini FX users are encouraged to explore the communication capabilities of these evaluation units in a variety of home environments.

Reliable power line communication in a commercial environment—where nearby outlets may be serviced from different distribution transformers with very long branch circuits—is possible with the addition of routers, as described in the *Centralized Commercial Building Applications with the PLT-21 Power Line Transceiver Engineering Bulletin* (005-0056-01). Communication in a commercial environment without the additional routers described in this engineering bulletin may not be reliable.

For best results, do not attempt to communicate through mains power bars or power strips that contain EMC filters. This can be accomplished by plugging the Mini kit supply into a plug on the input side of a filtered power bar.

2

Mini FX/PL Hardware Details

This chapter describes the service pin and reset buttons and LEDs, jumper settings, stand-alone power line coupler connector, and I/O connector on the PL 3150 and PL 3170 EVBs. It describes the push buttons, LEDs, temperature sensor, and piezo buzzer on the MiniGizmo I/O Boards. It also provides information you will need when using custom applications and I/O devices with the evaluation boards.

Introduction to PL 3150/PL 3170 EVB Hardware Details

This chapter provide additional details on the PL 3150/PL 3170 EVB hardware, including descriptions of the service and reset buttons and LEDs, jumper settings, stand-alone power line coupler connector, and I/O connector on the EVBs. In addition, it provides additional details on the I/O devices on the Mini Gizmo I/O Boards, which consists of eight push buttons, eight LEDs, a temperature sensor, and a piezo buzzer

You can view schematics for the peripheral circuitry of the PL 3150/PL 3170 EVB and for the Mini Gizmo I/O Board. The peripheral circuitry on the PL 3150/PL 3170 EVB is the section of the board that is external to the core circuit (the core circuit is outlined white on the EVBs). To view the PL 3150/PL 3170 EVB and Mini Gizmo I/O Board schematics, click **Start**, point to **Programs**, point to **Echelon Mini**, point to **Board Schematics**, and then click the desired schematics. For details on the PL core circuit, see the *PL 3120 / PL 3150 / PL 3170 Smart Transceiver Data Book*, which you can view by clicking **Start**, pointing to **Programs**, pointing to **Echelon Mini**, pointing to **Smart Transceiver Data Books**, and then clicking the manual.

PL 3150 and PL 3170 Evaluation Boards

The following sections describe the service and reset buttons and LEDs, jumper settings, stand-alone power line coupler connector, and I/O connector on the PL 3150/PL 3170 EVBs.

Service Pin and Reset Buttons

Each PL 3150/PL 3170 EVB includes a Service button and a Reset button that have corresponding LEDs.

You can use the Service Pin button to send a service pin message from an evaluation board. You will use the Service Pin button when you register the device with the Mini FX Application, as described in the *Mini FX User's Guide*. You can use the Service LED to identify the device state (applicationless, unconfigured, configured), and you can also use it to provide additional application-specific information.

You can use the Reset button to reset the PL 3150/PL 3170 EVB when an application running on the board appears to have failed, or to test the reset behavior of an application loaded on the board. The Reset LED illuminates when you press the Reset button, or the PL 3150/PL 3170 Smart Transceiver is reset.

Figure 2.1 shows the location of the Service and Reset buttons and LEDs on a PL 3170 EVB. The buttons are located in similar locations on the PL 3150 EVB.

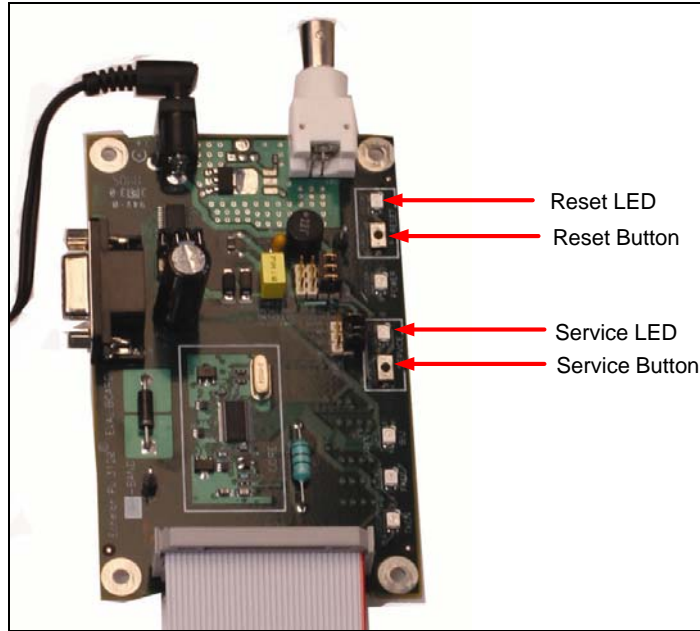


Figure 2.1 Service and Reset Buttons

Jumper Settings

Each Evaluation Board contains three sets of jumpers, as shown in Figure 2.2.

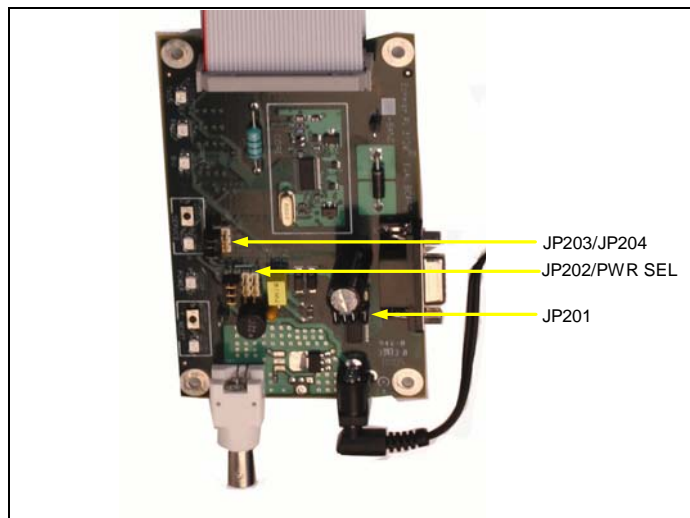
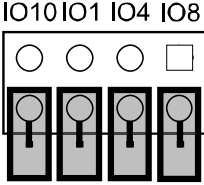
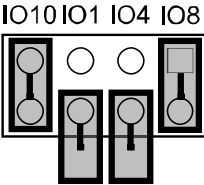
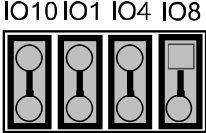
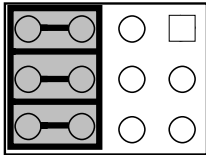
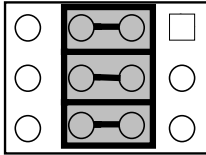


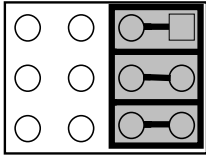
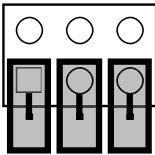
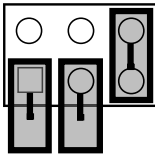
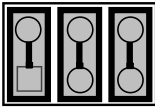
Figure 2.2 PL 3150/PL 3170 EVB Jumper Settings

Table 2.1 describes the evaluation board jumpers.

Table 2.1 PL 3150/PL 3170 EVB Jumpers

Function	Jumper	Description
RS-232 Enable (JP201)	 <p style="text-align: center;">JP201</p>	<p>Disables the Maxim MAX3387E EIA/TIA-232 communications interface. This is the default setting.</p>
	 <p style="text-align: center;">JP201</p>	<p>Connects the Smart Transceiver IO8 and IO10 pins to a Maxim MAX3387E EIA/TIA-232 communications interface to enable serial communication without handshake lines. IO10 is connected to pin 2 as a serial data output (TXD) on the RS-232 connector, and IO8 is connected to pin 3 as a serial data input (RXD).</p> <p>This is useful for connecting the evaluation board to your development computer so that you can send debug information from your evaluation board to a terminal emulation program on your computer such as Windows HyperTerminal. To do this, set the jumpers as shown to the left, connect the evaluation board to your development computer with a user-supplied serial cable, and then run Windows HyperTerminal on your computer to monitor the serial output. Configure HyperTerminal for direct connection to your serial port (typically COM1 or COM2), 4800 bps, 8 data bits, no parity, one stop bit, and no flow control.</p> <p>For information on implementing serial I/O, see the <i>EIA Serial Interfacing with the Neuron Chip</i> engineering bulletin (005-0008-01D).</p>

Function	Jumper	Description
RS-232 Enable (JP201)	 <p style="text-align: center;">JP201</p>	<p>Connects the Smart Transceiver IO1, IO4, IO8, and IO10 pins to a Maxim MAX3387E EIA/TIA-232 communications interface to enable serial communication with handshake lines. IO10 is connected to pin 2 on the RS-232 connector as a serial data output (TXD), IO8 is connected to pin 3 as a serial data input (RXD), IO1 is connected to pin 4 as a host ready input (HRDY~), and IO4 is connected to pin 7 as a request to send input (RTS~).</p> <p>This can be used in conjunction with the ShortStack Enable jumper to interface with other microcontrollers, using the ShortStack Micro Server running on the EVB. Echelon's ShortStack Micro Server enables any product that contains a microcontroller or microprocessor to quickly and inexpensively become a networked, Internet-accessible device. The ShortStack Micro Server provides a simple way to add LONWORKS networking to new or existing smart devices. For more information on the ShortStack Micro Server, see the <i>ShortStack User's Guide</i>. The ShortStack Micro Server and user's guide is available as a free download from www.echelon.com/shortstack.</p>
Power and Coupling Source Select (JP202)	 <p style="text-align: center;">JP202</p>	<p>Selects the power supply and power line carrier signal input from the J202 Power connector. This is used to connect to the Mini kit power supply, and is the default setting.</p>
Power and Coupling Source Select (JP202)	 <p style="text-align: center;">JP202</p>	<p>Selects the power supply input from the J202 Power connector, and the power line carrier signal input from the J203 Stand-alone Power Line Coupler input.</p>

Function	Jumper	Description
	<p>PWR SEL</p> <p>3 2 1</p>  <p>JP202</p>	<p>Selects the power supply input from pin 25 VDD5_EXT, pin 24 VA, and pin 23 GND on the P201 I/O connector, and the power line carrier signal input from the J203 Stand-alone Power Line Coupler input. You can use this setting to connect to a custom power supply and a custom power line coupler.</p>
ShortStack Enable (JP203)	<p>IO5 IO6 IO0</p>  <p>JP203</p>	<p>Disconnects the IO0, IO5, and IO6 ShortStack connections. This is the default setting</p>
	<p>IO5 IO6 IO0</p>  <p>JP203</p>	<p>Configures the IO0, IO5, and IO6 pins for use with a ShortStack Micro Server, with a 9600bps serial bit rate. See the <i>ShortStack User's Guide</i> for additional information about specifying the serial bit rate. IO0 is connected to pin 8 on the RS-232 connector through the Maxim MAX3387E EIA/TIA-232 communications interface as a clear to send output (CTS~).</p>
	<p>IO5 IO6 IO0</p>  <p>JP203</p>	<p>Configures the IO0, IO5, and IO6 pins for use with a ShortStack Micro Server, with a 76,800bps serial bit rate. See the <i>ShortStack User's Guide</i> for additional information about specifying the serial bit rate. IO0 is connected to pin 8 on the RS-232 connector through the Maxim MAX3387E EIA/TIA-232 communications interface as a clear to send output (CTS~).</p>

Stand-alone Power Line Coupler Connector

You can connect the PL 3150/PL 3170 EVB to a stand-alone power line coupler, as shown in Figure 2.3. The PL 3150/PL 3170 EVBs are typically connected to a combined power supply and power line coupler using the JP202 Power connector. A stand-alone power line coupler is useful for connecting to power lines with AC or DC voltage levels not supported by the Mini kit power supply, or for connecting to unpowered power lines. To use a stand-alone power line coupler, set the JP202 jumper to position 1 or 2 and then connect your stand-alone power line coupler to the J203 Stand-alone Power Line Coupler connector. This connector is compatible with the Echelon Model 78200-211, 78200-220, and 78200-221 PL-20 Power Line Couplers. For more information on power line couplers, see the *PL 3120 / PL 3150 / PL 3170 Smart Transceiver Data Book*. To view this book, click **Start**, point to **Programs**, point to **Echelon Mini**, point to **Smart Transceiver Data Books**, and then click it.

Figure 2.3 displays the location of the stand-alone power line coupler connector on the PL 3150/PL 3170 EVBs.

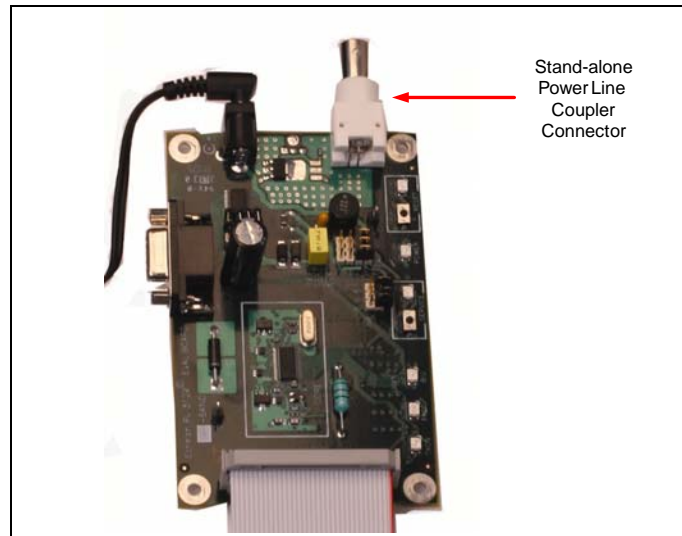


Figure 2.3 Stand-alone Power Line Coupler Connector

I/O Connector

Figure 2.4 shows the I/O connector pinout for the PL 3150/PL 3170 EVBs. You can use this connector to attach custom I/O devices to a PL 3150/PL 3170 EVB.

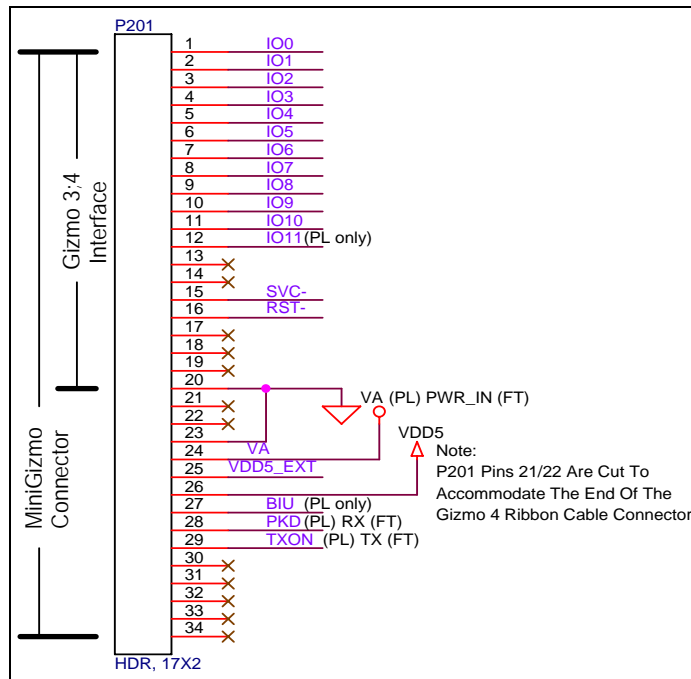


Figure 2.4 I/O Connector

MiniGizmo I/O Board

Each MiniGizmo I/O Board includes eight push buttons, eight LEDs, a temperature sensor, and a piezo buzzer, as shown in Figure 2.5. This section describes the I/O components on the MiniGizmo I/O Board. See the *Input/Output* section in Chapter 5 of the *Mini FX User's Guide* for example code you can use to interface with the MiniGizmo I/O Board. The Mini FX/PL examples described in the *Mini FX/PL Examples Guide* provide more detailed examples of how to use the MiniGizmo I/O Board.

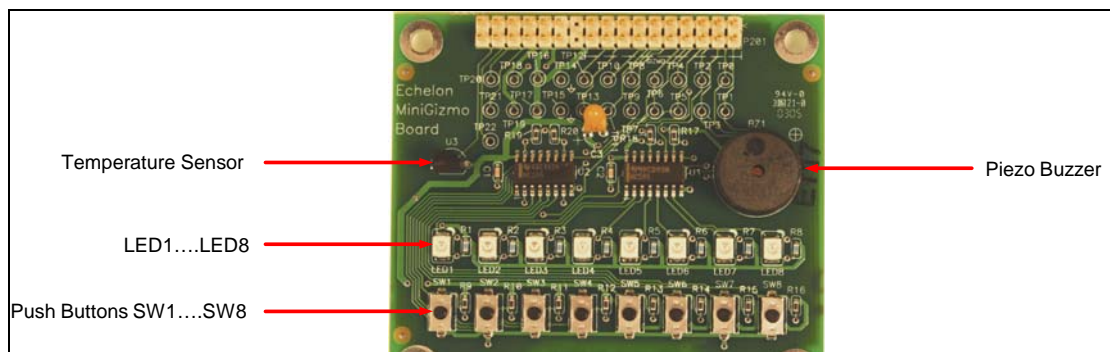


Figure 2.5 MiniGizmo

You can view schematics for the MiniGizmo I/O Board. To do this, click **Start**, point to **Programs**, point to **Echelon Mini**, point to **Board Schematics**, and then click **MiniGizmo Board Schematic**.

MiniGizmo Push Buttons and LEDs

The MiniGizmo I/O Board includes eight push buttons and eight LEDs. The push buttons are labeled **SW1** – **SW8**, and the LEDs are labeled **LED1** – **LED8**.

The push buttons are connected to a 74HC165 8-bit parallel-in/serial-out shift register. Data is shifted on the Smart Transceiver **IO4** (clock) and **IO5** (data) pins, with a latch strobe on **IO6** (active low to capture). The button readings must be debounced under application control.

The LEDs are connected to a 74HC595 8-bit serial-in/parallel-out shift register. Data is shifted on **IO2** (clock) and **IO3** (data), a rising edge on **IO1** strobes data into the latch. LEDs are driven active-low.

MiniGizmo Temperature Sensor

The MiniGizmo I/O Board includes a temperature sensor based on a 1-Wire® (“Touch I/O”) Dallas DS18S20 digital thermometer. The Touch I/O interface is connected to the Smart Transceiver **IO7** pin.

MiniGizmo Piezo Buzzer

The MiniGizmo I/O Board includes a simple piezo buzzer to provide audible feedback. The input of the piezo buzzer is connected to the Smart Transceiver **IO0** pin. You can generate a tone on the buzzer using the Neuron C **Frequency** output model. The piezo buzzer has a resonance frequency of approximately 4000Hz, so the output will sound best at frequencies near 4000Hz.

Design and Test for Electromagnetic Compatibility

Echelon's power line technology supports the creation of products that meet a wide variety of regulatory requirements. Chapter 6 of the *PL 3120® / PL 3150® / PL 3170™ Smart Transceiver Data Book* describes how to create products using Echelon's power line technology that meet various electromagnetic compatibility regulations.

The PL 3150 and PL 3170 EVBs are designed to facilitate testing of Echelon's power line technology. As such, they have no enclosure, providing open access to the IO connectors, buttons, LEDs, and other I/O components. They have been developed to allow consumer and commercial device OEM suppliers to evaluate the technology quickly, and have not been designed to be installed permanently in homes or commercial buildings. If you work with the EVBs in a home environment, operation of other electronic equipment that is sensitive to RF radiated emissions, such as televisions or radios, might be temporarily impaired during the evaluation period.

The standards for RF emissions vary by geographic region. To determine which standards apply in your region, consult the appropriate regulatory agencies. In the European Union, CISPR 22 (or equivalently, EN 55022) applies. In the North American market, the FCC regulates emissions from unintentional radiators under 47CFR15.109, Subpart B, which allows for substitution of CISPR 22. The EVBs comply with CISPR 22 Level A, but not Level B (which is required for deployment in home and commercial environments).



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