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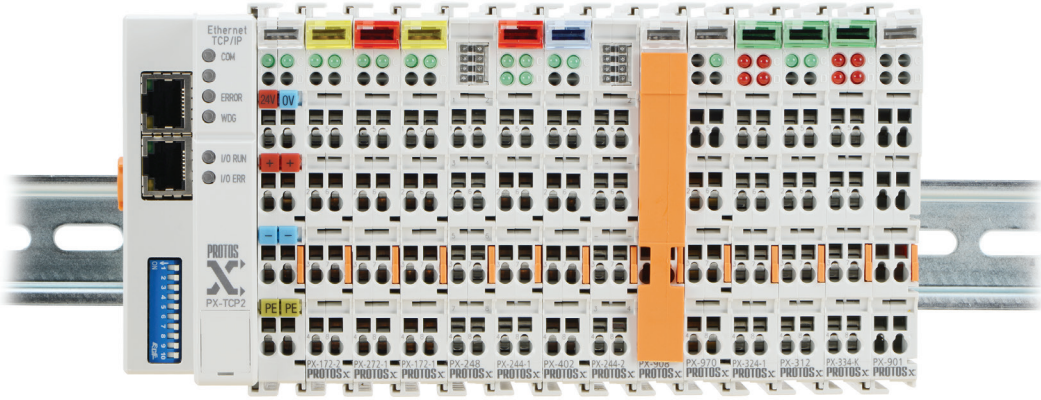
Protos X Installation and I/O Manual

Manual Number: PX-USER-M



Notes:

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Notes

Protos X Installation and I/O Manual

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Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

Manual Number: PX-USER-M

Issue: 1st Edition, Rev. D

Issue Date: 12/17

Publication History

Issue	Date	Description of Changes
1st Edition	10/14	Original
Revision A	11/15	Updated
Revision B	2/16	Updated
Revision C	9/17	Added EtherNet/IP bus coupler, general updates
Revision D	12/17	Updated Wiring Drawing for PX-322-1

Notes:

Table of Contents

Chapter 4: Protos X Configuration

Chapter 5: Troubleshooting

Chapter 1
Getting Started

In This Chapter...

1

About This Manual

The Purpose of this Manual

This manual is written for the user of the Protos X™ line of I/O products. This manual shows you how to install and wire the equipment. It also provides specifications for the couplers, input and output modules.

Supplemental Manuals

In some cases you may need an additional manual such as the master PLC User Manual or perhaps the manual for the PC-based control software you may be using.

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When you see the "notepad" icon in the left-hand margin, the paragraph to its immediate right will be a ***special note****. The word* ***NOTE****: in boldface will mark the beginning of the text.*

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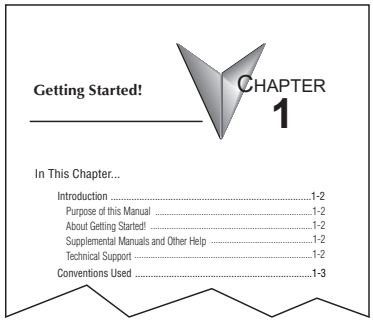
Key Topics for Each Chapter

The beginning of each chapter will list the key topics that can be found in that chapter.


Getting Started!

CHAPTER 1

In This Chapter...

1

Introduction

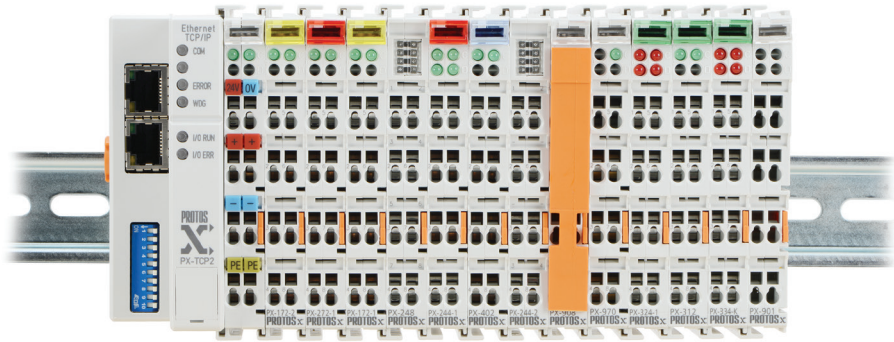
The Protos X™ I/O system allows a user to install remote field I/O devices without having to invest in another PLC. The small footprint of the Protos X I/O system allows it to be installed in tight locations at or in the vicinity of the equipment it is monitoring and/or controlling. The multiple I/O count options give the user the ability to monitor/control just a few points to a couple hundred points depending on the number of terminals used.

Communications to the bus couplers is done by Modbus communications. There are two Modbus TCP couplers (PX-TCP1 and PX-TCP2) and one RS-485 serial Modbus RTU\ASCII coupler (PX-MOD). Modbus addressing for the Field I/O can be easily identified by using the Protos X configuration software PX-CFGSW. The Modbus addressing can then be used by any controller that can communicate via Modbus to read/write data to the Protos X I/O.

To communicate using Ethernet an EtherNet/IP coupler (PX-EIP1) is available. This performs as an EtherNet/IP server in a EtherNet/IP network. Communication to the client is via an RJ45 Ethernet port. The maximum distance from client to the PX-EIP1 is 330 feet (100 meters) using 24AWG shielded, twisted pair Cat5e cable. It is highly recommended that a dedicated network be used for the Protos X system.

As shown below, the Protos X I/O system is a modular, field I/O system consisting of a Bus Coupler and its associated input/output Terminals. The Protos X field I/O series offers:

- 2, 4, 8, and 16-point discrete I/O terminals
- 2, 4 and 8-channel analog I/O terminals
- Three Bus Couplers that utilize the Modbus protocol with Modbus RTU/ASCII and Modbus TCP option
- An EtherNet/IP Bus Coupler that communicates via EtherNet/IP network
- Bus expansion terminals for expansion up to 255 I/O terminals per specific Bus Couplers
- And a variety of power supply options.



Protos X I/O System Components

Bus Couplers

Bus Couplers are available in four configurations. The PX-MOD provides EtherNet/IP or Modbus RTU/ASCII over RS485. The PX-EIP1 offers EtherNet/IP. The PX-TCP1 and PX-TCP2 modules offer Modbus TCP over Ethernet. The PX-TCP2 provides an additional port which can act as a switch to other couplers of the same type.

I/O Terminals

There are twelve discrete input and output terminals available offering 2 points, 4 points, 8 points or 16 points per terminal and include AC, DC and relay form factors.

There are also eighteen analog input and output terminals available offering 2 channels, 4 channels or 8 channels per terminal and include 4–20 mA, PT100 RTD, Type J and K thermocouple and 0–10 VDC or ±10VDC form factors.

Bus End Terminal/Bus Expansion Coupler Terminals

A Bus End Terminal, located at the end of a terminal assembly, is required for proper I/O bus communication. Bus expansion is available for the PX-MOD, PX-TCP1 and PX-EIP1 Bus Couplers. Bus expansion requires that a Bus Expansion End Terminal be used in place of the Bus End Terminal and a Bus Expansion Coupler Terminal be used in place of the PX-MOD, PX-TCP1 or PX-EIP1 at each expansion assembly.

Power Distribution Terminal

A Power Distribution Terminal is available to provide access to the integrated 24VDC Terminal Power Bus. The terminal provides 8 connection points each of 24V and 0V.

Power Separation Terminal

A Power Separation Terminal is available to provide interruption of power along the Terminal Power Bus.

Power Feed Terminals

Two Power Feed Terminals, 24VDC or 120–230 VAC, are available to add or change supply power to the Terminal Power Bus.

Protos X Bus Couplers	
Part Number	**Description**
PX-MOD	Modbus RTU/ASCII Bus Coupler
PX-TCP1	Modbus TCP Bus Coupler (1 port)
PX-TCP2	Modbus TCP Bus Coupler (2 ports)
PX-EIP1	EtherNet/IP Bus Coupler (1 port)

Power Feed Terminals	
Part Number	**Description**
PX-940	24VDC Power Feed Terminal
PX-970	120-230 VAC Power Feed Terminal

Bus Expansion Terminals	
Part Number	**Description**
PX-901	Bus End Terminal
PX-902	Bus Expansion End Terminal
PX-903	Bus Expansion Coupler Terminal

Power Distribution Terminal	
Part Number	**Description**
PX-949	24VDC Power Distribution Terminal

Protos X I/O System Components, (cont'd)

Discrete Input/Output Terminals	
Part Number	**Description**
PX-144	24VDC 4-point Input Terminal
PX-148	24VDC 8-point Input Terminal
PX-149	24VDC 16-point Input Terminal
PX-172-1	120–230 VAC 2-point Input Terminal
PX-172-2	120 VAC/VDC 2-point Input Terminal
PX-244-1	24VDC 4-point Output Terminal (0.5 A per point)
PX-244-2	24VDC 4-point Output Terminal (2A per point)
PX-248	24VDC 8-point Output Terminal (0.5 A per point)
PX-249	24VDC 16-point Output Terminal (0.5 A per point)
PX-272-1	230VAC/VDC 2-point Output Terminal (0.3 A per point)
PX-272-2	230VAC / 30VDC 2-point Output Terminal (2A per point)
PX-549	24VDC 8-point Input/ 24VDC 8-point Output Combination Terminal

Analog Input/Output Terminals	
Part Number	**Description**
PX-302	4–20 mA 2-channel Current Input Terminal
PX-304	4–20 mA 4-channel Current Input Terminal
PX-308	4–20 mA 8-channel Current Input Terminal
PX-312	±10VDC 2-channel Voltage Input Terminal
PX-314	±10VDC 4-channel Voltage Input Terminal
PX-318	±10VDC 8-channel Voltage Input Terminal
PX-322-1	2 Channel RTD Terminal
PX-324-1	4 Channel RTD Terminal
PX-332-J	2 Channel Thermocouple Terminal (J type)
PX-332-K	2 Channel Thermocouple Terminal (K type)
PX-334-J	4 Channel Thermocouple Terminal (J type)
PX-334-K	4 Channel Thermocouple Terminal (K type)
PX-402	4–20 mA 2-channel Current Output Terminal
PX-404	4–20 mA 4-channel Current Output Terminal
PX-408	4–20 mA 8-channel Current Output Terminal
PX-412	0–10 VDC 2-channel Voltage Output Terminal
PX-414	0–10 VDC 4-channel Voltage Output Terminal
PX-418	±10VDC 8-channel Voltage Output Terminal

Configuration Cable (USB v2.0)

A communications cable is available for configuration of the Bus Couplers. The cable has a USB type A connector for the PC and a 4-pin custom micro connector for the bus coupler.

Configuration Cable (USB)	
Part Number	**Description**
PX-USB-232	Configuration Cable 3m (9.8 ft)

Software Configuration Tool

The software configuration tool (PX-CFGSW) auto-configures the Modbus addresses and the interface allows the user to:

- Run the configurator
- View the configured Modbus addresses
- Modify the baud rate
- Change the Modbus offset
- Reboot the coupler
- Disable or modify Watchdog timer
- Configure first three octets of the IP address

Protos X I/O System Example

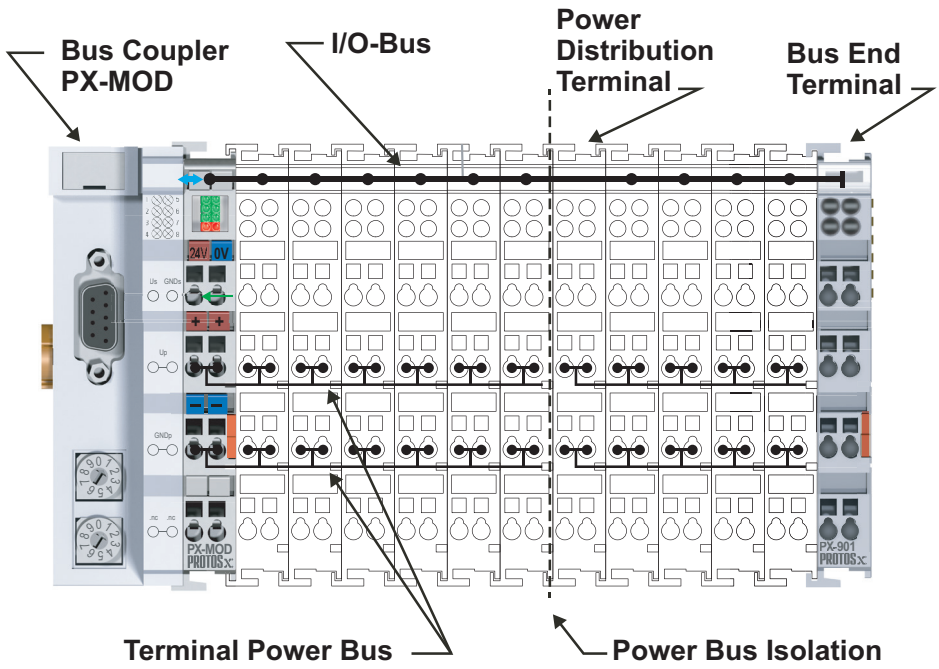
Typical System Setup

An example of a typical Protos X I/O system can be seen below. An **I/O Bus**, powered through the Bus Coupler, provides data communication across the terminal assembly via six contacts located on the side walls of the terminals. A **Terminal Power Bus** provides power for the I/O terminals via two power contacts. A power source of 24VAC or 24VDC must be connected to the Bus Coupler from an external supply.

If additional 24VDC supply is required for terminal wiring, eight points of 24VDC power can be distributed from the Terminal Power Bus using a **Power Distribution Terminal** (**PX-949**). This terminal must be mounted to the right of a terminal that passes 24VDC on the power bus. Both I/O Bus communication and terminal bus power are passed through to adjoining terminals.

For expansion beyond a 64 terminal assembly, a **Bus Expansion End Terminal** (**PX-902**) is used in place of a standard **Bus End Terminal** (**PX-901**). A **Bus Expansion Coupler Terminal** (**PX-903**) is used at each expansion assembly in place of a **PX-MOD or PX-TCP1 Bus Coupler**. Up to 31 Expansion couplers can be used in a group of assemblies. Connection is made between the Expansion Coupler Terminals via standard RJ45 Ethernet patch cable.

Note: *The PX-TCP2 Bus Coupler does not support expansion.*



Notes

SPECIFICATIONS

In This Chapter...

Bus Coupler: PX-MOD

The PX-MOD Modbus RTU/ASCII Slave Bus Coupler allows connection of up to 64 terminals per assembly, 255 terminals total, in a Modbus RTU/ASCII serial network. The PX-MOD communicates using high-level Modbus commands and automatically assigns Modbus addresses for inputs and outputs. The maximum amount of data is 512 bytes of input data and 512 bytes of output data, with up to 1020 inputs, 1020 outputs, 256 analog inputs and 256 analog outputs, when using bus expansion.

The PX-MOD has one RS-485 D-sub 9-pin port that functions in half duplex for connection to a Modbus master. The maximum distance from master to the PX-MOD is 4000 feet (1200 meters) using 24 AWG shielded, twisted pair. Termination resistors are required at the beginning and end of the network. It is highly recommended that a dedicated network be used for the Protos X system. A minimal assembly consists of a PX-MOD Bus Coupler, I/O Terminals and a Bus End Terminal.

PX-MOD I/O Bus Specifications	
Supply Power for I/O Bus	24VDC (-15%/+20%)
Input Current from Power Supply	70mA + (total I/O bus current) / 4
Recommended Fuse	10A Max
I/O Bus Current Supply	1000mA Max
Number of Bus Terminals Supported	64 per assembly, 255 w/ I/O Bus Expansion (based on power budget)
Number of Discrete Inputs/Outputs	1020 Inputs and 1020 Outputs with 255 terminals
Number of Analog Inputs/ Outputs	256 inputs and 256 outputs
Maximum Number of Data Bytes*	512 Input Bytes and 512 Output Bytes

* Number of Terminals can not exceed 512 input bytes and 512 output bytes.

PX-MOD Modbus Port Specifications	
Number of Stations	99
Station Configuration	Rotary Switches
Protocol	Modbus RTU/ASCII (default = RTU)
Data Transfer Rates	150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 baud
Maximum Cable Length	4000 ft. (1,200m)
Connector Type	9-pin, D-Sub, RS-485
Recommended Cable	24AWG, Shielded, Twisted Pair

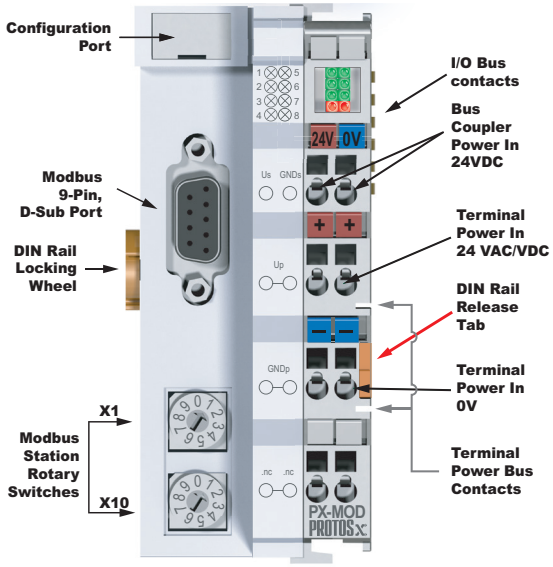
PX-MOD Terminal Power Bus Specifications	
Supply Power for Terminal Bus	24 VAC/VDC
Maximum Current	10A
Number of Power Contacts	2 (+24 VAC/DC, 0V)

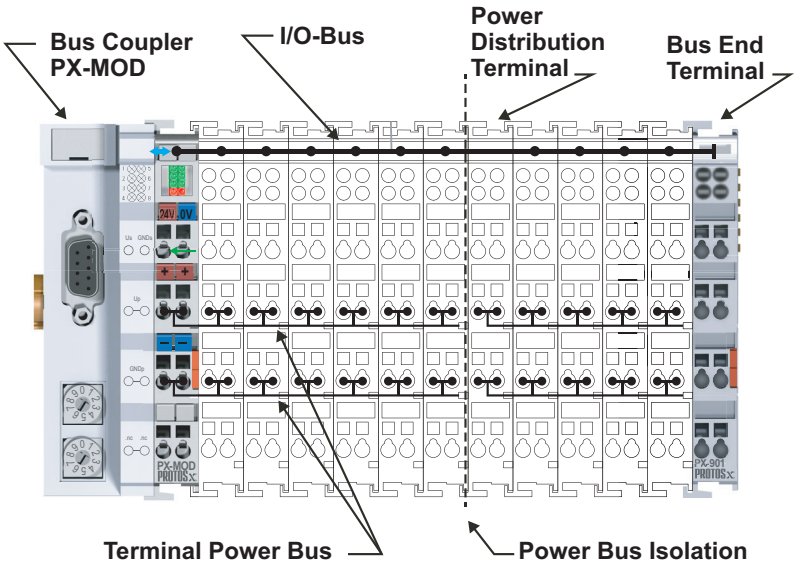
IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

General Specifications	
Operating Temperature	32° to 131°F (0° to 55 °C)
Storage Temperature	-13° to 185°F (-25° to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27
Noise Immunity	Conforms to EN 61000-6-2
Protection Class	IP20
Weight	100g
Dimensions (WxHxD)	44mm x 100mm x 66.4 mm (1.73 in x 3.94 in x 2.61 in)
*Agency Approvals**	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.





It is important to stay within the following three specifications:

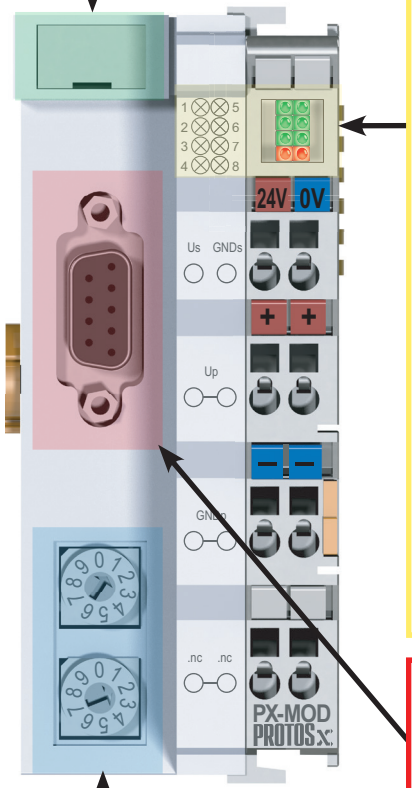
1. **Do not exceed the total number of 64 Terminals allowed per Assembly.**
2. **Do not exceed the total number of 512 Input Bytes and 512 Output Bytes.**
3. **Do not exceed the Coupler I/O Bus Power Budget of 1000mA as there is no internal current protection.**

Configuration Port

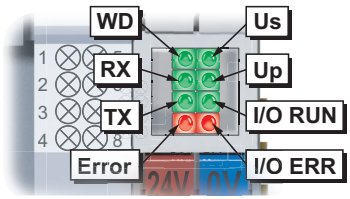
The Service Port connector is located under the flip-cover shown. This port is used for communication with the software configuration tool. The software configuration tool auto-configures the Modbus addresses and the interface allows the user to:

- Run the configurator
- View the configured Modbus addresses
- Modify the baud rate
- Change the Modbus offset
- Reboot the coupler
- Disable or modify Watchdog timer

Requires cable PX-USB-232, with a USB type A connector for the PC and a 4-pin custom micro connector for the Bus Coupler. Works with PX-CFGSW configuration software.
*Some 485 devices connected to the D-sub 9-pin may prevent Comm to the Configuration Port.

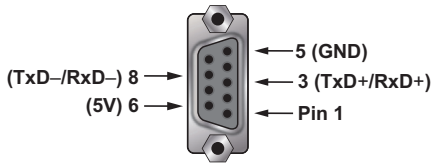


Status LEDs



LED Descriptions		
LED	***Status: ON***	***Status: OFF***
Green LED 1: WD	Watchdog is active	Watchdog error
Green LED 2: RX	Data being received	No data being received
Green LED 3: TX	Data being transmitted	No data being transmitted
Red LED 4: ERROR	Data Error, communications with the master device has been lost.	No data error or checksum error
Green LED 5: Us	Bus Coupler power on	Bus Coupler power off
Green LED 6: Up	Terminal power on	Terminal power off
Green LED 7: I/O RUN	I/O bus data active	Watchdog-timer overflow
Red LED 8: I/O ERR	I/O bus error, blinking code.	No I/O bus error

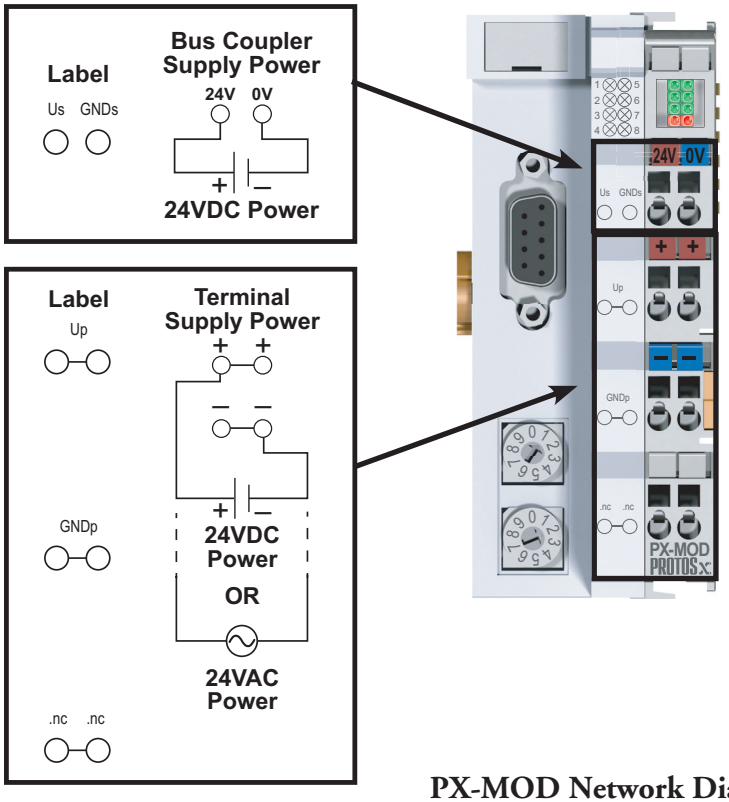
D-sub 9-pin, RS485 Connector



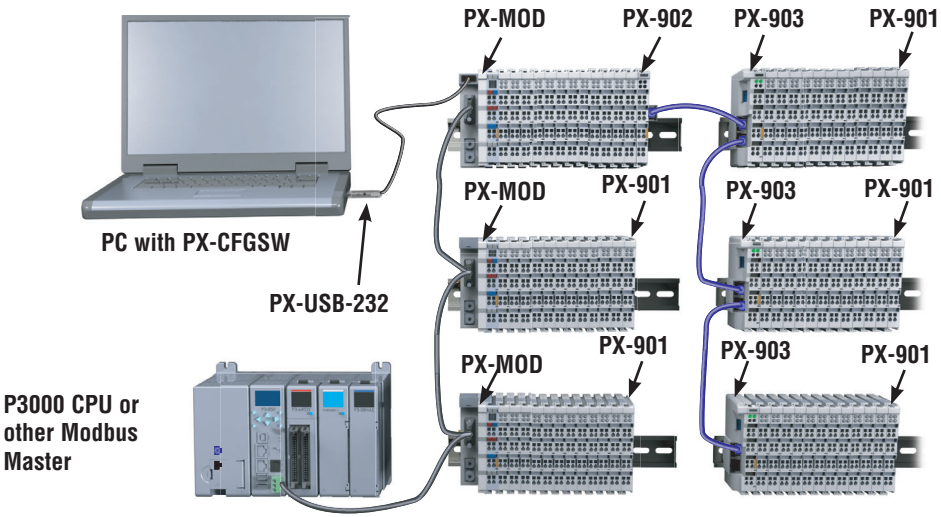
Address Selection - Rotary Switches

The Modbus node address for the PX-MOD is set using both rotary switches on the front of the coupler. The address is configured within the 01 to 99 range. The configured value of 00 is reserved for programming and configuration.
The lower rotary switch is used to set the tens digit (x10) of the node address. The upper rotary switch is used to set the ones digit (x1) of the node address. The switch address is accepted only when power is cycled. The example shown is configured for a node address of 21.

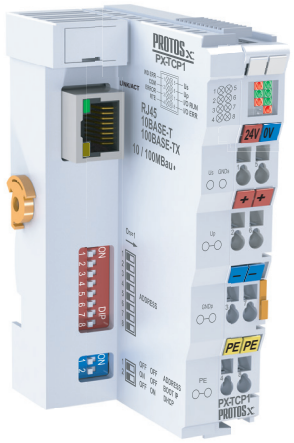
PX-MOD Wiring Connections



PX-MOD Network Diagram



Bus Coupler: PX-TCP1



The PX-TCP1 Modbus TCP Server Bus Coupler allows connection of up to 64 terminals per assembly, 255 terminals total, in a Modbus TCP network. The PX-TCP1 communicates using high-level Modbus commands and automatically assigns Modbus addresses for inputs and outputs. The maximum amount of data is 512 bytes of input data and 512 bytes of output data, with up to 1020 inputs, 1020 outputs, and 128 analog inputs or outputs, when using bus expansion.

The PX-TCP1 has one RJ45 Ethernet 10/100 Base T port for connection to a Modbus client. The maximum distance from client to the PX-TCP1 is 330 feet (100 meters) using 24 AWG shielded, twisted pair Cat5e cable. It is highly recommended that a dedicated network be used for the Protos X system. A minimal assembly consists of a PX-TCP1 Bus Coupler, I/O Terminals and a Bus End Terminal.

PX-TCP1 I/O Bus Specifications	
Supply Power for I/O Bus	24VDC (-15%/+20%)
Input Current from Power Supply	70mA + (total I/O bus current) / 4
Recommended Fuse	10A Max
I/O Bus Current Supply	1000mA Max
Number of Bus Terminals Supported	64 per assembly, 255 w/ I/O Bus Expansion (based on power budget)
Number of Discrete Inputs/Outputs	1020 Inputs and 1020 Outputs with 255 terminals
Number of Analog Inputs/ Outputs	128 total
Maximum Number of Data Bytes*	512 Input Bytes and 512 Output Bytes

* Number of Terminals can not exceed 512 input bytes and 512 output bytes.

PX-TCP1 Modbus Port Specifications	
Configuration	DIP switches and PX-CFGSW software
Protocol	Modbus TCP
Data Transfer Rates	10/100 Mbaud
Maximum Cable Length	100m between coupler and switch
Connector Type	Ethernet, RJ45
Recommended Cable	Shielded, Twisted Pair, Cat5e

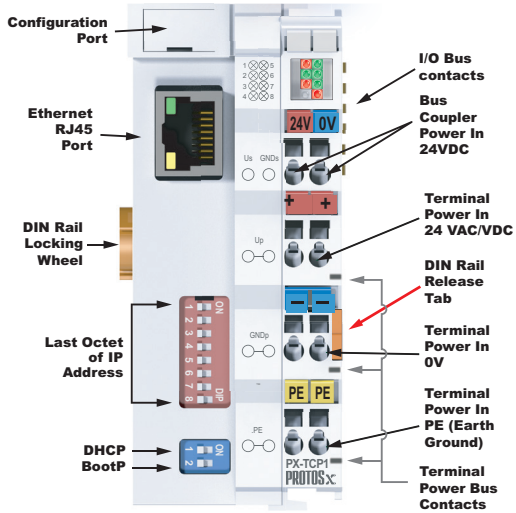
PX-TCP1 Terminal Power Bus Specifications	
Supply Power for Terminal Bus	24 VAC/VDC
Maximum Current	10A
Number of Power Contacts	3 (+24 VAC/VDC, 0V, PE)

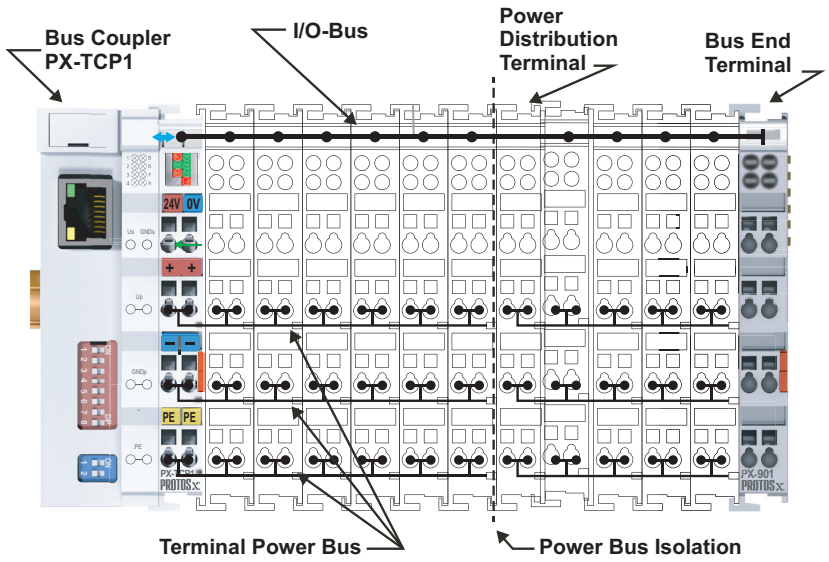
IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

General Specifications	
Operating Temperature	32° to 131°F (0° to 55 °C)
Storage Temperature	-13° to 185°F (-25° to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27
Noise Immunity	Conforms to EN 61000-6-2
Protection Class	IP20
Weight	100g
Dimensions (WxHxD)	44mm x 100mm x 66.4 mm (1.73 in x 3.94 in x 2.61 in)
*Agency Approvals**	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.





It is important to stay within the following three specifications:

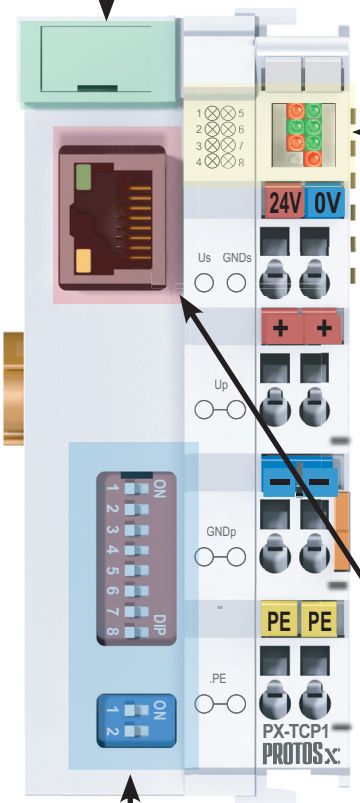
1. **Do not exceed the total number of 64 Terminals allowed per Assembly.**
2. **Do not exceed the total number of 512 Input Bytes and 512 Output Bytes.**
3. **Do not exceed the Coupler I/O Bus Power Budget of 1000mA as there is no internal current protection.**

Configuration Port

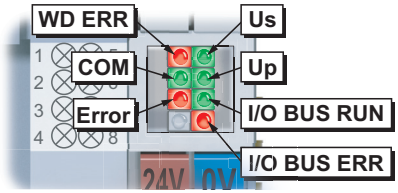
The Service Port connector is located under the flip-cover shown. This port is used for communication with the software configuration tool. The software configuration tool autoconfigures the Modbus addresses and the interface allows the user to:

• Run the configurator • View the configured Modbus addresses • Modify the baud rate • Reboot the coupler • Change the Modbus offset • Configure first three octets of the IP address • Disable or modify Watchdog timer

Requires cable PX-USB-232, with a USB type A connector for the PC and a 4-pin custom micro connector for the Bus Coupler. Works with PX-CFGSW configuration software.



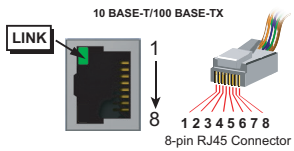
Status LEDs

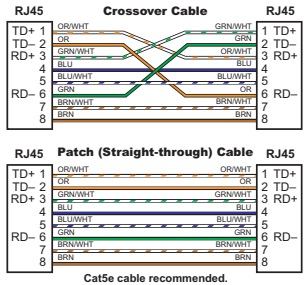


LED Descriptions

LED	Status: ON	Status: OFF
Red LED 1: WD ERR	Watchdog error	Watchdog is active after first Modbus write
Green LED 2: COM	Ethernet data is active (On or Flashing)	No data being recieved
Red LED 3: ERROR	Flashing: waiting for IP address if set to DHCP or BootP.	No error
Green LED 4: RTE	Not used	
Green LED 5: Us	Bus Coupler power on	Bus Coupler power off
Green LED 6: Up	Terminal power on	Terminal power off
Green LED 7: I/O-Bus RUN	I/O bus data active (On or Flashing)	No I/O bus activity
Red LED 8: I/O-Bus ERR	I/O bus error, blinking code.	No I/O bus error

RJ45 Connector



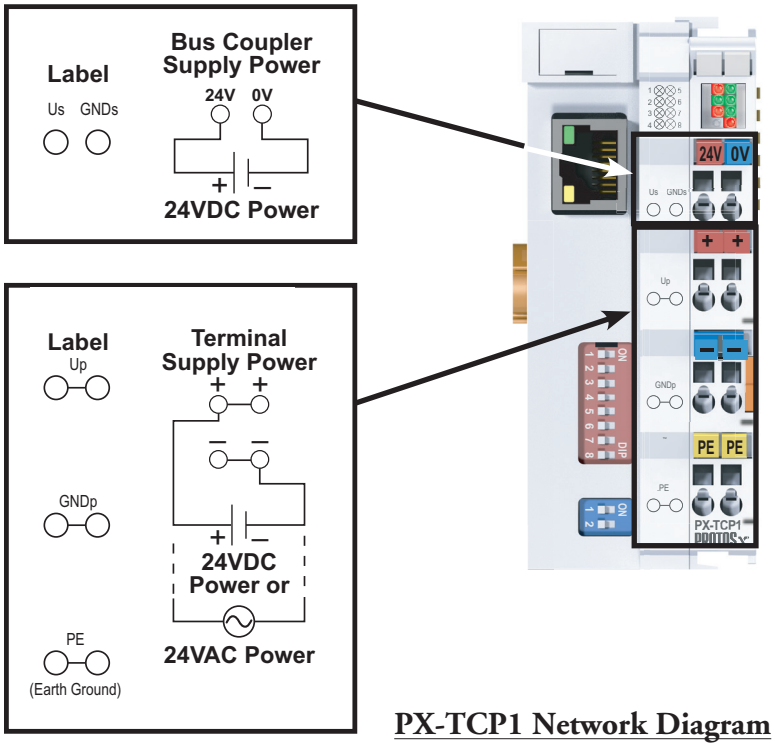


Address Selection DIP Switches

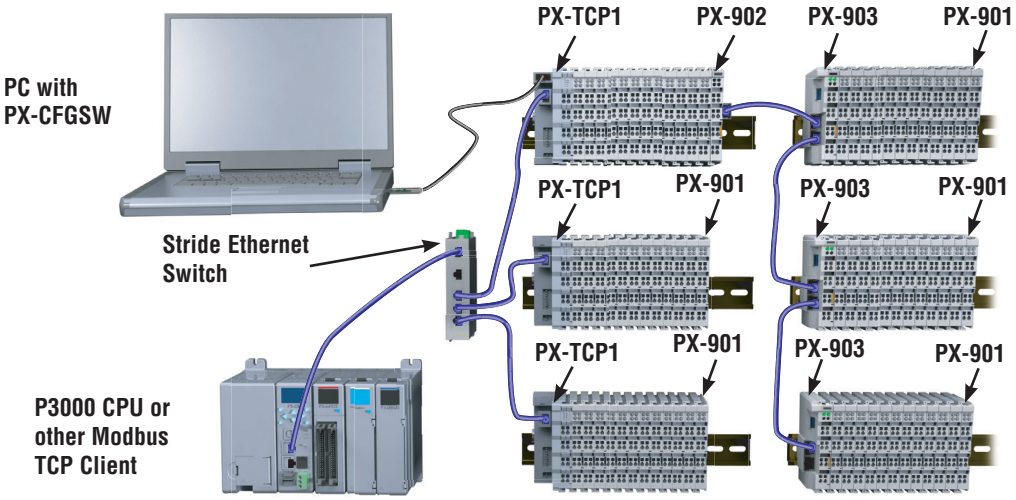
The last octet or byte of the IP Address for the PX-TCP1 is set using the large bank of DIP switches on the front of the coupler. The smaller bank of DIP switches is used to select the type of address assignment (DHCP, BootP, firm setting).

The IP Address DIP switches are arranged so that switch 1 corresponds to bit 0 (LSB) and switch 8 to bit 7 (MSB). The base address used is configured using the PX-CFGSW software tool. With the original factory settings, the IP Address is configured to the value 0.0.0.0. by default.

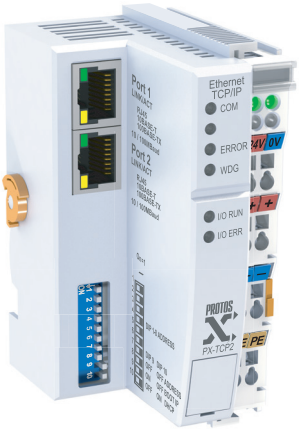
PX-TCP1 Wiring Connections



PX-TCP1 Network Diagram



Bus Coupler: PX-TCP2



The PX-TCP2 Modbus TCP Server Bus Coupler allows connection of up to 64 terminals in a Modbus TCP network. The PX-TCP2 communicates using high-level Modbus commands and automatically assigns Modbus addresses for inputs and outputs. The maximum amount of data is 512 bytes of input data and 512 bytes of output data, with up to 512 inputs, 512 outputs, and 128 analog inputs or outputs.

Communication to the client is via an RJ45 Ethernet port. A second port allows expansion of up to 20 total PX-TCP2 Couplers in a network. The maximum distance from a client to a PX-TCP2, and between each additional PX-TCP2, is 330 feet (100 meters) for each segment, using 24 AWG shielded, twisted pair Cat5e cable. It is highly recommended that a dedicated network be used for the Protos X system. A minimal assembly consists of a PX-TCP2 Bus Coupler, I/O Terminals and a Bus End Terminal.

PX-TCP2 I/O Bus Specifications	
Supply Power for I/O Bus	24VDC (-15%/+20%)
Input Current from Power Supply	70mA + (total I/O bus current) / 4
Recommended Fuse	10A Max
I/O Bus Current Supply	1750mA Max
Number of Bus Terminals Supported	64 per assembly (based on power budget)
Number of Discrete Inputs/Outputs	512 Inputs and 512 Outputs
Number of Analog Inputs/ Outputs	128 total
Maximum Number of Data Bytes*	512 Input Bytes and 512 Output Bytes

* Number of Terminals can not exceed 512 input bytes and 512 output bytes.

PX-TCP2 Modbus Port Specifications	
Configuration	DIP switches and PX-CFGSW software
Protocol	Modbus TCP
Data Transfer Rates	10/100 Mbaud
Maximum Cable Length	100m between Client and Coupler to Coupler
Connector Type	Ethernet, 2 x RJ45 (2 Channel Switch)
Recommended Cable	Shielded, Twisted Pair, Cat5e

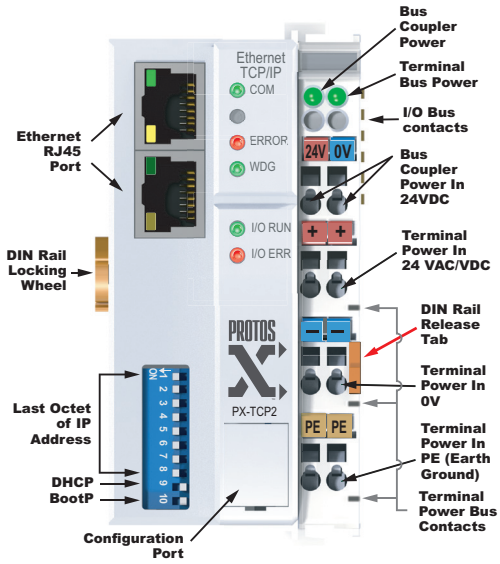
PX-TCP2 Terminal Power Bus Specifications	
Supply Power for Terminal Bus	24 VAC/VDC
Maximum Current	10A
Number of Power Contacts	3 (+24 VAC/VDC, 0V, PE)

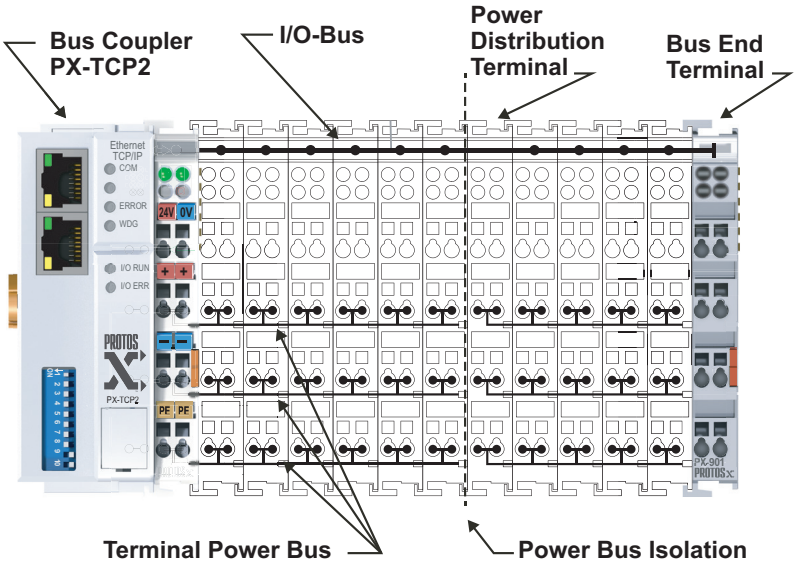
IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

General Specifications	
Operating Temperature	32° to 131°F (0° to 55 °C)
Storage Temperature	-13° to 185°F (-25° to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27
Noise Immunity	Conforms to EN 61000-6-2
Protection Class	IP20
Weight	170g
Dimensions (WxHxD)	44mm x 100mm x 66.4 mm (1.73 in x 3.94 in x 2.61 in)
*Agency Approvals**	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.





It is important to stay within the following three specifications:

1. **Do not exceed the total number of 64 Terminals allowed per Assembly.**
2. **Do not exceed the total number of 512 Input Bytes and 512 Output Bytes.**
3. **Do not exceed the Coupler I/O Bus Power Budget of 1750mA as there is no internal current protection.**

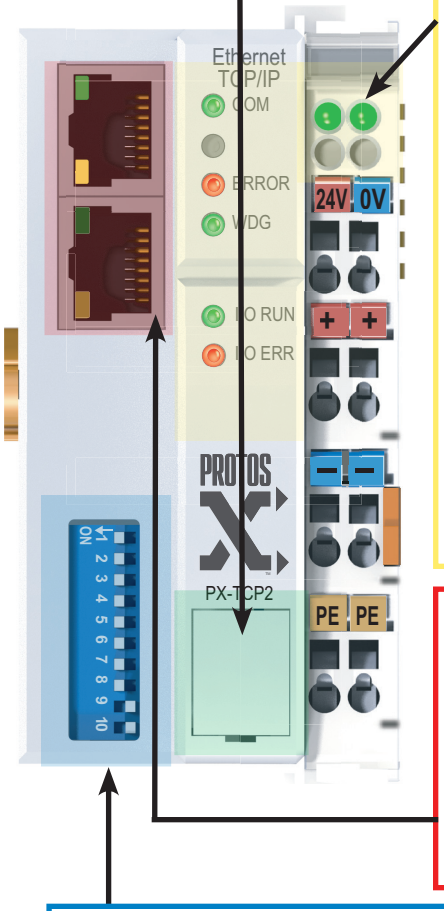
2

Configuration Port

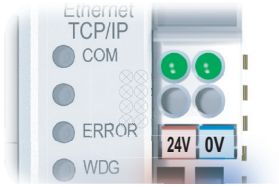
The Service Port connector is located under the flip-cover shown. This port is used for communication with the software configuration tool. The software configuration tool autoconfigures the Modbus addresses and the interface allows the user to:

• Run the configurator • View the configured Modbus addresses • Modify the baud rate • Reboot the coupler • Change the Modbus offset • Configure first three octets of the IP address • Disable or modify Watchdog timer

Requires cable PX-USB-232, with a USB type A connector for the PC and a 4-pin custom micro connector for the Bus Coupler. Works with PX-CFGSW configuration software.

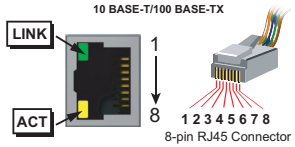


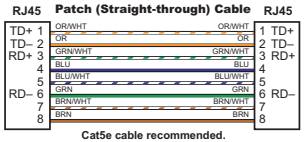
Status LEDs



LED Descriptions		
LED	***Status: ON***	***Status: OFF***
Green Power LED (left): Bus Coupler	Bus Coupler power on	Bus Coupler power off
Green Power LED (right): Terminal Bus	Terminal Bus power on	Terminal Bus power off
Green Ethernet LED: COM	On/Flashing: Receiving Data	No data being received
Red Ethernet LED: ERROR	Flashing: waiting for IP address if set to DHCP or BootP.	No Error
Green Ethernet LED: WDG	Watchdog is active	Watchdog error
Green I/O Bus LED: I/O RUN	I/O Bus Data Active (On or Flashing)	Terminal power off
Red I/O Bus LED: I/O ERR	I/O bus error, blinking code.	No I/O bus error

RJ45 Connector





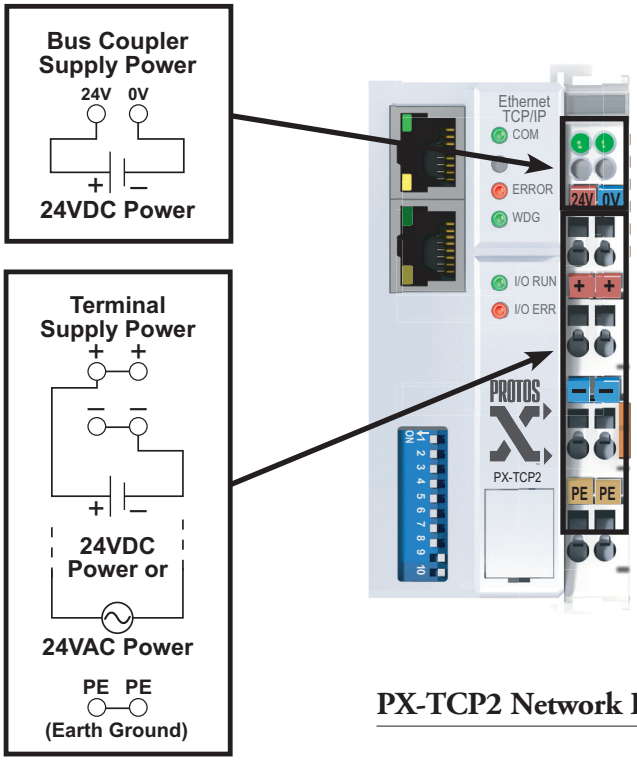
Cat5e cable recommended.

Address Selection DIP Switches

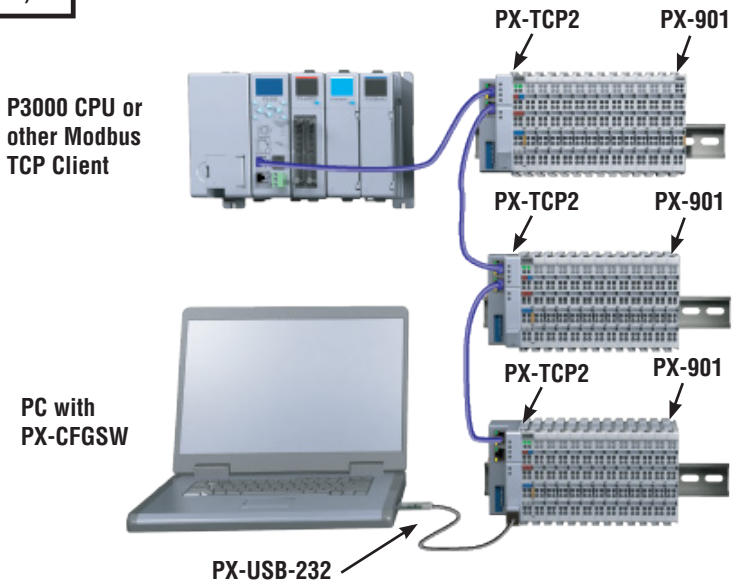
The last octet or byte of the IP Address, as well as the type of address assignment (DHCP, BootP, firm setting), for the PX-TCP2 is set using the DIP switches on the front of the coupler.

The IP Address DIP switches are arranged so that switch 1 corresponds to bit 0 (LSB) and switch 8 to bit 7 (MSB). Switches 9 and 10 allow for the address assignment selection. The base address used is configured using the PX-CFGSW software tool. With the original factory settings, the IP Address is configured to the value 0.0.0.0. by default.

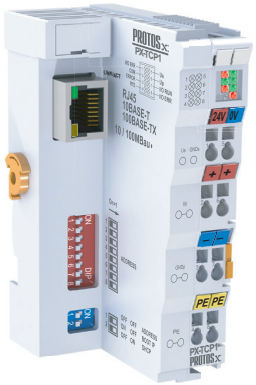
PX-TCP2 Wiring Connections



PX-TCP2 Network Diagram



Bus Coupler: PX-EIP1



The PX-EIP1 consists of one RJ45 Ethernet 10/100 Base T port for connection to an Ethernet client. The PX-EIP1 performs as a EtherNet/IP server in an EtherNet/IP network. Communication to the client is via an RJ45 Ethernet port. The maximum distance from client to the PX-EIP1 is 330 feet (100 meters) using 24AWG shielded, twisted pair Cat5e cable. The PX-EIP1 Bus Coupler supports up to 64 terminals per assembly, 255 terminals with Bus Expansion Couplers.

It is highly recommended that a dedicated network be used for the Protos X system. A minimal assembly consists of a PX-EIP1 Bus Coupler, I/O Terminals and a Bus End Terminal.

See page 2-59 for EtherNet/IP communication discussion.

PX-EIP1 I/O Bus Specifications	
Supply Power for I/O Bus	24VDC (-15%/+20%)
Input Current from Power Supply	70mA + (total I/O bus current) / 4
Recommended Fuse	10A Max total
I/O Bus Current Supply	1000mA Max
Number of Bus Terminals Supported	64 per assembly, 255 w/ I/O Bus Expansion (based on power budget)
Number of Discrete Inputs/Outputs	1020 Inputs and 1020 Outputs with 255 terminals
Number of Analog Inputs/ Outputs	128 total
Maximum Number of Data Bytes*	512 Input Bytes and 512 Output Bytes

* Number of Terminals can not exceed 512 input bytes and 512 output bytes.

PX-EIP1 EtherNet/IP Port Specifications	
Configuration	DIP switches and PX-CFGSW software (Requires V2.0 or later)
Protocol	EtherNet/IP (Support for Implicit Messaging only)
Data Transfer Rates	10/100 Mbps (Auto-crossover)
Maximum Cable Length	100m between coupler and switch
Connector Type	Ethernet, RJ45
Recommended Cable	Shielded, twisted pair, Cat5e

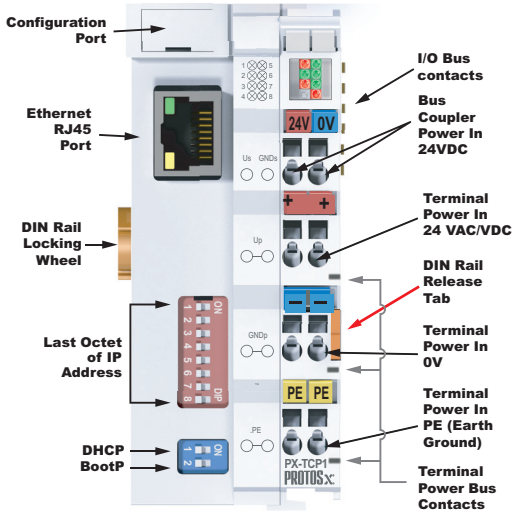
PX-EIP1 Terminal Power Bus Specifications	
Supply Power for Terminal Bus	24VDC
Maximum Current	10A
Number of Power Contacts	3 (+24 VAC/VDC, 0V, PE)

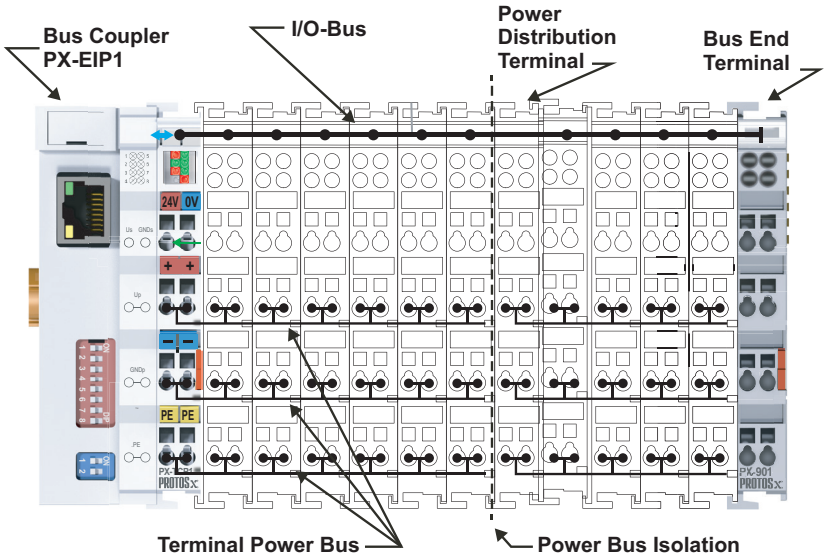
IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

General Specifications	
Operating Temperature	32° to 131°F (0° to 55 °C)
Storage Temperature	-13° to 185°F (-25° to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27
Noise Immunity	Conforms to EN 61000-6-2
Noise Emission	Conforms to EN 61000-6-4
Protection Class	IP20
Weight	100g
Dimensions (WxHxD)	44 x 100 x 66.4 mm (1.73 x 3.94 x 2.61 in)
*Agency Approvals**	UL/cUL File No. E172151 (BK9055), CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.





It is important to stay within the following three specifications:

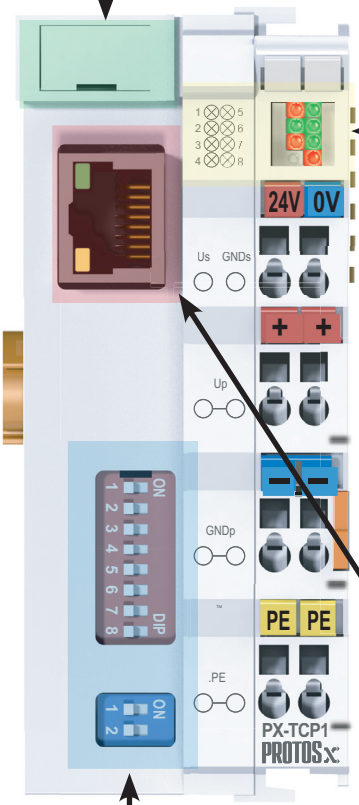
1. **Do not exceed the total number of 64 Terminals allowed per Assembly.**
2. **Do not exceed the total number of 512 Input Bytes and 512 Output Bytes.**
3. **Do not exceed the Coupler I/O Bus Power Budget of 1000mA as there is no internal current protection.**

Configuration Port

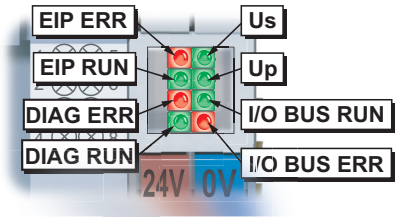
The Configuration Port connector is located under the flip-cover shown below. This port is used for communication with the software configuration tool. The software configuration tool auto-configures the EtherNet/IP addresses and the interface allows the user to:

• Run the configurator • View the configured EtherNet/IP bytes and words • Reboot the coupler • Configure first three octets of the IP address

Requires cable PX-USB-232, with a USB 2.0 type A connector for the PC and a 4-pin custom micro connector for the Bus Coupler. Works with PX-CFGSW configuration software version 2.0 or later releases.

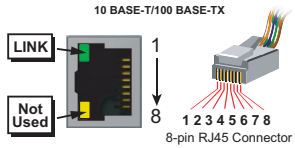


Status LEDs

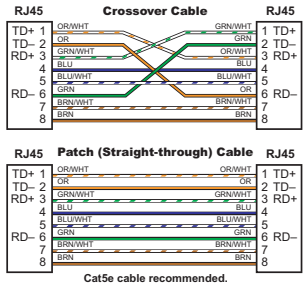


LED Descriptions		
LED	***Status: ON***	***Status: OFF***
Red LED 1: EIP ERR	See PX-CFGSW Help file or PX-USER-M manual Ch 5 for codes.	No EIP Error
Green LED 2: EIP Run	EIP Communication with Scanner (Client) **Flashing:** No active communication.	N/A
Red LED 3: DIAG Err	See PX-CFGSW Help File or PX-USER-M manual Ch 5 for codes.	No DIAG Err
Green LED 4: DIAG Run	Diagnostics active w/o error **Flashing:** Used in conjunction with Diag Error to determine fault.	N/A
Green LED 5: Us	Bus coupler power On	Bus coupler power Off
Green LED 6: Up	Terminal power On	Terminal power Off
Green LED 7: I/O Bus RUN	I/O bus data active (On or Flashing)	No I/O bus activity
Red LED 8: I/O Bus Err	I/O bus error, blinking code	No I/O bus error

RJ45 Connector



LED Status		
Green LINK LED	ON = Connection Good	Flashing = Comm Active

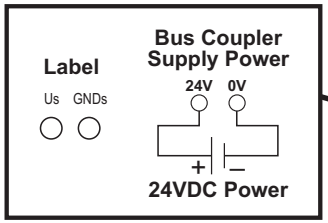


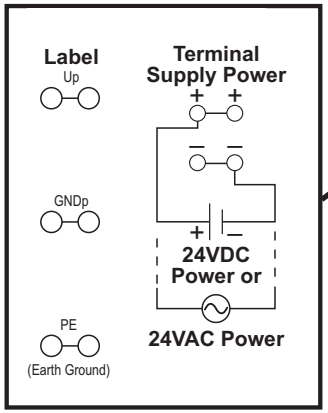
Address Selection DIP Switches

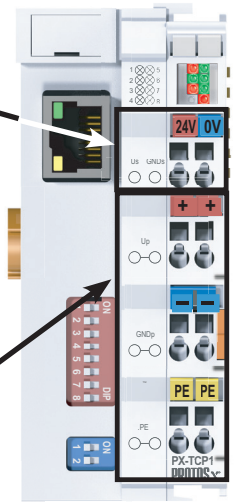
The last octet or byte of the IP Address for the PX-EIP1 is set using the large bank of DIP switches on the front of the coupler. The smaller bank of DIP switches is used to select the type of address assignment (DHCP, BootP, firm setting).

The IP Address DIP switches are arranged so that switch 1 corresponds to bit 0 (LSB) and switch 8 to bit 7 (MSB). The base address used is configured using the PX-CFGSW software tool. With the original factory settings, the IP Address is configured to the value 0.0.0.0 by default.

PX-EIP1 Wiring Connections



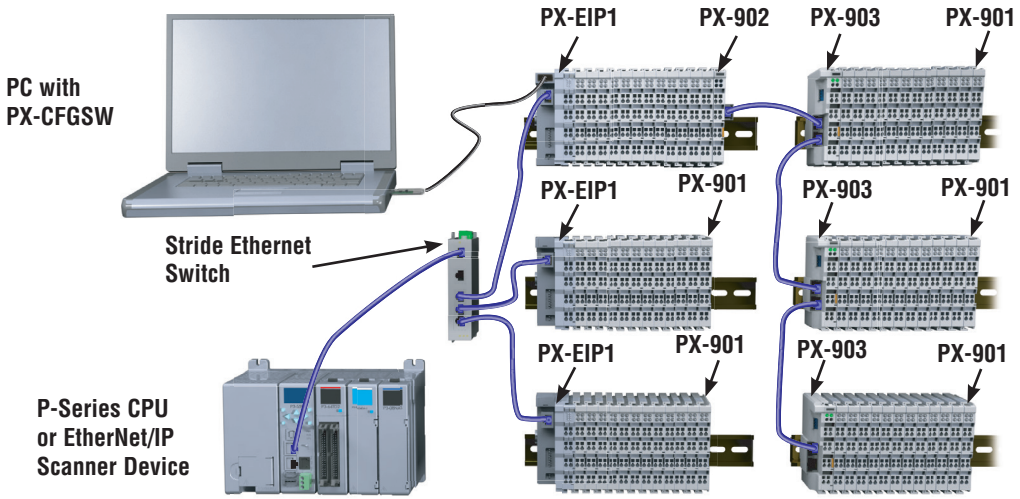




Wire connections are made through spring clamp style terminals. The terminals are designed for a single-conductor solid or stranded wire. Wire connection is made by firmly pushing the screwdriver into the screwdriver slot, inserting the wire into the wire slot and removing the screwdriver, locking the wire into position.

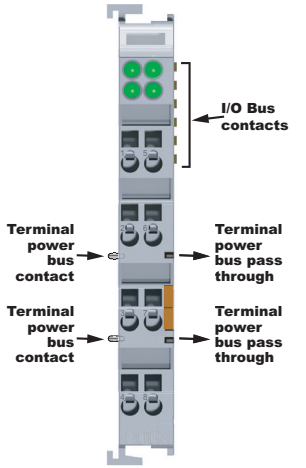
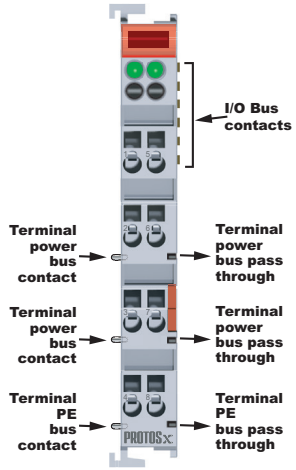
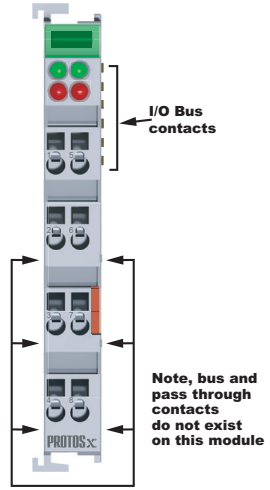
Wiring Specifications	
Connection Type	Spring Clamp Terminals
Wire Gauge /Wire Cross-Section	28–14 AWG / 0.08–2.5 mm^2
Screwdriver Width	Use screwdriver width 2.5 mm (0.10) such as our TW-SD-MSL-2
Wire Stripping Length	8mm (5/16 in)

PX-EIP1 Network Diagram



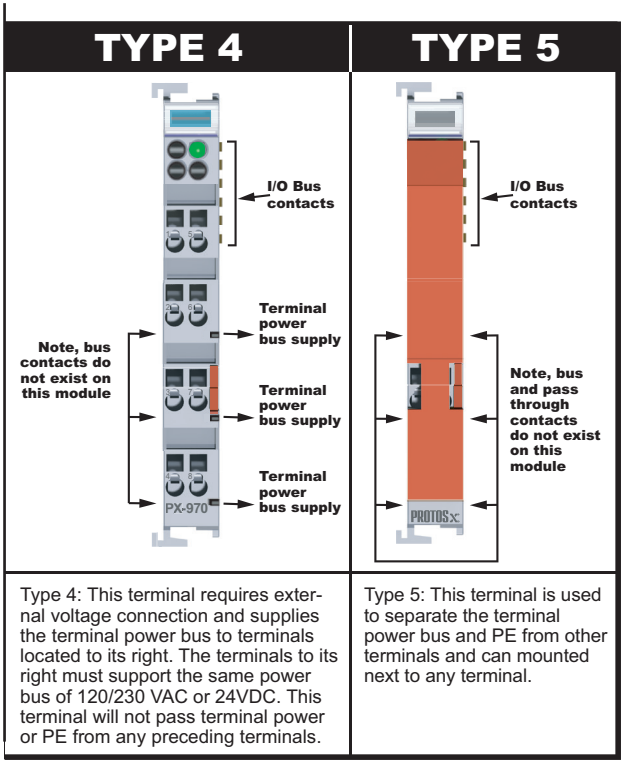
Protos X Terminal Types

Another consideration when choosing terminals is the different types available. Some of the terminals will pass terminal bus power and terminal PE (earth ground) connections. Some terminals will only pass terminal bus power and others do not pass any terminal power. The modules that pass terminal power cannot be inserted to the right of a terminal that does not. For this reason it is important to note the differences in the terminal types and how they handle the terminal power bus. The terminal types are shown in the panels below and on the following page with a brief functional description.

TYPE 1	TYPE 2	TYPE 3
		
Type 1: This terminal passes the terminal power bus from the preceding terminal to the next terminal and therefore it must be mounted to a preceding terminal that passes bus power.	Type 2: This terminal passes the terminal power bus and PE from the preceding terminal to the next terminal and therefore it must be preceded by a terminal that passes both terminal power bus and PE.	Type 3: This terminal does not pass the terminal power bus or PE and can be preceded by any terminal, however it will interrupt the terminal power bus and PE.

Panel continued on following page.

Protos X Terminal Types, continued



Type 4: This terminal requires external voltage connection and supplies the terminal power bus to terminals located to its right. The terminals to its right must support the same power bus of 120/230 VAC or 24VDC. This terminal will not pass terminal power or PE from any preceding terminals.

Type 5: This terminal is used to separate the terminal power bus and PE from other terminals and can mounted next to any terminal.

Bus End/Expansion Terminals

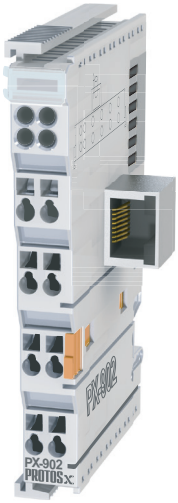
PX-901:
Bus End Terminal

The PX-901 (type 3) Bus End Terminal is installed at the end of a terminal assembly and is required for proper I/O Bus communication.

PX-901 Terminal Specifications	
Current Consumption (from I/O Bus)	None
Electrical Isolation	500V_{ms} (I/O bus/signal voltage)

PX-901 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	50g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.



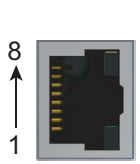
PX-902:
Bus Expansion End Terminal

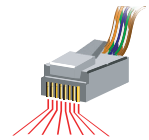
The PX-902 (type 3) Bus Expansion End Terminal enables expansion of terminal assemblies. The PX-902 is installed at the end of a PX-MOD, PX-TCP1, or PX-EIP1 assembly and connects the I/O Bus to a PX-903 Bus Expansion Coupler Terminal via the RJ45 port. No configuration is required.

PX-902 Terminal Specifications	
Power Source	I/O Bus power (approx. 6V)
Current Consumption (from I/O Bus)	70mA
Electrical Isolation	500V_{ms} (I/O bus/ field potential)
Heat Dissipation	1W max
Status Indicators	None
Number of Expansion Coupler Terminals Supported	31 max. (Using PX-903)
Configuration	Automatic
Maximum Distance Between Each Expansion Coupler	16.5 ft (5m)
Connection Type	Ethernet, RJ45
Recommended Cable	Shielded, Twisted Pair, Cat5e
Placement	Used only with Bus Coupler, replaces a PX-901 End Terminal

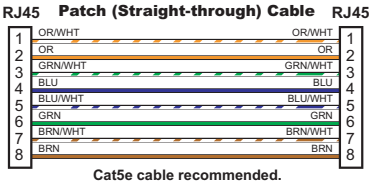
PX-902 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27
Noise Immunity	Conforms to EN 61000-6-2
Protection Class	IP20
Weight	146g
Dimensions (WxHxD)	27.5 x 100 x 68.8 mm (1.08 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.



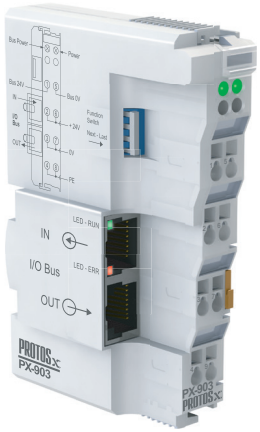


8-pin RJ45 Connector



Cat5e cable recommended.

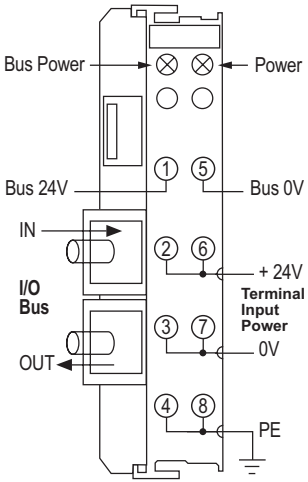
2



PX-903:
Bus Expansion Coupler Terminal

The PX-903 (type 4) Bus Expansion Coupler Terminal enables expansion of terminal assemblies. The PX-903 is installed at the beginning of an expansion terminal assembly and connects to a PX-902 Bus Expansion End Terminal or other PX-903 terminals.

Use of the PX-902 and PX-903 allows expansion of up to 31 PX-903 couplers in a group. Communication is through the RJ45 ports. No configuration is required.

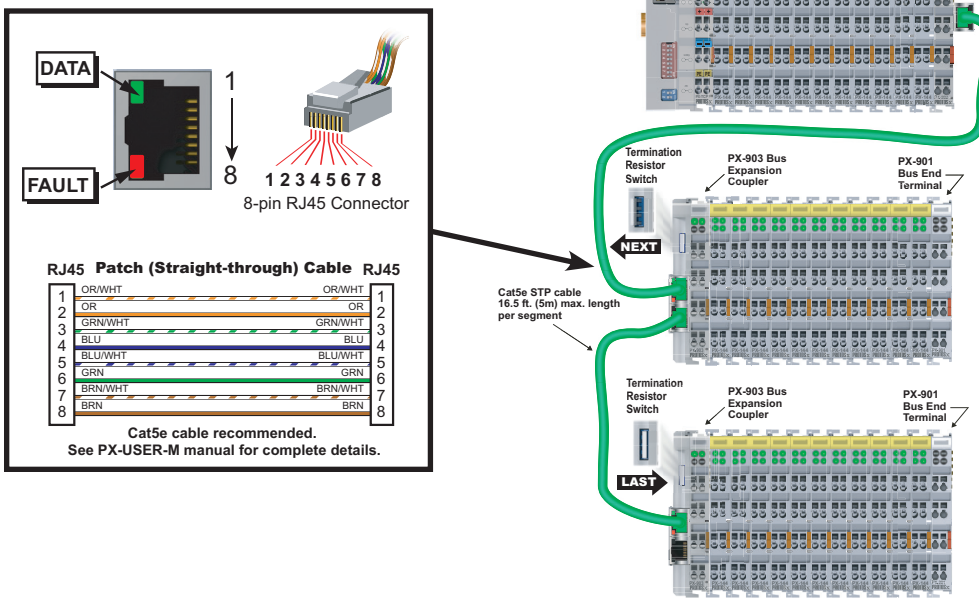


PX-903 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27
Noise Immunity	Conforms to EN 61000-6-2
Protection Class	IP20
Weight	146g
Dimensions (WxHxD)	24.5 x 100 x 68.8 mm (0.96 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes (Supply)
Adjacent Mounting on Bus Terminals without Power Contact	Yes (Supply)
Passes Terminal Bus Power	Yes (Supply)
Passes PE Bus	Yes (Supply)
Agency Approvals*	CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Bus Expansion Connection LED Status	
LED	***LED ON***
Green I/O Bus In	I/O Bus is transferring data
Red I/O Bus In	I/O Bus fault

PX-903 Terminal Specifications	
Supply Power for I/O Bus	24VDC (-15%/+20%)
Current Consumption (from I/O Bus)	200mA Max, 70mA + (total I/O bus current) / 4
Recommended Fuse	10A max
I/O Bus Current Supply	400mA max
Starting Current	2.5 x continuous current
Number of Bus Terminals Supported	64
Supply for Terminal Power Bus	24 VAC/VDC
Maximum Terminal Power Bus Current	10A
Number of Terminal Power Bus Contacts	3 (+24 VAC/VDC, 0V, PE)
Electrical Isolation	500V_{ms} (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	2 Power LEDs
Number of Expansion Couplers in a Terminal Group	31 max
Configuration	Automatic
Maximum Distance Between Each Expansion Coupler	16.5 ft (5m)
Connection Type	Ethernet, 2 x RJ45
Recommended Cable	Shielded, Twisted Pair, Cat5e
Termination Resistor Switch	Dip Switch, set to Last for last coupler in expansion group, otherwise set to Next

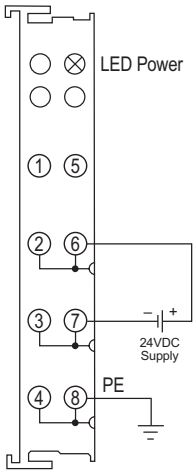


Power Terminals

PX-940:
Power Feed Terminal, 24VDC

The PX-940 (type 4) Power Feed Terminal allows adding or changing power voltage sources within a terminal assembly. Terminals mounted to the right of the PX-940 receive 24VDC through the terminal input connections.

PX-940 Terminal Specifications	
Supply Power to Terminal	24VDC
Maximum Current	10A
Number of Power Contacts	3 (+24VDC, 0V, PE)
Current Consumption (from I/O Bus)	None
Electrical Isolation	500V_{ms} (I/O bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	1 Power LED

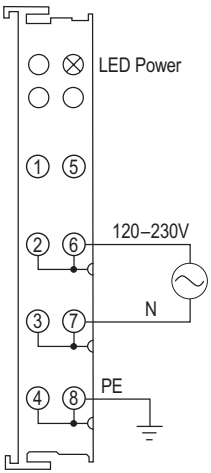


PX-940 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	50g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	Yes (Supply)
Passes PE Bus	Yes (Supply)
*Agency Approvals**	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-970: Power Feed Terminal, 120-230 VAC

The PX-970 (type 4) Power Feed Terminal allows adding or changing power voltage sources within a terminal assembly. Terminals mounted to the right of the PX-970 receive 120-230 VAC through the terminal input connections.



PX-970 Terminal Specifications	
Supply Power to Terminal	120-230 VAC
Maximum Current	10A
Number of Power Contacts	3 (120-230 VAC, 0V, PE)
Current Consumption (from I/O Bus)	None
Electrical Isolation	$500V_{ms}$ (I/O bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	1 Power LED

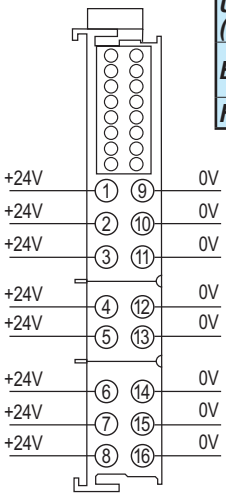
PX-970 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	50g
Dimensions (WxHxD)	12x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	Yes (Supply)
Passes PE Bus	Yes (Supply)
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-949: Power Distribution Terminal, 24VDC

The PX-949 (type 1) Power Distribution Terminal provides eight 24VDC and eight 0V connections powered by the terminal power bus.

PX-949 Terminal Specifications	
Nominal Voltage	≤ 60VDC
Maximum Current	10A
Number of Power Contacts	(8) 24V and (8) 0V
Connection Voltage	24VDC
Current Consumption (from I/O Bus)	None
Electrical Isolation	$500V_{ms}$ (I/O bus/signal voltage)
Heat Dissipation	1W max



PX-949 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-908:
Power Separation Terminal

The PX-908 (type 5) Power Separation Terminal provides interruption of power along the terminal power bus while passing I/O bus data. It is easily identified by the orange cover.

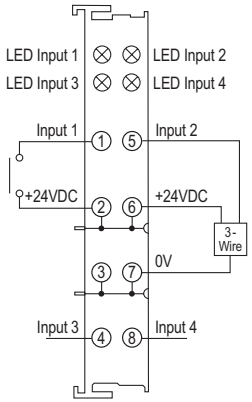
PX-908 General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	50g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Discrete Terminals

PX-144:
Four-point, 24VDC Discrete Input Terminal

The PX-144 (type 1) DC Input Terminal provides four electrically isolated 24VDC sinking inputs with LED status. Intended for use with 3-wire and 2-wire sensors.



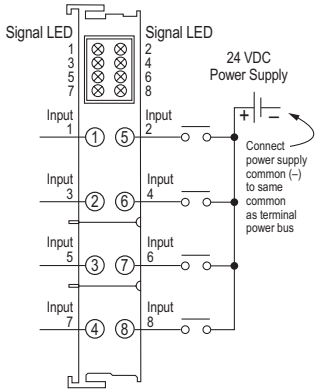
Terminal Specifications	
Inputs Per Terminal	4
Input Type	Sinking
Input Data Bytes Used	1/2 byte (4-bits)
Input Power Source	24VDC provided via terminal power bus
Current Consumption (from Terminal Pwr Bus)	5mA typical
Operating Voltage Rating	24VDC (-15%/+20%)
Peak Voltage Rating	30VDC
ON Voltage Level	15 to 30 VDC
OFF Voltage Level	-3 to +5 VDC
Minimum ON Current	50mA
Maximum OFF Current	100mA
Current Consumption (from I/O Bus)	5mA typical
Electrical Isolation	500Vms (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	3ms
ON to OFF Response	3ms
Status Indicators	4, indicates input is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	55g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
*Agency Approvals**	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-148:
Eight-point, 24VDC Discrete Input Terminal

The PX-148 (type 1) DC Input Terminal provides eight electrically isolated 24VDC sinking inputs with LED status.



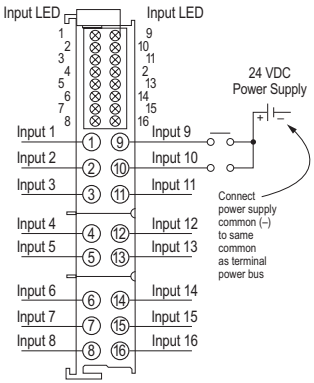
Terminal Specifications	
Inputs Per Terminal	8
Input Type	Sinking
Input Data Bytes Used	1-byte
Input Power Source	Requires external 24VDC power source
Current Consumption (from Terminal Power Bus)	2mA + load, typical
Operating Voltage Rating	24VDC (-15%/+20%)
Peak Voltage Rating	30VDC
ON Voltage Level	15 to 30 VDC
OFF Voltage Level	-3 to +5 VDC
Minimum ON Current	2.0 mA
Maximum OFF Current	1.5 mA
Current Consumption (from I/O Bus)	5mA typical
Electrical Isolation	500V_{ms} (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	3ms
ON to OFF Response	3ms
Status Indicators	8, indicates input is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	55g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-149:
Sixteen-point, 24VDC Discrete Input Terminal

The PX-149 (type 1) DC Input Terminal provides sixteen electrically isolated 24VDC sinking inputs with LED status.



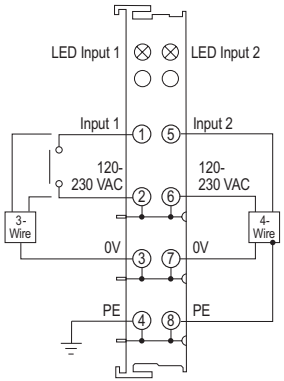
Terminal Specifications	
Inputs Per Terminal	16
Input Type	Sinking
Input Data Bytes Used	2-bytes
Input Power Source	Requires external 24VDC power source
Current Consumption (from Terminal Power Bus)	NA
Operating Voltage Rating	24VDC (-15%/+20%)
Peak Voltage Rating	30VDC
ON Voltage Level	11 to 30 VDC
OFF Voltage Level	-3 to +5 VDC
Minimum ON Current	2mA
Maximum OFF Current	40mA
Current Consumption (from I/O Bus)	20mA typical
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	3ms
ON to OFF Response	3ms
Status Indicators	16, indicates input is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-172-1:
Two-point, 120-230 VAC Discrete Input Terminal

The PX-172-1 (type 2) DC Input Terminal provides two electrically isolated 120-230 VAC inputs with LED status. Intended for use with 4-wire, 3-wire and 2-wire devices.



Note: Terminal PX-908 is recommended to isolate terminal power or use PX-970 to supply and isolate power.

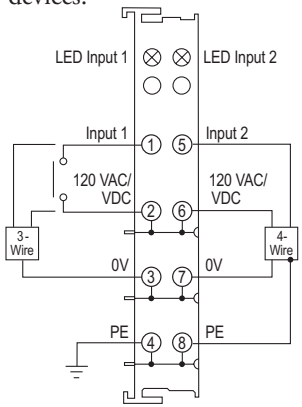
Terminal Specifications	
Inputs Per Terminal	2
Input Type	NA
Input Data Bytes Used	1/4 byte (2-bits)
Input Power Source	Requires external 120-230 VAC power source. PX-908 terminal recommended to provide power to the terminal power bus.
Current Consumption (from Terminal Power Bus)	6mA typical
Operating Voltage Rating	120 to 230 VAC
Peak Voltage Rating	260VAC
ON Voltage Level	79 to 260 VAC
OFF Voltage Level	0 to 40 VAC
Minimum ON Current	250mA
Maximum OFF Current	500mA
Current Consumption (from I/O Bus)	3mA typical
Electrical Isolation	500V_{ms} (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	10ms
ON to OFF Response	10ms
Status Indicators	2, indicates input is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, AC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	Yes
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-172-2:
Two-point, 120 VAC/VDC Discrete Input Terminal

The PX-172-2 (type 2) DC Input Terminal provides two electrically isolated 120 VAC/ VDC inputs with LED status. Intended for use with 4-wire, 3-wire and 2-wire devices.



Note: Terminal PX-908 is recommended to isolate terminal power or use PX-970 to supply and isolate power.

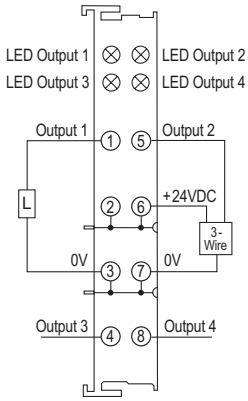
Terminal Specifications	
Inputs Per Terminal	2
Input Type	NA
Input Data Bytes Used	1/4 byte (2-bits)
Input Power Source	Requires external 120 VAC/VDC power source. PX-908 terminal recommended to provide power to the terminal power bus.
Current Consumption (from Terminal Power Bus)	6mA typical
Operating Voltage Rating	120 VAC/VDC
Peak Voltage Rating	140 VAC/VDC
ON Voltage Level	80 to 140 VAC/VDC
OFF Voltage Level	0 to 40 VAC/VDC
Minimum ON Current	250mA
Maximum OFF Current	500mA
Current Consumption (from I/O Bus)	3mA typical
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	10ms
ON to OFF Response	10ms
Status Indicators	2, indicates input is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, 120 VAC/VDC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	Yes
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-244-1:
Four-point, 0.5 A, 24VDC Discrete Output Terminal

The PX-244-1 (type 1) DC Output Terminal provides four 24VDC 0.5 A short-circuit protected sourcing outputs with LED status. Intended for use with 3-wire and 2-wire devices.



Terminal Specifications	
Outputs Per Terminal	4
Commons Per Terminal	2
Output Type	Sourcing
Output Data Bytes Used	1/2 byte (4-bits)
Output Power Source	24VDC provided via terminal power bus
Current Consumption (from Load Voltage)	30mA typical
Operating Voltage	24VDC (-15%/+20%)
Maximum Load Current	0.5 A per channel (Short-Circuit Protected)
On Voltage Drop	0.4 VDC @ 0.5 A
Maximum Leakage Current	300mA
Maximum Inrush Current	1.5 A
Maximum Short-Circuit Voltage	35V
Load Type	Resistive, inductive, lamp
Current Consumption (from I/O Bus)	9mA typical
Reverse Voltage Protection	No
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	100ms max
ON to OFF Response	20ms max
Status Indicators	4, indicates output is ON

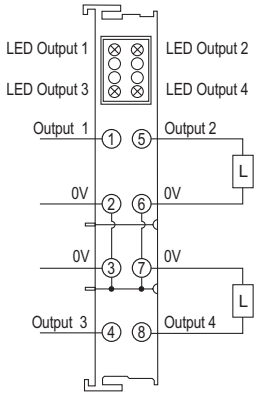
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

2

PX-244-2:
Four-point, 2A, 24VDC Discrete Output Terminal

The PX-244-2 (type 1) DC Output Terminal provides four 24VDC 2A short-circuit protected sourcing outputs with LED status.



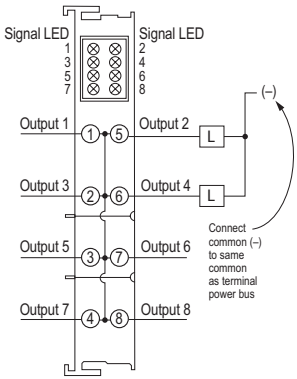
Terminal Specifications	
Outputs Per Terminal	4
Commons Per Terminal	4
Output Type	Sourcing
Output Data Bytes Used	1/2 byte (4-bits)
Output Power Source	24VDC provided via terminal power bus
Current Consumption (from Load Voltage)	30mA typical
Operating Voltage	24VDC (-15%/+20%)
Maximum Load Current	2A per channel (Short-Circuit Protected)
On Voltage Drop	0.14 VDC @ 2A
Maximum Leakage Current	60mA
Maximum Inrush Current	35A
Maximum Short-Circuit Voltage	52V
Load Type	Resistive, inductive, lamp
Current Consumption (from I/O Bus)	9mA typical
Reverse Voltage Protection	Yes
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	160ms typ, 300ms max
ON to OFF Response	10ms min, 80ms max
Status Indicators	4, indicates output is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-248:
Eight-point, 0.5 A, 24VDC Discrete Output Terminal

The PX-248 (type 1) DC Output Terminal provides eight 24VDC 0.5 A short-circuit protected sourcing outputs with LED status.



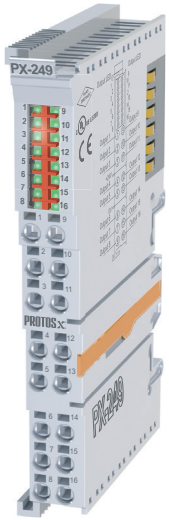
Terminal Specifications	
Outputs Per Terminal	8
Commons Per Terminal	Field wired
Output Type	Sourcing
Output Data Bytes Used	1-byte
Output Power Source	24VDC provided via terminal power bus
Current Consumption (from Load Voltage)	60mA + load typical
Operating Voltage	24VDC (-15%/+20%)
Maximum Load Current	0.5 A per channel (Short-Circuit Protected)
On Voltage Drop	0.4 VDC @ 0.5 A
Maximum Leakage Current	300mA
Maximum Inrush Current	1.5 A
Max. Short-Circuit Voltage	35V
Load Type	Resistive, inductive, lamp
Current Consumption (from I/O Bus)	18mA typical
Reverse Voltage Protection	Yes
Electrical Isolation	500V_{ms} (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	100ms max
ON to OFF Response	20ms max
Status Indicators	8, indicates output is ON

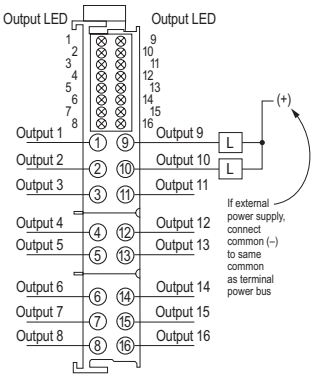
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-249:
Sixteen-point, 0.5 A, 24VDC Discrete Output Terminal

The PX-249 (type 1) DC Output Terminal provides sixteen 24VDC 0.5 A short-circuit protected sinking outputs with LED status.



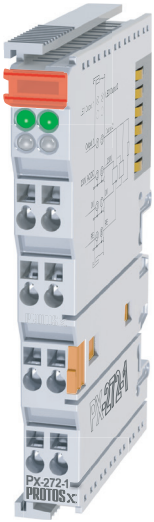


Terminal Specifications	
Outputs Per Terminal	16
Commons Per Terminal	Field wired
Output Type	Sinking
Output Data Bytes Used	2-bytes
Output Power Source	Requires external 24VDC power source
Current Consumption (from Load Voltage)	35mA + load typical
Operating Voltage	24VDC (-15%/+20%)
Maximum Load Current	0.5 A per channel (Short-Circuit Protected)
On Voltage Drop	0.12 VDC @ 0.5 A
Maximum Leakage Current	75mA
Maximum Inrush Current	3.5 A
Max. Short-Circuit Voltage	36V
Load Type	Resistive, inductive, lamp
Current Consumption (from I/O Bus)	45mA typical
Reverse Voltage Protection	Yes
Electrical Isolation	500V_{ms} (I/O bus/field potential)
Heat Dissipation	1W max
OFF to ON Response	0.45 ms
ON to OFF Response	3.3 ms
Status Indicators	16, indicates output is ON

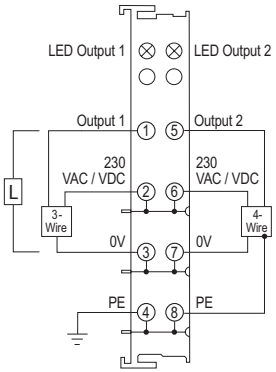
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-272-1:
Two-point, 0-230 VAC/VDC Discrete Solid State Relay Output Terminal



The PX-272-1 (type 2) Relay Output Terminal provides two 230 VAC/ VDC 0.3 A outputs with LED status. Intended for use with 4-wire, 3-wire and 2-wire devices.



Note: Terminal PX-908 is recommended to isolate terminal power or use PX-970 to supply and isolate power.

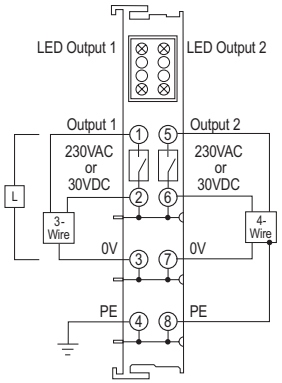
Terminal Specifications	
Outputs Per Terminal	2
Commons Per Terminal	2
Output Type	Solid State Relay (DC sourcing only)
Output Data Bytes Used	1/4 byte (2-bits)
Output Power Source	230 VAC/VDC provided via terminal power bus
Current Consumption (from Terminal Power Bus)	(ON resistance max 100mV) + load
Operating Voltage	0 to 230 VAC/VDC (DC 100Hz)
Maximum Load Current	0.3 A per point
Maximum Leakage Current	< 1mA (off state)
Maximum Inrush Current	0.5 A for 20s, 1.5 A for 100ms
Contact Resistance	2.1 V, typical 3.2 V, max.
Surge Voltage Protection	From 400VAC
Load Type	Resistive, inductive
Current Consumption (from I/O Bus)	10mA
Electrical Isolation	500Vms (I/O bus/field potential) 2500VDC (1 min.)
Heat Dissipation	1W max
Switch-ON Time	4 to 6 ms
Switch-OFF Time	0.05 to 0.1 ms
Switch-ON Delay	320ms
Switch-OFF Delay	6.2 ms
Status Indicators	2, indicates output is ON

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	55g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, 230 VAC/VDC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	Yes
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-272-2:
Two-point, 230VAC / 30VDC Discrete Relay Output Terminal

The PX-272-2 (type 2) Relay Output Terminal provides two 230VAC / 30VDC 5A outputs with LED status. Intended for use with 4-wire, 3-wire and 2-wire devices.



Note: Terminal PX-908 is recommended to isolate terminal power or use PX-970 to supply and isolate power.

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	85g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, 230VAC or 30VDC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	Yes
Agency Approvals*	UL/cUL File No. E157382, CE

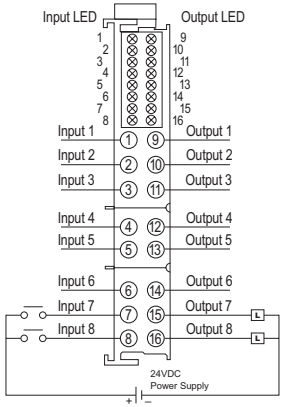
Terminal Specifications	
Outputs Per Terminal	2
Commons Per Terminal	2
Output Type	SPST Relay, normally open contact (DC sourcing only)
Output Data Bytes Used	1/4 byte (2-bits)
Output Power Source	230VAC/30VDC provided via terminal power bus
Current Consumption (from Terminal Power Bus)	(ON resistance typ 2.4 V, max 3.2 V) + load
Operating Voltage	230VAC/30VDC
Maximum Load Current	5A per point
Maximum Load Current with Resistive Load	AC: 5A @230VAC, 1250VA DC: 5A @ 30VDC, 150W
Maximum Load Current with Inductive Load, cosine = 0.4, L/R=7ms	AC: 2A @230VAC DC: 2A @ 30VDC
Minimum Load (approximate)	10mA @ 5VDC (as supplied) 100mA @ 20VDC (after approx. ≥ 100mA has been switched at least once)
Load Type	Resistive, inductive, lamp
Switching Times	Reaction Time: 10ms max. Release Time; 4ms max. Bounce Time: 5ms max.
Contact Material	Silver Cadmium Oxide
Current Consumption (from I/O Bus)	80mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential) 2500VDC (1 min.)
Heat Dissipation	1W max
Switching Frequency at Maximum Contact Load	10/minute
Maximum Contact Resistance	< 30mV
Minimum Insulation Resistance	100MV @ 500VDC
Mechanical Operating Life	20,000,000 switching operations
Electrical Operating Life	Minimum 100,000 switching operations with resistive loads
Test Voltage Between Open Contacts	750V for 1 minute
Status Indicators	2, indicates output is ON

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-549:

Eight inputs/Eight outputs, 24VDC Discrete Input/Output Terminal

The PX-549 (type 1) DC Input/Output Terminal provides eight 24VDC inputs and eight 24VDC 0.5 A outputs with reverse polarity protection and LED status.



Connect power supply common (–) to same common as terminal power bus

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	60g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

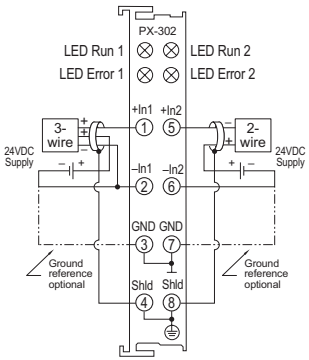
Terminal Specifications	
Inputs/Outputs Per Terminal	8 sinking inputs / 8 sourcing outputs
Data Bytes Used	1-byte (inputs) / 1-byte (outputs)
Input/Output Power Source	Requires external 24VDC power source
Operating Voltage Rating	24VDC (-15%/+20%)
Current Consumption (from I/O Bus)	25mA typical
Current Consumption (from Terminal Power Bus)	15mA + load typical
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	8 input and 8 output, indicates ON
Input Specifications	
Peak Voltage Rating	30VDC
ON Voltage Level	15 to 30 VDC
OFF Voltage Level	-3 to +5 VDC
Minimum ON Current	2mA
Minimum OFF Current	40mA
Current Consumption (from I/O Bus)	3mA typical
OFF to ON Response	3ms
ON to OFF Response	3ms
Output Specifications	
Max. Load Current per Output	0.5 A (Short-Circuit Protected)
On Voltage Drop	0.14 VDC @ 2A
Maximum Leakage Current	5mA
Maximum Inrush Current	2A
Maximum Short-Circuit Voltage	45V
Load Type	Resistive, inductive, lamp
Reverse Voltage Protection	Yes
OFF to ON Response	50ms
ON to OFF Response	75ms

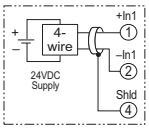
* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Analog Terminals

PX-302:
Two-channel, 4-20 mA Analog Input Terminal

The PX-302 (type 3) Analog Input Terminal provides two electrically isolated 4-20 mA inputs with 12-bit resolution and Run and Error LED status.





Terminal Specifications	
Number of Channels	2
Input Ranges	4 to 20 mA
Resolution	12 bits
Input Type	External ground reference
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 4-bytes input PX-TCP1/TCP2: 8-bytes in/ 8-bytes out (not used)
Input Power Source	Loop power external
Current Consumption (from Terminal Power Bus)	NA
Input Impedance	50V internal resistor
Absolute Max Ratings	35VDC surge
Conversion Time	Approx. 2ms
Full Scale Calibration Error	± 0.3% of full scale
Current Consumption (from I/O Bus)	60mA
Electrical Isolation	500V_{ms} (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, see LED Status chart

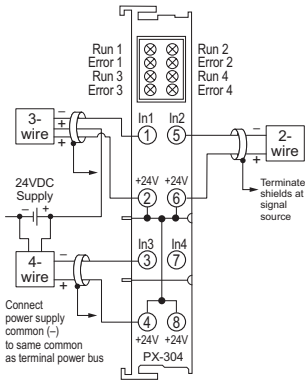
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.
Red LED: ERROR	Broken wire or current is > 21.5 mA	Normal Operation

PX-304:
Four-channel, 4-20 mA Analog Input Terminal

The PX-304 (type 1) Analog Input Terminal provides four electrically isolated 4–20 mA inputs with 12-bit resolution and Run and Error LED status.



Terminal Specifications	
Number of Channels	4
Input Ranges	4 to 20 mA
Resolution	12 bits
Input Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 8-bytes input PX-TCP1/TCP2: 16-bytes in/16-bytes out (not used)
Input Power Source	24VDC provided via terminal power bus
Current Consumption (from Terminal Power Bus)	Load
Input Impedance	< 85V
Absolute Max Ratings	30VDC surge
Conversion Time	Approx. 2ms
Full Scale Calibration Error	± 0.3% of full scale
Current Consumption (from I/O Bus)	85mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	8, see LED Status chart

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	75g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

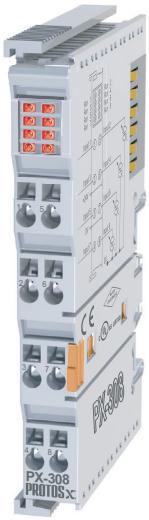
* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

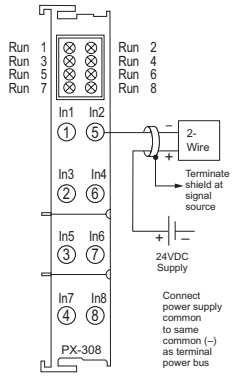
LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.
Red LED: ERROR	Broken wire or current is > 20.8 mA	Normal Operation

2

PX-308:
Eight-channel, 4-20 mA Analog Input Terminal

The PX-308 (type 1) Analog Input Terminal provides eight electrically isolated 4-20 mA inputs with 12-bit resolution and Error LED status.





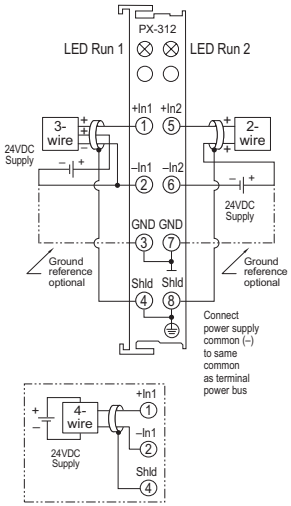
Terminal Specifications	
Number of Channels	8
Input Ranges	4 to 20 mA
Resolution	12 bits
Input Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 16-bytes input PX-TCP1/TCP2: 32-bytes in/32-bytes out (not used)
Input Power Source	Requires external 24VDC power source
Current Consumption (from Terminal Power Bus)	Load
Input Impedance	< 85V
Absolute Max Ratings	30VDC surge
Conversion Time	Approx. 4ms
Full Scale Calibration Error	± 0.3% of full scale
Current Consumption (from I/O Bus)	105mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	8, Red: Error, broken wire or current is > 20.8 mA

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	75g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

PX-312:
Two-channel, -10 to +10 VDC Analog Input Terminal

The PX-312 (type 3) Analog Input Terminal provides two electrically isolated -10 to +10 VDC inputs with 12-bit resolution and LED status.



Terminal Specifications	
Number of Channels	2
Input Ranges	-10 to +10 VDC
Resolution	12 bits (11 bits between 0–10 VDC)
Input Type	External ground reference
Data Format	Decimal: -32767 to +32767
Data Bytes Consumed	PX-MOD: 4-bytes input PX-TCP1/TCP2: 8-bytes in/ 8-bytes out (not used)
Input Power Source	Voltage source external
Current Consumption (from Terminal Power Bus)	NA
Input Impedance	> 200kV
Absolute Max Ratings	35VDC surge
Conversion Time	Approx. 2ms
Full Scale Calibration Error	± 0.3% of full scale
Current Consumption (from I/O Bus)	65mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	2, indicates I/O Bus activity

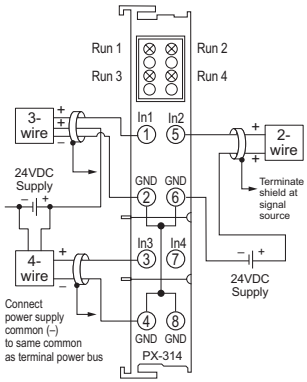
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

2

PX-314:
Four-channel, -10 to +10 VDC Analog Input Terminal

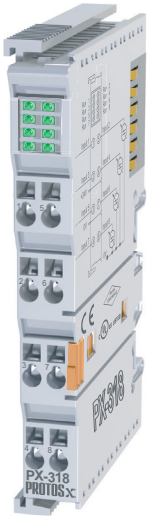
The PX-314 (type 1) Analog Input Terminal provides four electrically isolated -10 to +10 VDC inputs with 12-bit resolution and LED status.



Terminal Specifications	
Number of Channels	4
Input Ranges	-10 to +10 VDC
Resolution	12 bits (11 bits between 0–10 VDC)
Input Type	Single-ended
Data Format	Decimal: -32767 to +32767
Data Bytes Consumed	PX-MOD: 8-bytes input
	PX-TCP1/TCP2: 16-bytes in/16-bytes out (not used)
Input Power Source	Voltage source external
Current Consumption (from Terminal Power Bus)	NA
Input Impedance	> 130kV
Absolute Max Ratings	30VDC surge
Conversion Time	Approx. 2ms
Full Scale Calibration Error	± 0.3% of full scale
Current Consumption (from I/O Bus)	100mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, indicates I/O Bus activity

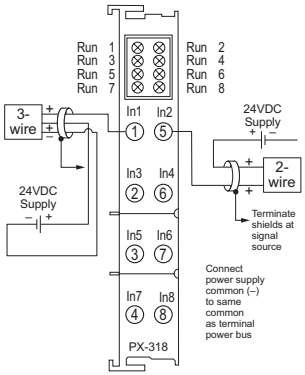
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	75g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.



PX-318:
Eight-channel, -10 to +10 VDC Analog Input Terminal

The PX-318 (type 1) Analog Input Terminal provides eight electrically isolated -10 to +10 VDC inputs with 12-bit resolution and LED status.



Terminal Specifications	
Number of Channels	8
Input Ranges	-10 to +10 VDC
Resolution	12 bits (11 bits between 0 to 10 VDC)
Input Type	Single-ended
Data Format	Decimal: -32767 to +32767
Data Bytes Consumed	PX-MOD: 16-bytes input
	PX-TCP1/TCP2: 32-bytes in/32-bytes out (not used)
Input Power Source	Voltage source external
Current Consumption (from Terminal Pwr Bus)	NA
Input Impedance	> 130kV
Absolute Max Ratings	30VDC surge
Conversion Time	Approx. 4ms
Full Scale Calibration Error	± 0.3% of full scale
Current Consumption (from I/O Bus)	140mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	8, indicates I/O Bus activity

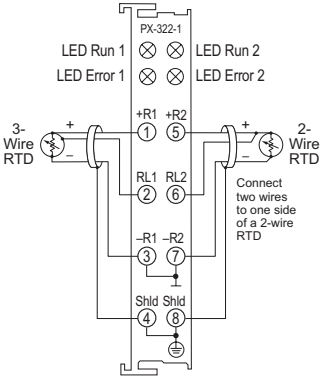
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	75g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

2

PX-322-1:
Two-channel RTD Input Terminal

The PX-322-1 (type 3) RTD Input Terminal provides two PT100 RTD inputs with full linearization and LED status.



Terminal Specifications	
Number of Channels	2
Range	-200 to 850 °C
Resolution	0.1 °C per digit
Input Type	PT100
Data Bytes Consumed	PX-MOD: 4-bytes input
	PX-TCP1/TCP2: 8-bytes in/8-bytes out (not used)
Connection Method	2-wire or 3-wire (3-wire default)
Power Supply	Via I/O Bus
Conversion Time	Approx. 250ms
Measuring Current	5mA typical
Linearity Error	< ± 1°C
Current Consumption (from I/O Bus)	60mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, see LED Status chart

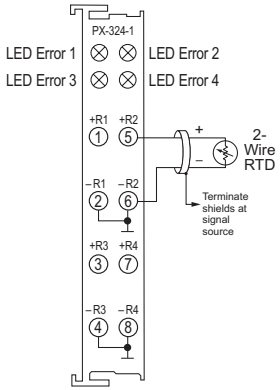
General Specifications	
Operating Temp	0 to 55 °C
Storage Temp	-25 to 85 °C
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.
Red LED: ERROR	Sensor fault, e.g. broken wire	No Error

PX-324-1:
Four-channel RTD Input Terminal

The PX-324-1 (type 3) RTD Input Terminal provides four PT100 RTD inputs with full linearization and LED status.



Terminal Specifications	
Number of Channels	4
Range	-200 to 850 °C
Resolution	0.1 °C per digit
Input Type	PT100
Data Bytes Consumed	PX-MOD: 8-bytes input
	PX-TCP1/TCP2: 16-bytes in/16-bytes out (not used)
Connection Method	2-wire
Power Supply	Via I/O Bus
Conversion Time	Approx. 250ms
Measuring Current	5mA typical
Linearity Error	< ± 1°C
Current Consumption (from I/O Bus)	60mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, red, sensor fault

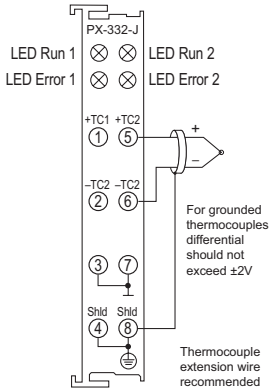
General Specifications	
Operating Temp	0 to 55 °C
Storage Temp	-25 to 85 °C
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

2

PX-332-J:
Two-channel Type J Thermocouple Input Terminal

The PX-332-J (type 3) Thermocouple Input Terminal provides two Type J thermocouple inputs with full linearization, cold-junction compensation, and LED status.



Terminal Specifications	
Number of Channels	2
Range	-100 to 1200 °C
Resolution	0.1 °C per digit
Input Type	Type J thermocouple
Data Bytes Consumed	PX-MOD: 4-bytes input PX-TCP1/TCP2: 8-bytes in/8-bytes out (not used)
Connection Method	2-wire (Thermocouple extension wire recommended)
Power Supply	Via I/O Bus
Conversion Time	Approx. 250ms
Measuring Current	5mA typical
Linearity Error	± 0.5% (relative to full scale value)
Current Consumption (from I/O Bus)	65mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, see LED Status chart

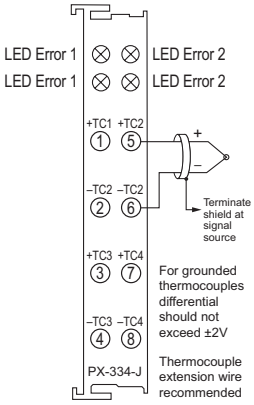
General Specifications	
Operating Temp	0 to 55 °C
Storage Temp	-25 to 85 °C
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.
Red LED: ERROR	Sensor fault, e.g. broken wire	No Error

PX-334-J:
Four-channel Type J Thermocouple Input Terminal

The PX-334-J (type 3) Thermocouple Input Terminal provides four Type J thermocouple inputs with full linearization, cold-junction compensation, and LED status.



Terminal Specifications	
Number of Channels	4
Range	-100 to 1200 °C
Resolution	0.1 °C per digit
Input Type	Type J thermocouple
Data Bytes Consumed	PX-MOD: 8-bytes input PX-TCP1/TCP2: 16-bytes in/16-bytes out (not used)
Connection Method	2-wire (Thermocouple extension wire recommended)
Power Supply	Via I/O Bus
Conversion Time	Approx. 250ms
Measuring Current	5mA typical
Linearity Error	± 0.5% (relative to full scale value)
Current Consumption (from I/O Bus)	75mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, red, sensor fault/broken wire

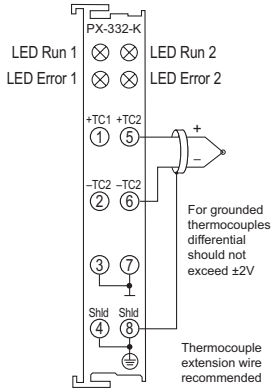
General Specifications	
Operating Temp	0 to 55 °C
Storage Temp	-25 to 85 °C
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

2

PX-332-K:
Two-channel Type K Thermocouple Input Terminal

The PX-332-K (type 3) Thermocouple Input Terminal provides two Type K thermocouple inputs with full linearization, cold-junction compensation, and LED status.



General Specifications	
Operating Temp	0 to 55 °C
Storage Temp	-25 to 85 °C
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

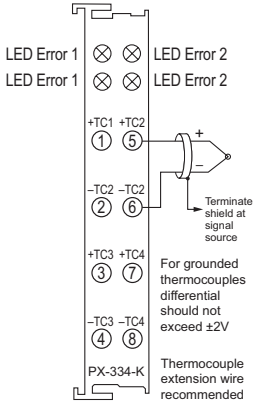
* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Terminal Specifications	
Number of Channels	2
Range	-100 to 1370 °C
Resolution	0.1 °C per digit
Input Type	Type K thermocouple
Data Bytes Consumed	PX-MOD: 4-bytes input
	PX-TCP1/TCP2: 8-bytes in/8-bytes out (not used)
Connection Method	2-wire (Thermocouple extension wire recommended)
Power Supply	Via I/O Bus
Conversion Time	Approx. 250ms
Measuring Current	5mA typical
Linearity Error	± 0.5% (relative to full scale value)
Current Consumption (from I/O Bus)	65mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, see LED Status chart

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.
Red LED: ERROR	Sensor fault, e.g. broken wire	No Error

PX-334-K:
Four-channel Type K Thermocouple Input Terminal

The PX-334-K (type 3) Thermocouple Input Terminal provides four Type K thermocouple inputs with full linearization, cold-junction compensation, and LED status.



Terminal Specifications	
Number of Channels	4
Range	-100 to 1370 °C
Resolution	0.1 °C per digit
Input Type	Type K thermocouple
Data Bytes Consumed	PX-MOD: 8-bytes input
	PX-TCP1/TCP2: 16-bytes in/16-bytes out (not used)
Connection Method	2-wire (Thermocouple extension wire recommended)
Power Supply	Via I/O Bus
Conversion Time	Approx. 250ms
Measuring Current	5mA typical
Linearity Error	± 0.5% (relative to full scale value)
Current Consumption (from I/O Bus)	75mA
Electrical Isolation	$500V_{ms}$ (I/O bus/field potential)
Heat Dissipation	1W max
Status Indicators	4, red, sensor fault/broken wire

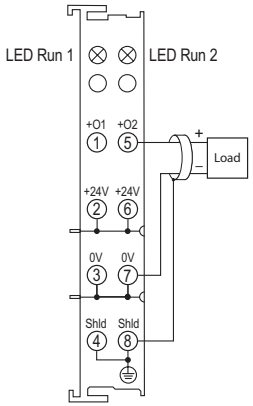
General Specifications	
Operating Temp	0 to 55 °C
Storage Temp	-25 to 85 °C
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	70g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

2

PX-402:
Two-channel, 4-20 mA Analog Output Terminal

The PX-402 (type 1) Analog Output Terminal provides two electrically isolated, 4-20 mA outputs with 12-bit resolution and Run LED status.



Terminal Specifications	
Number of Channels	2
Output Ranges	4 to 20 mA
Resolution	12 bit
Output Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 4-bytes output
	PX-TCP1/TCP2: 8-bytes out/8-bytes in (not used)
Output Power Source	24VDC via terminal power bus
Current Consumption (from Load Voltage)	50mA + load
Source Load	< 500V (short-circuit protected)
Conversion Time	Approx. 1.5 ms
Accuracy	± 0.5 LSB linearity error, ± 0.5 LSB offset error ± 0.1% of the full scale value
I/O Bus current Consumption (5V)	60mA
Electrical Isolation	$500V_{ms}$ (I/O Bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	2, see LED Status chart

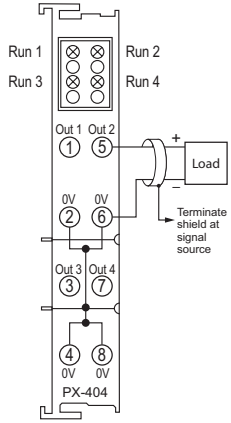
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	80g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.

PX-404:
Four-channel, 4-20 mA Analog Output Terminal

The PX-404 (type 1) Analog Output Terminal provides four electrically isolated, 4-20 mA outputs with 12-bit resolution and Run LED status.



Terminal Specifications	
Number of Channels	4
Output Ranges	4 to 20 mA
Resolution	12 bit
Output Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 8-bytes output
	PX-TCP1/TCP2: 16-bytes out/16-bytes in (not used)
Output Power Source	24VDC via terminal power bus
Current Consumption (from Load Voltage)	60mA + load
Source Load	< 350V (short-circuit protected)
Conversion Time	Approx. 4ms
Accuracy	± 0.5 LSB linearity error, ± 0.5 LSB offset error ± 0.1% of the full scale value
I/O Bus current Consumption (5V)	20mA
Electrical Isolation	$500V_{ms}$ (I/O Bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	4, see LED Status chart

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	80g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

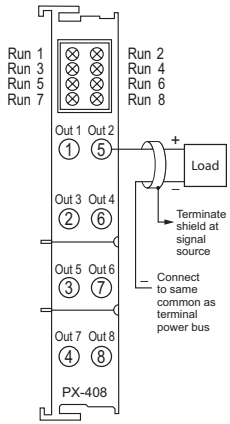
* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog-timer overflow if no data transmitted within WD set time.

2

PX-408:
Eight-channel, 4-20 mA Analog Output Terminal

The PX-408 (type 1) Analog Output Terminal provides eight electrically isolated, 4-20 mA outputs with 12-bit resolution and Run LED status.



Terminal Specifications	
Number of Channels	8
Output Ranges	4 to 20 mA
Resolution	12 bit
Output Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 16-bytes output PX-TCP1/TCP2: 32-bytes out/32-bytes in (not used)
Output Power Source	24VDC via terminal power bus
Current Consumption (from Load Voltage)	50mA + load
Source Load	< 150V (short-circuit protected)
Conversion Time	Approx. 8ms
Accuracy	± 0.5 LSB linearity error, ± 0.5 LSB offset error ± 0.1% of the full scale value
I/O Bus current Consumption (5V)	25mA
Electrical Isolation	$500V_{ms}$ (I/O Bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	8, see LED Status chart

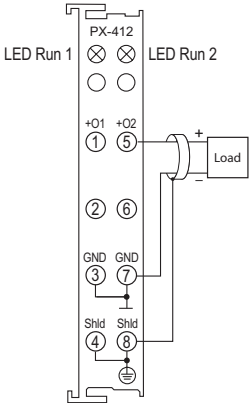
General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	80g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog error if no data transmitted within WD set time.

PX-412:
Two-channel, 0 to 10 VDC Analog Output Terminal

The PX-412 (type 3) Analog Output Terminal provides two electrically isolated, 0 to 10 VDC outputs with 12-bit resolution, common ground potential, and Run LED status.



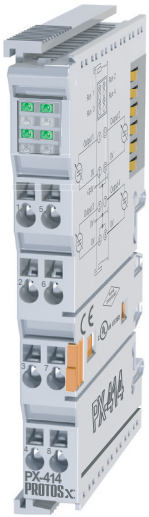
Terminal Specifications	
Number of Channels	2
Output Ranges	0 to 10 VDC
Resolution	12 bit
Output Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 4-bytes output
	PX-TCP1/TCP2: 8-bytes out/8-bytes in (not used)
Output Power Source	24VDC via terminal power bus
Current Consumption (from Load Voltage)	50mA + load
Source Load	> 5kV (short-circuit protected)
Conversion Time	Approx. 1.5 ms
Accuracy	± 0.5 LSB linearity error, ± 0.5 LSB offset error ± 0.1% of the full scale value
I/O Bus current Consumption (5V)	75mA
Electrical Isolation	$500V_{ms}$ (I/O Bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	2, see LED Status chart

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	85g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

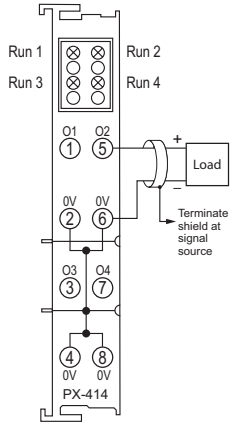
LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog error if no data transmitted within WD set time.

2



PX-414:
Four-channel, 0 to 10 VDC Analog Output Terminal

The PX-414 (type 1) Analog Output Terminal provides four electrically isolated, 0 to 10 VDC outputs with 12-bit resolution, common ground potential, and Run LED status.



General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	85g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	Yes
Passes Terminal Bus Power	No
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

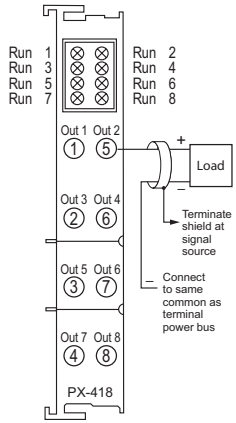
* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Terminal Specifications	
Number of Channels	4
Output Ranges	0 to 10 VDC
Resolution	12 bit
Output Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 8-bytes output
	PX-TCP1/TCP2: 16-bytes out/16-bytes in (not used)
Output Power Source	24VDC via terminal power bus
Current Consumption (from Load Voltage)	50mA + load
Source Load	> 5kV (short-circuit protected)
Conversion Time	Approx. 1.5 ms
Accuracy	± 0.5 LSB linearity error, ± 0.5 LSB offset error ± 0.1% of the full scale value
I/O Bus current Consumption (5V)	75mA
Electrical Isolation	$500V_{ms}$ (I/O Bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	2, see LED Status chart

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog error if no data transmitted within WD set time.

PX-418:
Eight-channel, -10 to +10 VDC Analog Output Terminal

The PX-418 (type 1) Analog Output Terminal provides eight electrically isolated, -10 to +10 VDC outputs with 12-bit resolution, common ground potential, and Run LED status.



Terminal Specifications	
Number of Channels	8
Output Ranges	-10 to +10 VDC
Resolution	12 bit
Output Type	Single-ended
Data Format	Decimal: 0-32767
Data Bytes Consumed	PX-MOD: 16-bytes output
	PX-TCP1/TCP2: 32-bytes out/32-bytes in (not used)
Output Power Source	24VDC via terminal power bus
Current Consumption (from Load Voltage)	20mA
Source Load	> 5kV (short-circuit protected)
Conversion Time	Approx. 8ms
Accuracy	± 0.5 LSB linearity error, ± 0.5 LSB offset error ± 0.1% of the full scale value
I/O Bus current Consumption (5V)	20mA
Electrical Isolation	$500V_{ms}$ (I/O Bus/signal voltage)
Heat Dissipation	1W max
Status Indicators	8, see LED Status chart

General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	-13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	85g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
Adjacent Mounting on Bus Terminals with Power Contact	Yes, DC only
Adjacent Mounting on Bus Terminals without Power Contact	No
Passes Terminal Bus Power	Yes
Passes PE Bus	No
Agency Approvals*	UL/cUL File No. E157382, CE

* To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

LED Status		
LED	***LED ON***	***LED OFF***
Green LED: RUN	Normal Operation	Watchdog error if no data transmitted within WD set time.

Protos X Modbus Communication

The Protos X system is designed as a Modbus Server/Client configuration, with Bus Coupler Terminals serving as Servers, and a PLC or PC controller as the Client. Control is through the Client using standard Modbus RTU or TCP protocol via serial or Ethernet communications.

Configuration is done through the Protos X Configuration Software. Modbus addresses are automatically assigned based on I/O Terminal type and placement within an assembly.

The following Modbus functions are supported with the Protos X Bus Couplers.

Supported Modbus Function Codes		
Function Code	***Function***	***Description***
1	Read Coil Status	Read input and output bits as an octet string.
2	Read Input Status	Read input bit as an octet string.
3	Read Holding Registers	Read number of input words.
4	Read Input Registers	Read number of input words.
5	Force Single Coil	Write output bit.
6	Preset Single Register	Writes a value in an output word.
15	Force Multiple Coils	Writes a number of output bits.
16	Preset Multiple Registers	Writes a number of output words.

Protos X EtherNet/IP Communication

The Protos X EtherNet/IP module uses IO Messaging to communicate as an adapter device. The data that is transported is defined as Input data and Output data. Don't confuse this type of data with what most PLCs define as Inputs and Outputs. In most PLCs, Inputs are typically associated with an Input module that reads values from real word devices. Outputs are typically associated with an Output module that turns real word devices off and on.

In IO Messaging, Input data is data that is sent from the target device back to the Scanner (Originator) or to multiple devices that are listening (multicast messages). Output data is data that is sent from the Adapter (Target) device. This data may or may not be connected to real word devices. That is completely dependent upon the Adapter device. For example, since Protos X is an EtherNet/IP Adapter device, the Input data and Output data is defined in internal registers and does not directly tie to any Input and Output point to the real world. If it is desired to tie these elements to real word devices, that must be accomplished in code in the Scanner device.

Protos X EtherNet/IP Communication

The terminology associated with EtherNet/IP may be confusing. To better understand this nomenclature, some of the frequently used terms are listed below with a brief descriptive definition.

- Scanner: This is the term used to describe the device that initiates the EtherNet/IP sessions. The Scanner is sometimes referred to as the "Originator" as well. In more standard Ethernet terms, the Scanner would often be called the "Client".
- Adapter: This is the device that responds to the EtherNet/IP communications that are initiated by the Scanner. The Adapter is also known as the "Target" as well. Typically, the Adapter is an Ethernet"Server".
- Connection Point (Assembly Instance): A Connection Point value is the "Class Code" reference for a data block. This value is required for access to input and output data in IO Messaging. It is typically defined for each input and output data block by the Adapter device manufacturer.

Communication Format	
Integer 8 bit Unsigned, Integer 16 bit, or Integer 32 bit	
Assembly Instance	***Size***
Input: 100	(4xINT 8 (Byte) or 2xINT 16 or 1xINT 32) + terminals
Output: 102	(4xINT 8 (Byte) or 2xINT 16 or 1xINT 32) + terminals
Configuration: 100	0

- IO Messaging: IO Messaging (also called "Implicit Messaging") is a method of reading and writing blocks of data without defining the Connection Point and size for each block transfer. The Connection Point, size and transfer rate (RPI) are defined at the beginning and then the data blocks are transferred at the specified intervals.

NOTES:

Installation and Wiring

In This Chapter...

Safety Guidelines

NOTE: Products with CE marks *perform their required functions safely and adhere to relevant standards as specified by CE directives provided they are used according to their intended purpose and that the instructions in this manual are adhered to. The protection provided by the equipment may be impaired if this equipment is used in a manner not specified in this manual. A listing of our international affiliates is available on our Web site: http://www.automationdirect.com*

WARNING: Providing a safe operating environment for personnel and equipment is your responsibility and should be your primary goal during system planning and installation. Automation systems can fail and may result in situations that can cause serious injury to personnel or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electromechanical devices, such as relays or limit switches, that are independent of the PLC application to provide protection for any part of the system that may cause personal injury or damage. Every automation application is different, so there may be special requirements for your particular application. Make sure you follow all national, state, and local government requirements for the proper installation and use of your equipment.

Plan for Safety

The best way to provide a safe operating environment is to make personnel and equipment safety part of the planning process. You should examine every aspect of the system to determine which areas are critical to operator or machine safety. If you are not familiar with PLC system installation practices, or your company does not have established installation guidelines, you should obtain additional information from the following sources.

- NEMA — The National Electrical Manufacturers Association, located in Washington, D.C. publishes many different documents that discuss standards for industrial control systems. You can order these publications directly from NEMA. Some of these include:

  ICS 1, General Standards for Industrial Control and Systems

  ICS 3, Industrial Systems

  ICS 6, Enclosures for Industrial Control Systems

- NEC — The National Electrical Code provides regulations concerning the installation and use of various types of electrical equipment. Copies of the NEC Handbook can often be obtained from your local electrical equipment distributor or your local library.
- Local and State Agencies — many local governments and state governments have additional requirements above and beyond those described in the NEC Handbook. Check with your local Electrical Inspector or Fire Marshall office for information.

Three Levels of Protection

The publications mentioned provide many ideas and requirements for system safety. At a minimum, you should follow these regulations. Also, you should use the following techniques, which provide three levels of system control.

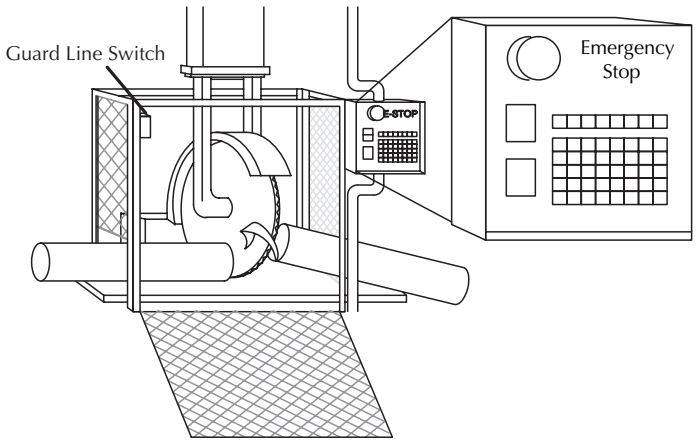
- Emergency stop switch for disconnecting system power
- Mechanical disconnect for output terminal power
- Orderly system shutdown sequence in the control program

Emergency Stops

It is recommended that emergency stop circuits be incorporated into every control system. For maximum safety, these circuits must not be wired into the controller, but should be hardwired externally. The emergency stop switches should be easily accessed by the operator and are generally wired into a master control relay (MCR) or a safety control relay (SCR) that will remove power from the I/O system in an emergency.

MCRs and SCRs provide a convenient means for removing power from the I/O system during an emergency situation. By de-energizing an MCR (or SCR) coil, power to the input (optional) and output devices is removed. This event occurs when any emergency stop switch opens. However, the controller continues to receive power and operate even though all its inputs and outputs are disabled.

The MCR circuit could be extended by placing a controller fault relay (closed during normal operation) in series with any other emergency stop conditions. This would cause the MCR circuit to drop the I/O power in case of a controller failure (memory error, I/O communications error, etc.).



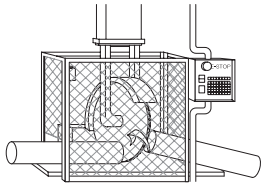
Emergency Power Disconnect

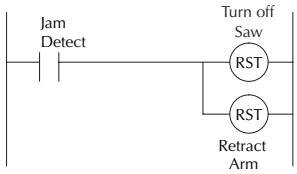
A properly rated emergency power disconnect should be used to power the system as a means of removing the power from the entire control system. It may be necessary to install a capacitor across the disconnect to protect against a condition known as "outrush". This condition occurs when the output Triacs are turned off by powering off the disconnect, thus causing the energy stored in the inductive loads to seek the shortest distance to ground, which is often through the Triacs.

After an emergency shutdown or any other type of power interruption, there may be requirements that must be met before the control program can be restarted. For example, there may be specific register values that must be established (or maintained from the state prior to the shutdown) before operations can resume. In this case, you may want to use retentive memory locations, or include constants in the control program to insure a known starting point.

Orderly System Shutdown

Ideally, the first level of fault detection is the control program, which can identify machine problems. Certain shutdown sequences should be performed. The types of problems are usually things such as jammed parts, etc. that do not pose a risk of personal injury or equipment damage.





WARNING: The control program must not be the only form of protection for any problems that may result in a risk of personal injury or equipment damage.

Hardware Installation

Before installing the Protos X I/O system, there are several things that need to be taken into consideration. The first of these considerations is the hardware configuration.

Hardware Configuration

A basic Protos X configuration will consist of a bus coupler, discrete or analog I/O terminals, and an end terminal. There are several limitations which must be considered when setting up the hardware.

1) Each bus coupler has a maximum number of terminals (64) which can be attached to the bus coupler assembly. The PX- MOD and PX-TCP1 allow expansion above the single assembly maximum (64) to the maximum number of terminals (255) by using the bus expansion terminals. The PX-TCP2 does not allow more than the maximum of 64 terminals per assembly. However since the PX-TCP2 has a built in switch, other PX-TCP2 modules can be easily connected for additional terminals.

2) Each bus coupler has 512 Bytes of input mapping and 512 Bytes of output mapping that can be used for terminal I/O points. Each I/O terminal used on the assembly will consume part of the 512 Bytes for I/O mapping. Discrete I/O will consume 1 bit of data per channel. So if you have a two-point input terminal it will consume two bits of one byte of the 512 input bytes allowed. If you have an eight-point output terminal it will consume one byte of the 512 output bytes.

   Analog modules will consume different amounts of I/O mapping depending on which bus coupler is used. For the PX-TCP1 and PX-TCP2, each analog channel will consume four input bytes and four output bytes regardless if it is an input or output terminal. With the PX-MOD bus coupler, each analog channel will only consume 2 input bytes or 2 output bytes. It will consume input bytes if the terminal is an input terminal and output bytes if the terminal is a output terminal.

3) Each bus coupler has a coupler I/O Bus power budget. **This power budget must not be exceeded as there is no internal protection in the coupler and damage to the bus coupler will occur**. The specs for each terminal lists the amount of current (in milliamps) it consumes from the I/O Bus. The available I/O Bus power supplied per bus coupler is listed in the individual specs for each bus coupler. Determine the power requirements (power supplied and power consumed) of your system before installing the hardware. See example below.

Power Budget Example

This example shows how to calculate the power budget for a typical Protos X system. It is constructed using a PX-MOD Bus Coupler and six I/O Terminals. It is recommended you construct a similar table for your system. Follow the steps below to determine your power budget.

1. Using a chart similar to the one on the following page, fill in columns 1 and 2.
2. Using the specification tables for each module, enter the current supplied and current used by each device (columns 3).
3. Add together the current used by the system (row C) for column 3 and put the total in the row labeled “Maximum Current Required” (row D).
4. Subtract the calculated “Maximum Current Required” (row D), from the “Current Supplied” and place the difference in the row labeled “Remaining Current Available” (row E).

5. If "Maximum Current Required" is greater than "Current Supplied" in column 3, the power budget will be exceeded. It will be unsafe to use this configuration, and you will need to restructure your I/O configuration.

A	Column 1	Column 2	Column 3
	Terminal	***Terminal Type***	***I/O Bus (from Coupler)***
B	***CURRENT SUPPLIED***		
	PX-MOD	Bus Coupler	1000mA
C	***CURRENT REQUIRED***		
	PX-144 PX-172-1 PX-322-1 PX-312 PX-244-1 PX-412	4 pt DC Discrete Input 2 pt AC Discrete Input 2 ch RTD Input 2 ch DC Analog Input 4 pt DC Discrete Output 2 ch DC Analog Output	5mA 3mA 60mA 65mA 9mA 75mA
D	Maximum Current Required		217mA
E	Remaining Current Available		783mA

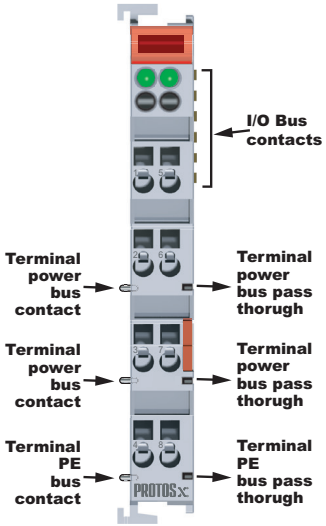
Terminal I/O Bus Wiring Options

There are different Terminal I/O Bus wiring options per terminal chosen. Some of the terminals offer access to the Terminal I/O Bus power through connection points on the front of the terminals. Usually the lower point count discrete terminals will offer this option. However with terminals having a higher point count, these connection points are not available. If Terminal I/O Bus power is needed for external devices, the PX-949 Power Distribution Terminal provides access through eight connection points to the 24VDC and 0V on the bus. There are also a couple of terminals that can be used to isolate (PX-908) or add an external voltage source to the Terminal I/O Bus. The PX-940 can be used as a 24VDC power supply terminal to connect an external 24VDC power source to the Terminal I/O Bus. The PX-970 can be used as a 120/230 VAC power source to the Terminal I/O Bus. In the assembly, neither of these terminals connect to the terminal power bus on their left side. Instead, they will carry the externally connected power source to the terminals attached on the right as long as the modules support terminal power transfer.

Terminal Placement

It is very important to understand the placement of the terminals in an assembly. Always start the assembly with a Bus Coupler and add terminals from left to right, ending with a Bus End Terminal or Bus Expansion End Terminal, attaching each terminal as shown in the System Installation section which follows.

In an assembly there is an I/O Bus, which passes data and power from the Bus Coupler to the Bus End Terminal via six I/O Bus contacts. There is also a Terminal Power Bus, which can provide power to the terminals and/or field devices via the terminal connections. Power is passed via two or three contacts located on the sides of the terminals. Not all terminals pass Terminal Bus Power, and the voltages on the bus can vary. Because of this, there are four conditions to take into consideration. These conditions can be found in the General Specifications table for each terminal unit (See Chapter 2 for terminal specifications).



General Specifications	
Operating Temp	32 to 131 °F (0 to 55 °C)
Storage Temp	13 to 185 °F (-25 to 85 °C)
Relative Humidity	5% to 95%, non-condensing
Environment Air	No corrosive gases permitted
Mounting/ Orientation Restrictions	35mm DIN rail/None
Vibration	Conforms to EN 60068-2-6
Shock	Conforms to EN 60068-2-27/ EN 60068-2-29
Noise Immunity	Conforms to EN 61000-6-2/ EN 61000-6-4
Protection Class	IP20
Weight	55g
Dimensions (WxHxD)	12 x 100 x 68.8 mm (0.47 x 3.94 x 2.71 in)
(a) *Adjacent Mounting on Bus Terminals with Power Contact*	Yes, DC only
(b) *Adjacent Mounting on Bus Terminals without Power Contact*	No
(c) *Passes Terminal Bus Power*	Yes
(d) *Passes PE Bus*	No
*Agency Approvals**	UL/cUL File No. E157382, CE

a. **Adjacent Mounting on Bus Terminals with Power Contact:** Terminals where Yes is shown can be mounted to the right of a terminal that passes power. Some terminals will specify DC Only or AC Only and should only be mounted adjacent to a terminal that passes the same voltage.

b. **Adjacent Mounting on Bus Terminals without Power Contact:** Terminals where Yes is shown do not use power from the Terminal Power Bus. These would be the Power Feed Terminals, Power Separation Terminal, and some of the Analog I/O Terminals.

c. **Passes Terminal Bus Power:** Terminals where No is indicated, do not pass power through the Terminal Power Bus. These would be the End Terminals, Power Separation Terminal, and some of the Analog I/O Terminals.

d. **Passes PE Bus:** Terminals where Yes is shown use PE (earth ground) from the Terminal Power Bus. These would be the Power Feed Terminals and any Discrete I/O Terminals that support 4-wire field devices.

System Installation and Removal

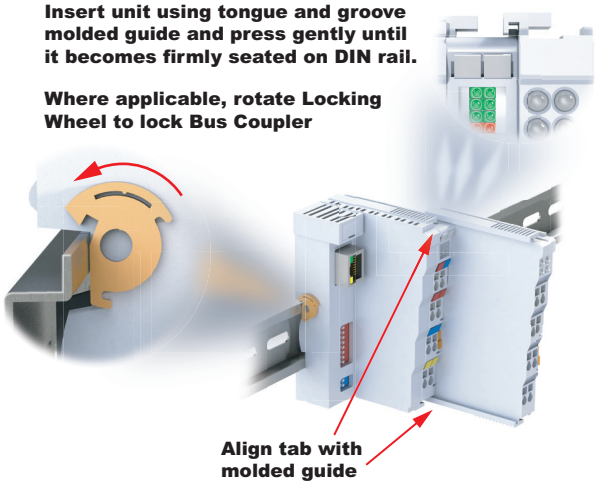
Bus Coupler Installation

Attach a Bus Coupler onto a 35mm DIN rail and secure it into position using the DIN rail locking wheel (where applicable) located on the left side of the coupler.

Bus Terminal Installation

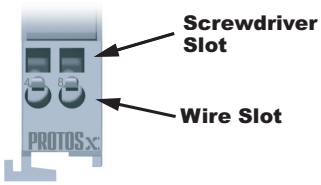
To add a bus terminal, insert unit onto right side of Bus Coupler using the tongue and groove at the top and bottom of the unit, pressing gently until it snaps onto the DIN rail.

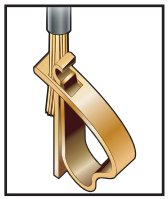
NOTE: *A proper connection cannot be made by sliding the units together on the DIN rail. When correctly installed, no significant gap can be seen between the attached units. Bus connection is made through the six slide contacts located on the upper right side of the units. Add up to 64 bus terminals per Bus Coupler, including a bus end terminal.*



Wiring Connections

Wire connection is made through a spring clamp style terminal. This terminal is designed for a single-conductor solid or stranded wire. Wire connection is made by firmly pushing the screwdriver into the screwdriver slot, inserting the wire into the wire slot and removing the screwdriver, locking the wire into position.



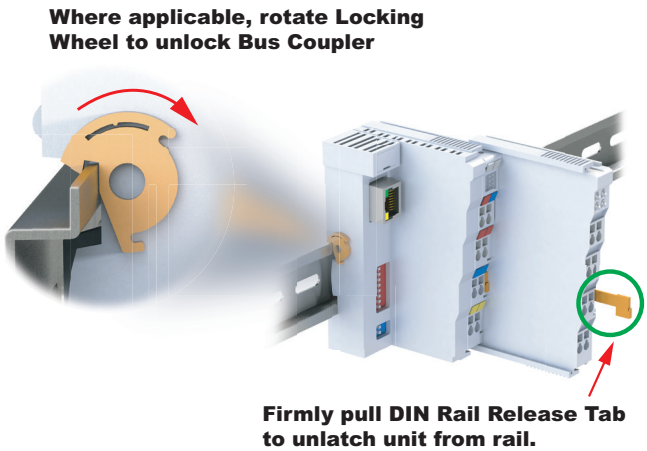


Wiring Specifications	
Connection Type	Spring Clamp Terminals
*Wire Gauge/Wire Cross Section**	28–14 AWG / 0.08–2.5 mm^2
Wire Stripping Length	8mm

* For Thermocouple terminals, a thermocouple extension wire is recommended

Removing the Bus Coupler and Bus Terminals

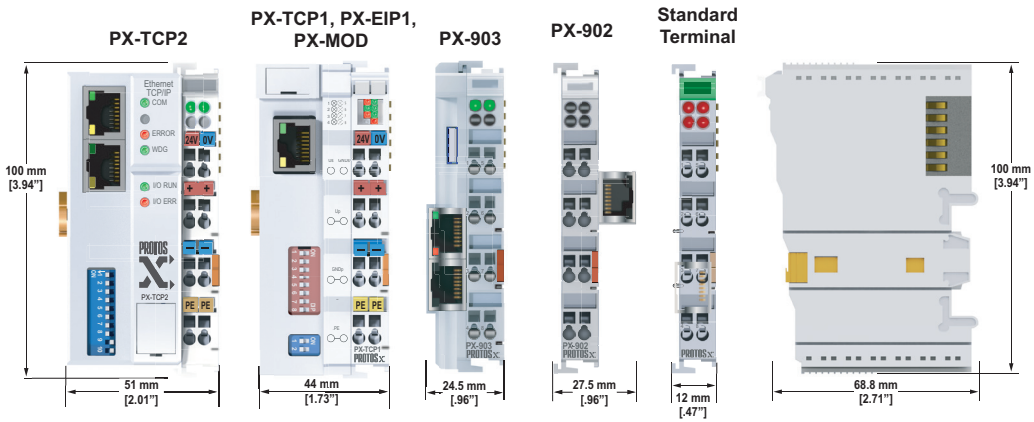
A locking mechanism prevents individual units from being pulled off. For bus terminal removal, pull the orange DIN rail release tab firmly to unlatch the unit from the rail. If attached to other terminal units, slide unit forward until released. For Bus Couplers with locking wheels, release the DIN rail locking wheel, then pull firmly on DIN rail release tab.



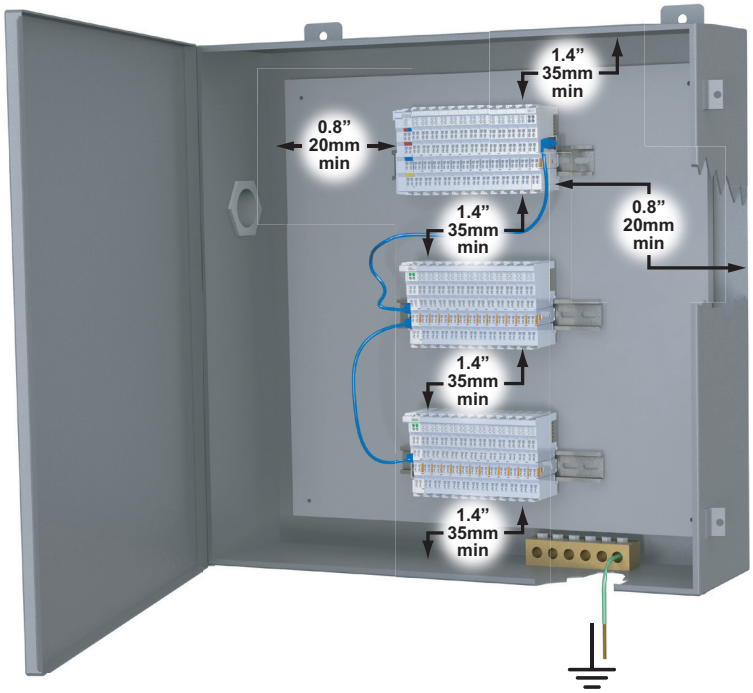
Terminal Dimensions and Spacing Requirements

Use the following diagrams to make sure the Protos X system can be installed in your application. Protos X terminals require 35mm DIN rail for mounting and there are no orientation restrictions.

It is important to check the Protos X dimensions against the conditions required for your application.



Also, to ensure proper airflow for cooling purposes, units should be spaced, at a minimum, as shown below.



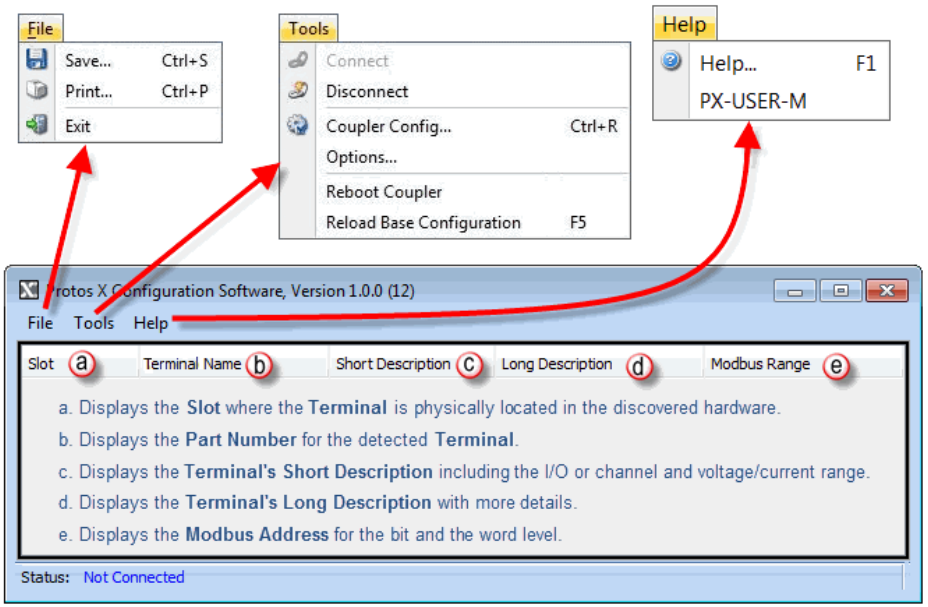
PROTOS X CONFIGURATION

In This Chapter...

Protos X Software Configuration Tool (PG-CFGSW)

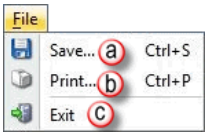
The PX-CFGSW software configuration tool is used to identify the Modbus addressing, Modbus function codes, and change some of the bus coupler settings. The software tool is a free download from our website or it can be purchased separately on a CD.

The Protos X configuration software is a very simple tool to easily manage connections to the Protos X hardware. When the software opens, the Main Screen will have everything you need. The Main Screen graphic below provides a quick overview of the features included with the Protos X configuration software.



Once the Protos X configuration software is open, three menu choices (File, Tools and Help), are available from the Main Menu bar. Some of the items within the menu drop-downs have a keyboard short-cut associated with them that permit quick access. The Main Menu items also have short-cuts for easy access by holding down the "ALT" key on your keyboard and pressing the first letter of the Menu item (i.e., ALT+ F will open the File Menu).

File Menu



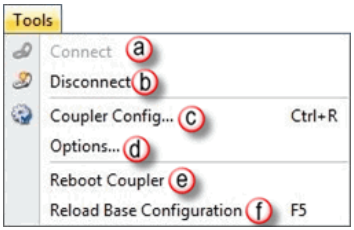
a. **Save...** This selection or Ctrl+S, Saves a ".csv" (comma separated value) file containing information downloaded from the Bus Coupler. The file is Saved to a directory chosen by the user. This read only file containing Terminal and Addressing information can be viewed when opened using MS Excel®. This file cannot be used to load configuration data to a Bus Coupler.

b. **Print...** Selecting Print or **Ctrl +P**, prints the screen as it is viewed. Therefore, if all the Terminals are expanded, the Printout will include all the Terminals with the expanded view. If only one Terminal is expanded, the Printout will only include the expanded view for that Terminal.

c. **Exit** Choosing this selection Exits/Closes the Protos X configuration software.

4

Tools Menu



a. **Connect:** When the PX-USB-232 is connected to a Bus Coupler it is detected and the selection will become active. An inactive selection will look faded as seen in the Connection selection on the graphic above. When active, click on Connect to make a connection with the Bus Coupler.

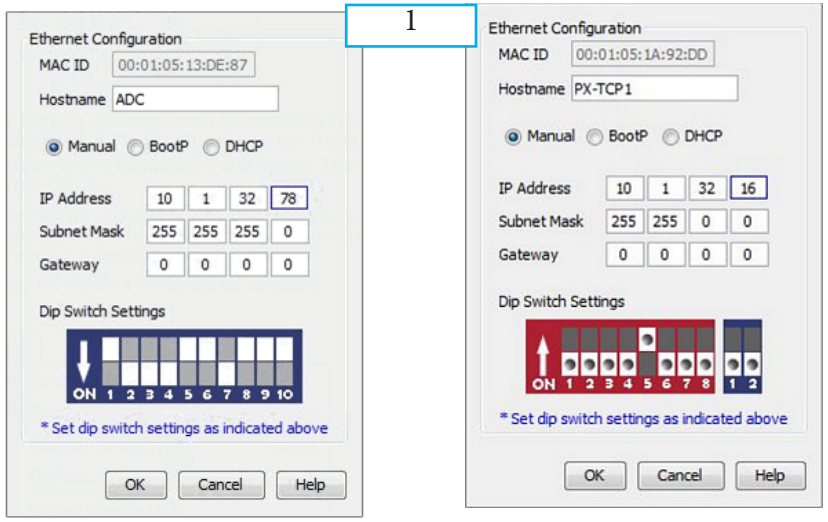
b. **Disconnect:** Click to Disconnect the Configuration Software from the Bus Coupler. The Configuration Software does not send/ receive continual messages to/ from the Bus Couplers. If a cable has been removed or communications has been interrupted, you may have to reconnect to the Bus Coupler.

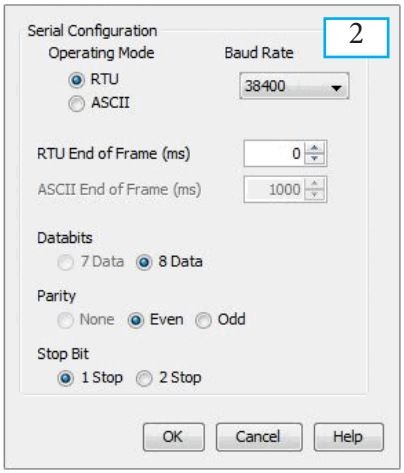
c. **Coupler Config...:** This selection opens the Coupler Configuration window. The Coupler Configuration dialog will vary depending on the Bus Coupler you are connected to (Serial or Ethernet.)

Note: *The rotary switches on the PX-MOD should be set to " 00 " for the Configuration Tool to connect.*

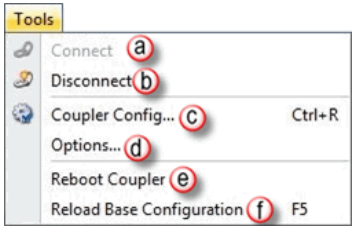
1. Ethernet Connection (See boxes on following page): If connected to the Ethernet Bus Coupler, the configuration window will allow you to view the MAC ID, change the Host Name, choose whether to manually assign an IP Address or choose the BootP or the DHCP option for IP Address assignment. If you choose to manually assign the IP Address, you can enter the IP Address, Subnet Mask, and the Gateway, if your network has one. The first three octets of the IP Address will be assigned through the configuration software. The last octet must be set by the DIP switches on the Bus Coupler. The configuration software will display how the DIP switches should be set based on the Address that is entered into the address field. See the following DIP switch configuration example.

Tools Menu, (cont'd)



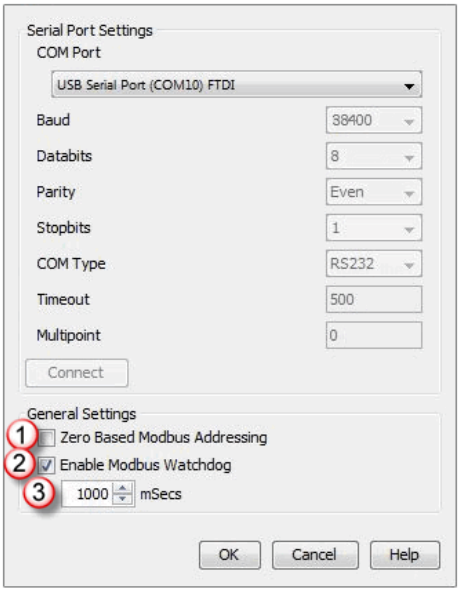


2. Serial Connection: If connected to the Serial Bus Coupler, the configuration window shown at left will allow you to select the operating mode (Modbus RTU or Modbus ASCII), baud rate, end of frame time (in milliseconds), data bits, parity, and stop bits (see box below). These settings should reflect the COM Port settings of the master device.



d. **Options...:** This selection opens the Options setup window. This dialog box is used for selecting the COM Port type and connecting to the Bus Coupler. The port settings are configured in the Coupler Configuration window and cannot be changed in this dialog.

Tools Menu, (cont'd)



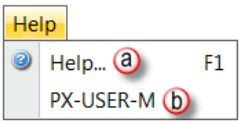
The General Settings portion of this window can be edited as follows:

1. **Zero Based Modbus Addressing:** You can choose to enable the Zero Based Modbus Addressing by clicking the checkbox. This will start the Modbus addresses at "0", or if not chosen they will start at "1".
2. **Enable Modbus Watchdog:** This option is checked by default. Click the checkbox to disable the Modbus Watchdog if needed. Setting this option will cause the Bus Coupler to fault after a set time period (in milliseconds), if there has been no Modbus communications. If Enable Modbus Watchdog is not checked and communications is lost, the Protos X outputs will remain in their last state.
3. Modify the Modbus Watchdog timeout period in milliseconds. Choose a value between 0–65535.

e. **Reboot Coupler:** Click on this selection to send a reboot command to the Bus Coupler so you can reset it without power cycling.

f. **Reload Base Configuration:** Click on this selection to reload the base configuration. This forces the Bus Coupler to read the configuration of the terminals within the assembly and reload the configuration based on the reading.

Help Menu



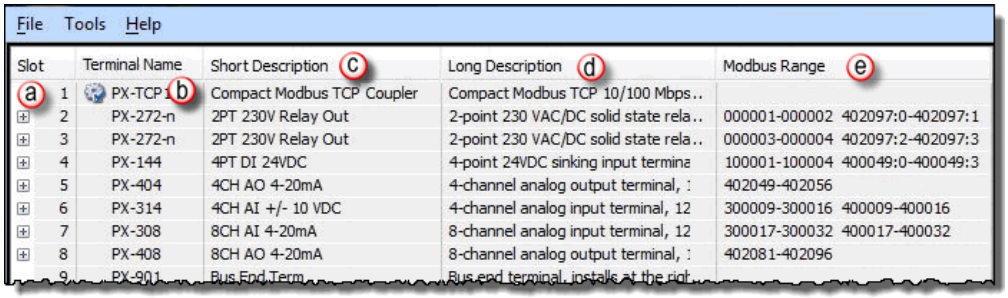
a. **Help...** This selection opens the Help File.

b. **PX-USER-M** Opens the User Manual.

Understanding the Protos X Configuration Software Tool

Once the Bus Coupler has been discovered by the software, all the information you need to identify the Modbus addresses of the I/O terminals will be displayed on the Main Screen of the Protos X Configuration Software. The Main Screen should look similar to the graphic below: Each column function is described in the following text.

a. **Slot:** Shows the physical location of the terminal in the discovered hardware. Slots are incremented from left to right.



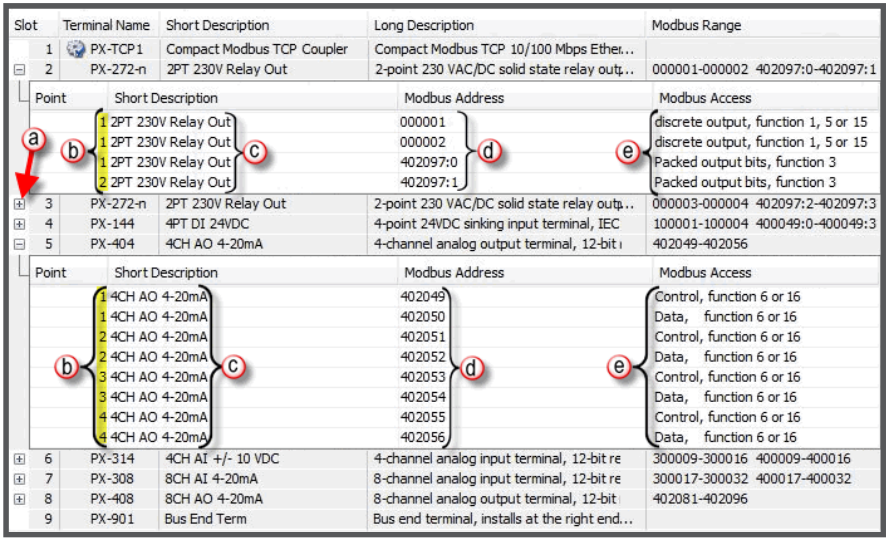
b. **Terminal Name:** Displays the terminal part number.

c. **Short Description:** Displays a short description of the terminal including I/O or channel count and voltage/current range.

d. **Long Description:** Displays a more detailed and complete description of the terminal.

e. **Modbus Range:** Displays the Modbus address for the bit and word level.

Each terminal can be expanded to show the Modbus information in more detail.



a. **Expand (+) / Minimize (-)Symbol:** Use the (+) symbol to expand the terminal tree. When expanded, use the (-) symbol to collapse the terminal tree.

b. **Point:** Shows the points for this terminal.

c. **Short Description:** Shows the short description of the terminal type.

d. **Modbus Address:** Displays the Modbus addresses for each specific terminal by bit and word level.

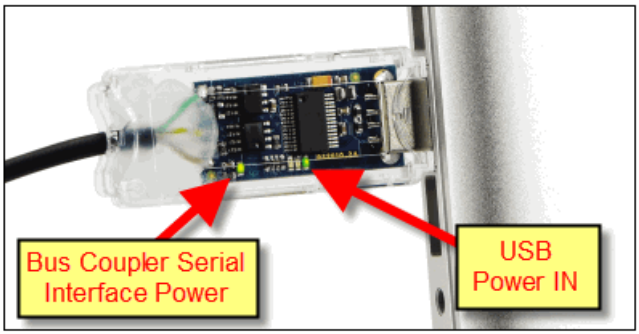
e. **Modbus Access:** Shows the corresponding Modbus function codes that can be used to read from or write to the terminal.

Using the Configuration Software

These steps assume that the Protos X Configuration Software has been installed. To ensure proper operation of the configuration software once it has been installed, follow these steps:

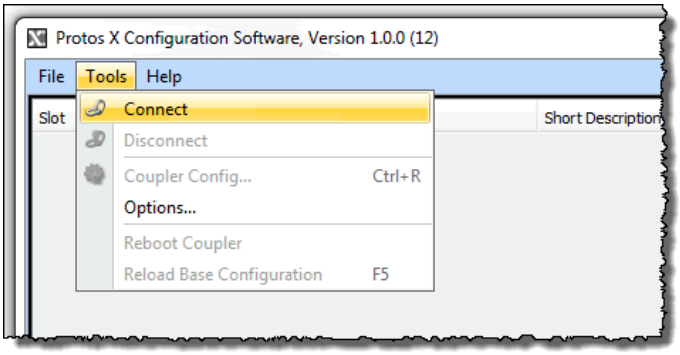
1. Confirm that the PX-USB-232 configuration cable is properly connected to the USB port of your PC and the other end is properly connected to the Bus Coupler port.
2. Confirm that the Protos X Bus Coupler is powered up.
3. If properly connected, the green LEDs on the Bus Coupler and the cable will be illuminated. These LEDs indicate when there is power on the USB port and that the Bus Coupler the cable is plugged into is powered up.

NOTE: *Some RS-485 devices on the PX-MOD 9-pin D-sub port may prevent comm to the programming port.*

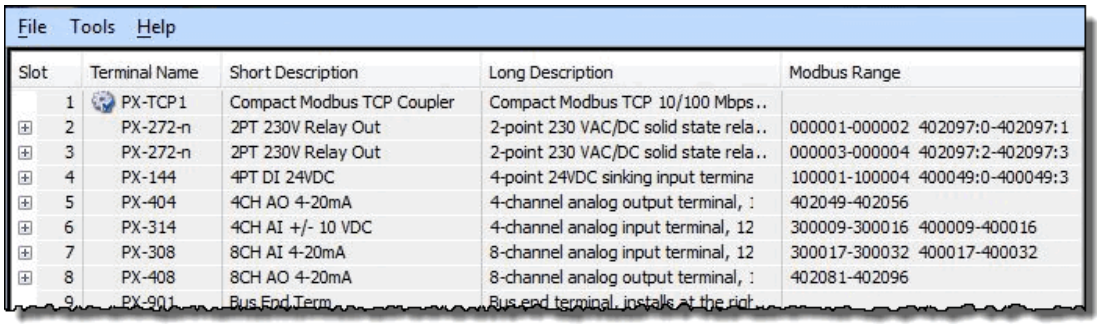


If the configuration software is not running, click the program icon (shown below) on your desktop to open the Software.

4. Once the configuration software opens, go to the Tools menu and select Connect from the drop down menu.



5. Once Connect is selected, the software should discover the Bus Coupler, read the I/O configuration and populate the Main Screen with information. It should look similar to the graphic shown below.



Protos X Discrete and Analog I/O Mapping

Once the PX-CFGSW has been used to identify the Modbus addressing for the Protos X terminals in your assembly, you are ready to start reading and writing data from your Modbus controller to the Protos X Bus Coupler. Following is a description of the register mapping for the terminal I/O.

Discrete I/O

Discrete I/O can be read from or written to by using a bit level Modbus function code or a word level Modbus function code. In the following example for a relay output terminal (shown on top) you could use the function codes 1 (read coil status), 5 (force a single coil), or 15 (force multiple coils) to access the data of the relay output terminal at the bit level. You could also access the relay output at the word level by using the Modbus function code 3 (read holding register).

For the input terminal in the example below, Modbus function code 2 (read input status) can be used to read the input points at the bit level. At the word level, Modbus function code 4 (read input register) or Modbus function code 3 (read holding register) can be used.

3	PX-272-n	2PT 230V Relay Out	2-point 230 VAC/DC solid state relay output terminal,	000001-000002 402057:0-402057:1
Point		Short Description	Modbus Address	Modbus Access
		1 2PT 230V Relay Out	000001	discrete output, function 1, 5 or 15
		2 2PT 230V Relay Out	000002	discrete output, function 1, 5 or 15
		1 2PT 230V Relay Out	402057:0	Packed output bits, function 3
		2 2PT 230V Relay Out	402057:1	Packed output bits, function 3
4	PX-144	4PT DI 24VDC	4-point 24VDC sinking input terminal,	100001-100004 400009:0-400009:3
Point		Short Description	Modbus Address	Modbus Access
		1 4PT DI 24VDC	100001	discrete input, function 2
		2 4PT DI 24VDC	100002	discrete input, function 2
		3 4PT DI 24VDC	100003	discrete input, function 2
		4 4PT DI 24VDC	100004	discrete input, function 2
		1 4PT DI 24VDC	300009:0	Packed Input bits, function 4
		2 4PT DI 24VDC	300009:1	Packed Input bits, function 4
		3 4PT DI 24VDC	300009:2	Packed Input bits, function 4
		4 4PT DI 24VDC	300009:3	Packed Input bits, function 4
		1 4PT DI 24VDC	400009:0	Packed Input bits, function 3
		2 4PT DI 24VDC	400009:1	Packed Input bits, function 3
		3 4PT DI 24VDC	400009:2	Packed Input bits, function 3
		4 4PT DI 24VDC	400009:3	Packed Input bits, function 3

Analog I/O

Analog terminals will always use word level Modbus read/write commands. Analog input terminals also have a Status register (1 byte) and a Data register (2 bytes). Analog output terminals have a Control register (1 byte) and a Data register (2 bytes). **At this time, the Control Byte will not be used for the output terminals**. The upper bytes of the Status and Control registers are not used but are consumed by the Coupler to make sure all registers are word aligned so data does not start in the middle of a word. In the following example, the analog output terminal registers will start at register 402049.

Since the Control register will not be used, the output data can be written to the Data register using Modbus function code 6 (preset single register) or 16 (preset multiple registers).

2	PX-402	2CH AO 4-20mA	2-channel analog output terminal,	402049-402052

Point	Short Description	Modbus Address	Modbus Access
1	2CH AO 4-20mA	402049	Control, function 6 or 16
1	2CH AO 4-20mA	402050	Data, function 6 or 16
2	2CH AO 4-20mA	402051	Control, function 6 or 16
2	2CH AO 4-20mA	402052	Data, function 6 or 16

The analog input terminals will have a Status register associated with each input channel. The Status register can be used to determine if there is an input fault and if it is an over-range or under-range error (see status word bit map below). The Modbus function code 4 (read input register) or 3 (read holding register) can be used to get data stored in the Status and Data words of the analog output terminal.

The PX-MOD will not have Status or Control registers associated with each channel's Data word. Analog Input and Output terminals will only consume two bytes (one word) per channel. PX-TCP1 and PX-TCP2 Analog Input and Output terminals will consume 8 bytes (4 words) per channel.

5	PX-332-n	2CH THM In	2-channel thermocouple input terminal,	300005-300008 400005-400008

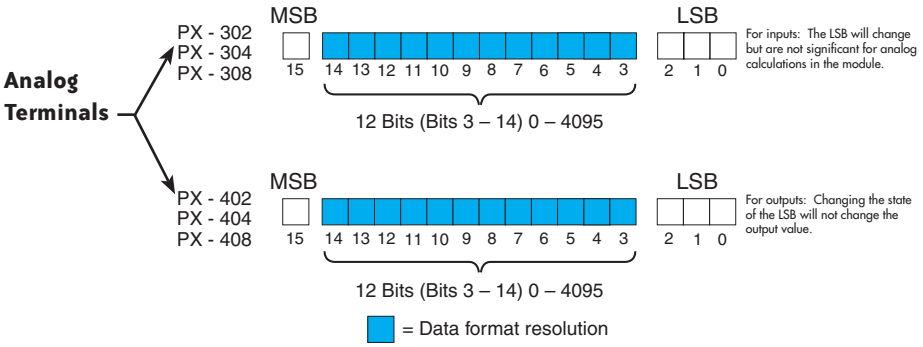
Point	Short Description	Modbus Address	Modbus Access
1	2CH THM In	300005	Status, function 4
1	2CH THM In	300006	Data, function 4
2	2CH THM In	300007	Status, function 4
2	2CH THM In	300008	Data, function 4
1	2CH THM In	400005	Status, function 3
1	2CH THM In	400006	Data, function 3
2	2CH THM In	400007	Status, function 3
2	2CH THM In	400008	Data, function 3

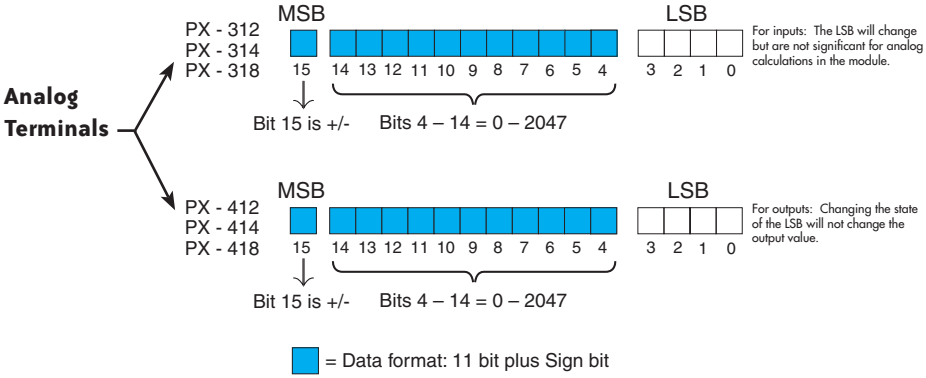
Analog Input Terminal Status Register Bit Mapping

To access the status bits use Modbus function code 4 (read input register) or 3 (read holding register) and use bit of word addressing or unpack bits from the word level to access the individual bits.

Bit		30005:6					30005:1	30005:0
Name		Error					Over range	Under range

Within these word locations, the individual bits represent specific information about the analog signal.





Notes:

Troubleshooting

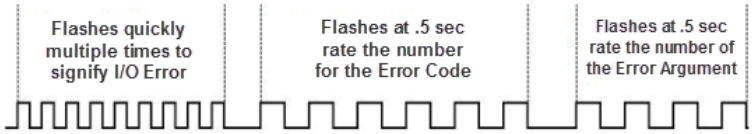
In This Chapter...

Diagnostic LEDs

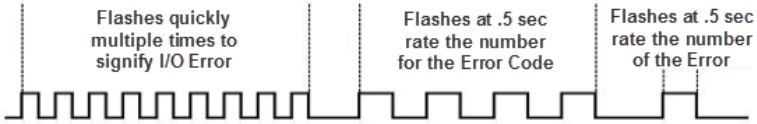
All Protos X Bus Couplers have LED lights which can be used to troubleshoot errors. For instance, the I/O BUS Diagnostics LEDs will indicate the status of the bus terminals and their connections. The green LED will light up in order to indicate a fault-free operation. The red LED will blink with two different frequencies to indicate an error. The error is encoded in the blinks as follows:

Blink Code	
Fast Blinking	Start of the Error Code
First Slow Sequence	Error Code
Second Slow Sequence	Error Code Argument

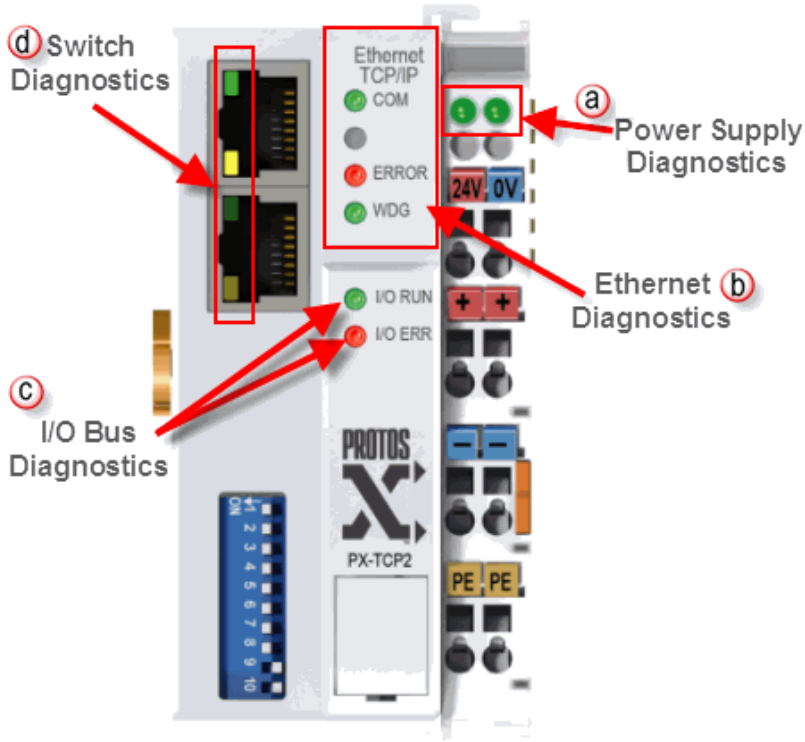
Below is an example of an I/O Error showing Error Code 6 (Bus Coupler Error) and Error Argument 4 (DIP Switch incorrect for Boot IP) from Terminal Bus Coupler PX-TCP2.



Below is an example of an I/O Error showing Error Code 4 (I/O Bus Data Error) and Error Argument 1 (Break behind bus terminal n, in this case number 1) from Terminal Bus Coupler PX-TCP2.



PX-TCP2 Diagnostics LEDs



a. Power Supply Diagnostic LEDs

PX-TCP2 Power Supply Diagnostic LEDs	
LED	***Meaning***
Left LED = OFF	No Bus Coupler power
Right LED = OFF	No 24VDC Terminal Bus Power

b. Ethernet Diagnostics LEDs

PX-TCP2 Ethernet Diagnostic LEDs		
LED	***ON***	***OFF***
COM	ON/Flashing = data received The LED flashes slowly if DHCP or BootP is active but the Bus Coupler has not yet received an IP Address	No data received
ERROR	The LED flashes rapidly (5 times, only when switching ON); the Bus Coupler is addressed with ARP The settings on the DIP Switch are not valid	No error
WDG	Watchdog is active (No error)	Watchdog error or no communication (start communication or reset WD error)

c. I/O Bus Diagnostics LEDs

PX-TCP2 I/O Bus Diagnostic LEDs	
LED	***Meaning***
I/O RUN	ON or Flashing: I/O Bus Running
I/O ERR	Flashing: See error codes below

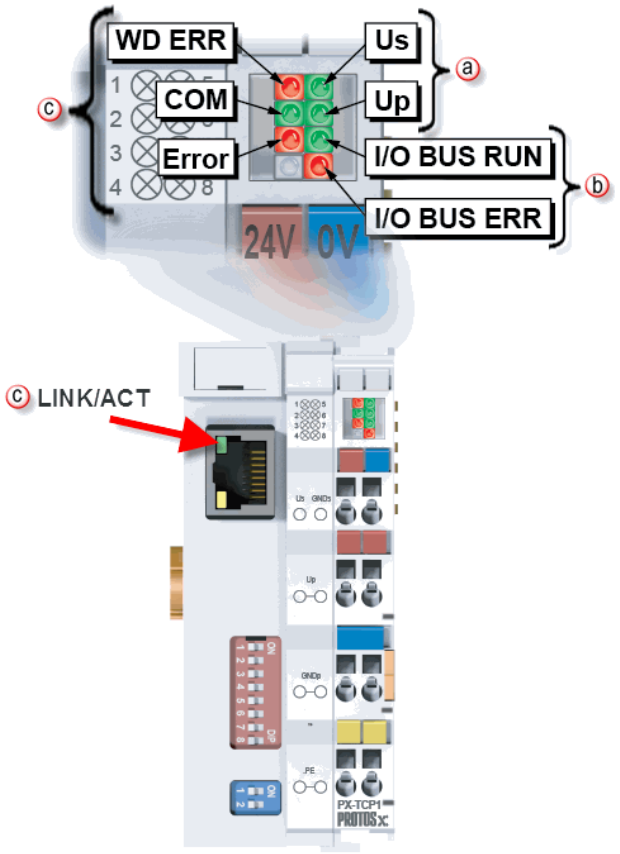
PX-TCP2 Error Codes for I/O Bus Diagnostics			
Error Code	***Error Code Argument***	***Description***	***Remedy***
Persistent, continuous blinking		EMC Problems	• Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	• Contact ADC Returns Department at (800) 633-0405 • Insert fewer Bus Terminals, the programmed configuration has too many entries in the table • Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	
	2	Unknown Data type	

PX-TCP2 Error Codes for I/O Bus Diagnostics			
Error Code	***Error Code Argument***	***Description***	***Remedy***
2 Pulses	0	Programmed Configuration has an incorrect entry	• Check programmed configuration for correctness • Incorrect table entry
	n(n>0)	Table comparison (Bus Terminal (n))	
3 Pulses	0	I/O Bus Command Error	• No Bus Terminal inserted • One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	• Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary • Check whether the Bus End Terminal PX-901 is connected
	n	Break behind Bus Terminal (n)	
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n^{th} Bus Terminal
6 Pulses	0	Error at installation	• Exchange Bus Coupler • Perform a hardware reset on the Bus Coupler (switch OFF and ON again) • Change the IP Address • Set 1-8 to ON or OFF, see BootIP • Perform a hardware reset on the Bus Coupler (switch OFF and ON again)
	1	• Internal Data Error • DIP Switch changed after a software reset	
	2	Other device with this IP Address in the network	
	4	DIP Switch incorrect for BootIP	
	8	Internal Data Error	
	16	Error in IP socket	
14 Pulses	n	n^{th} Bus Terminals is no longer correct	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded
16 Pulses	n	Length of the I/O Bus data is no longer correct	Check the amount of bytes consumed by terminals to make sure the 512 bytes Input and 512 bytes output has not been exceeded

d. Switch Diagnostics LEDs

PX-TCP2 Switch Diagnostic LEDs			
LED	***ON***	***Flashing***	***OFF***
LINK/ACT	Link is OK	Communication OK	No Link
10/100 Baud	100 MBaud	-	10 MBaud

PX-TCP1 Diagnostics LEDs



a. Us/Up LEDs

PX-TCP1 Power Supply Diagnostic LEDs	
LED (Power LEDs)	***Meaning***
Power LED Us	OFF: No Bus Coupler 24VDC
Power LED Up	OFF: No Terminal Power Bus 24VDC

b. I/O Bus Diagnostics LEDs

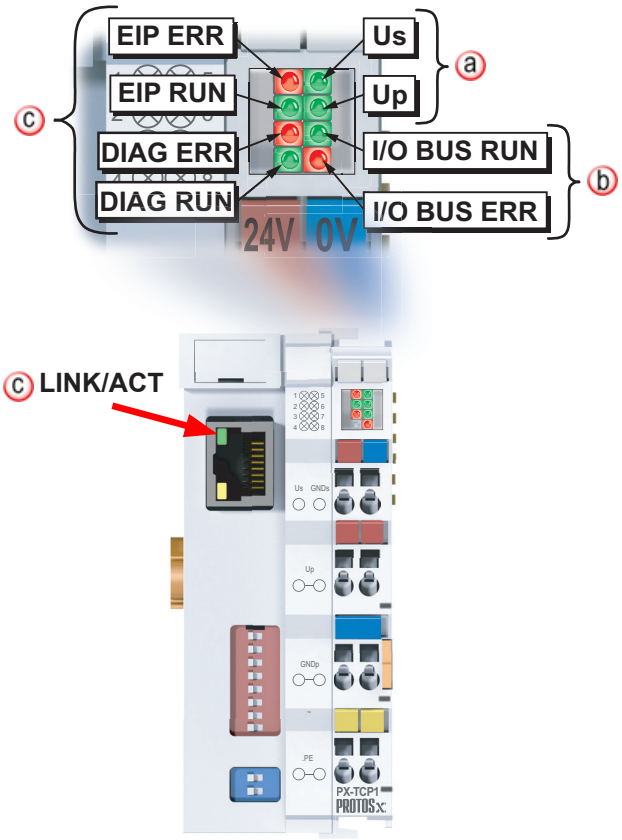
PX-TCP1 I/O Bus Diagnostic LEDs	
LED (I/O Bus)	***Meaning***
I/O Bus RUN	ON or Flashing: I/O Bus Running
I/O Bus ERR	Flashing: See error codes on following page

PX-TCP1 Error Codes for I/O Bus Diagnostics			
Error Code	***Error Code Argument***	***Description***	***Remedy***
-	Flashing Continuously	EMC Problems	• Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	• Contact ADC Returns Department at (800) 633-0405 • Insert fewer Bus Terminals, the programmed configuration has too many entries in the table • Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	
	2	Unknown Data type	
2 Pulses	-	Reserve	-
3 Pulses	0	I/O Bus Command Error	• No Bus Terminal inserted • One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	• Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary • Check whether the Bus End Terminal PX-901 is connected
	n	Break behind Bus Terminal (n)	
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n^{th} Bus Terminal
6 Pulses	0	Error at installation	• Exchange Bus Coupler • Perform a hardware reset on the Bus Coupler (switch OFF and ON again)
	1	Internal Data Error	
	2	DIP Switch changed after a software reset	
7 Pulses	0	Cycle Time was exceeded	Warning: The set cycle time was exceeded. This indication (flashing LEDs) can only be cleared by booting the Bus Coupler again Remedy: Increase the cycle time
9 Pulses	0	Checksum Error in Flash program	• Transmit program to the Coupler again • Remove the faulty library
	1	Incorrect or faulty library implemented	
10 Pulses	n	Bust Terminal n is not consistent with the configuration that existed when the boot project was created	Check the n^{th} Bus Terminal. The boot project must be deleted if the insertion of an n^{th} Bus Terminal is intentional
14 Pulses	n	n^{th} Bus Terminals has the wrong format	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded

c. WD/COM/Error LEDs

PX-TCP1 Ethernet Diagnostic LEDs	
LED (Ethernet)	***Meaning***
WD ERR	ON: Watchdog Error
COM	ON or Flashing: communication with controller
ERROR	Flashing: DHCP or BootP active, waiting for an IP Address
RTE	ON: Hard real time is switched ON at TC. No ADS communication is possible at the same time . All TCP, UDP and ICMP telegrams (e.g., ping) will not be answered
LINK/ACT	ON: LINK available Flashing: LINK available and communicating

PX-EIP1 Diagnostics LEDs



a. Us/Up LEDs

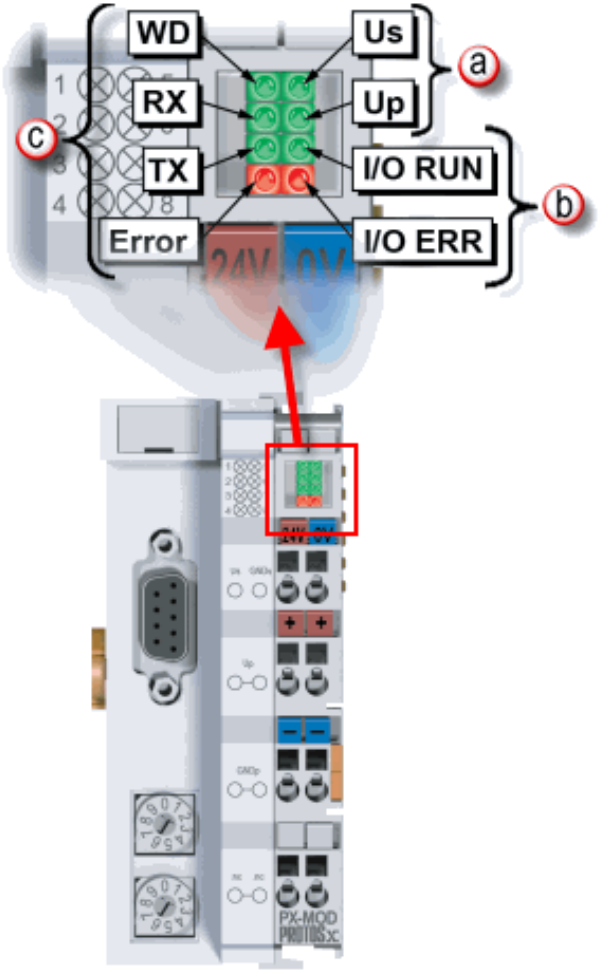
PX-EIP1 Power Supply Diagnostic LEDs	
LED (Power LEDs)	***Meaning***
Power LED Us	OFF: No Bus Coupler 24VDC
Power LED Up	OFF: No Terminal Power Bus 24VDC

b. I/O Bus Diagnostics LEDs

PX-EIP1 I/O Bus Diagnostic LEDs	
LED (I/O Bus)	***Meaning***
I/O Bus RUN	ON or Flashing: I/O Bus Running
I/O Bus ERR	Flashing: See error codes on following page

PX-EIP1 Error Codes for I/O Bus Diagnostics			
Error Code	***Error Code Argument***	***Description***	***Remedy***
-	Flashing Continuously	EMC Problems	• Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	• Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	• Insert fewer Bus Terminals, the programmed configuration has too many entries in the table
	2	Unknown Data type	• Contact ADC Returns Department at (800) 633-0405
2 Pulses	-	Reserved	-
3 Pulses	0	I/O Bus Command Error	• No Bus Terminal inserted • One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	• Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary
	n	Break behind Bus Terminal (n)	• Check whether the Bus End Terminal PX-901 is connected
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n^{th} Bus Terminal
6 Pulses	0	Error at installation	• Exchange Bus Coupler • Perform a hardware reset on the Bus Coupler (switch OFF and ON again)
	1	Internal Data Error	
	2	DIP Switch changed after a software reset	
7 Pulses	0	Cycle Time was exceeded	Warning: The set cycle time was exceeded. This indication (flashing LEDs) can only be cleared by booting the Bus Coupler again Remedy: Increase the cycle time
9 Pulses	0	Checksum Error in Flash program	• Transmit program to the Coupler again
	1	Incorrect or faulty library implemented	• Remove the faulty library
10 Pulses	n	Bust Terminal n is not consistent with the configuration that existed when the boot project was created	Check the n^{th} Bus Terminal. The boot project must be deleted if the insertion of an n^{th} Bus Terminal is intentional
14 Pulses	n	n^{th} Bus Terminals has the wrong format	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded

PX-MOD Diagnostics LEDs



a. Us/Up LEDs

PX-MOD Power Supply Diagnostic LEDs	
LED (Power LEDs)	***Meaning***
Power LED Us	OFF: No Bus Coupler 24VDC
Power LED Up	OFF: No Terminal Power Bus 24VDC

b. I/O Bus Diagnostics LEDs

PX-MOD I/O Bus Diagnostic LEDs	
LED (I/O Bus)	***Meaning***
I/O RUN	ON or Flashing: I/O Bus Running
I/O ERR	Flashing: See error codes on following page

PX-MOD Error Codes for I/O Bus Diagnostics			
Error Code	***Error Code Argument***	***Description***	***Remedy***
Persistent, continuous blinking		EMC Problems	• Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	• Contact ADC Returns Department at (800) 633-0405 • Insert fewer Bus Terminals, the programmed configuration has too many entries in the table • Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	
	2	Unknown Data type	
2 Pulses	0	Programmed Configuration has an incorrect entry	• Check programmed configuration for correctness • Incorrect table entry
	n(n>0)	Table comparison (Bus Terminal (n))	
3 Pulses	0	I/O Bus Command Error	• No Bus Terminal inserted • One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	• Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary • Check whether the Bus End Terminal PX-901 is connected
	n	Break behind Bus Terminal (n)	
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n^{th} Bus Terminal
14 Pulses	n	n^{th} Bus Terminals has the wrong format	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded
16 Pulses	n	Length of the I/O Bus data is no longer correct	Check the amount of bytes consumed by terminals to make sure the 512 bytes Input and 512 bytes output has not been exceeded

c. WD/TX/RX LEDs

PX-MOD Modbus Diagnostic LEDs	
LED (Modbus)	***Meaning***
WD	ON: Watchdog is good
RX	ON: data is being received
TX	ON: data is being transmitted
Error	ON: Data Error, communications with the Master Device has been lost

Bus Coupler Diagnostics Additional Notes

1. The number of pulses (n) indicates the position of the last Bus Terminal before the fault. Passive Bus Terminals, such as the power feed terminal, are not included in the count.
2. In the case of some Errors, rectification does not cause the Bus Coupler to leave the blink sequence. The Bus Coupler stays in the Stop state. The Bus Coupler can only be restarted either by switching the power supply OFF and ON again, or by a software reset.
3. Hot Swap NOT Permitted: Always remove power from the system before inserting or removing bus terminals or couplers as failure to do so could cause malfunction or damage to the terminals, couplers or other connected devices.
4. The occurrence of a fault in the course of operation does not immediately trigger the display of Error Codes by the LEDs. The Bus Coupler must be requested to diagnose the Bus Terminals. The diagnostic request is generated after switching ON.

Fieldbus Errors

The Protos X PX-TCP1, PX-TCP2, and PX-MOD Bus Couplers have built-in watchdog timer functions for end user applications. The watchdog timer functionality provides controlled output handling in the event of communication loss. When the watchdog timer is enabled by any Modbus Write message, the outputs will stay active as long as there are incoming Modbus read or write messages (If 0x1122 set to 1). Or as long as there are incoming Modbus write messages (If 0x1122 set to 0). In the event that the incoming Modbus messages are interrupted for a period longer than the watchdog timer value setting, the outputs will turn OFF. At this point, the end user must re-establish communications to the Bus Coupler and send a watchdog reset command to the device in order to re-enable the outputs. Alternately cycle power to the Bus Coupler, or use the PX-CFGSW to reboot the coupler.

The watchdog timer can be disabled under Tools> Options when connected with the PX-CFGSW. **However if communication is lost, the bus terminal outputs will remain in their last state and will not update until communication is re-established.**

The end user application interfaces with the watchdog timer functionality through pre-defined Modbus TCP registers. The specific registers and Modbus addresses are shown below.

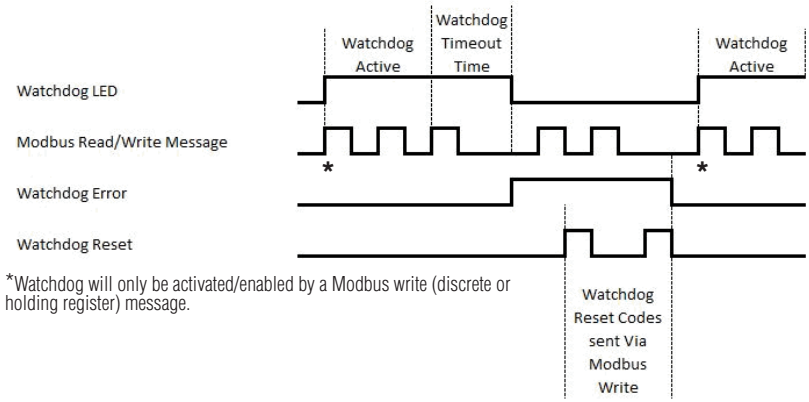
Watchdog Interfacing Addresses					
Address (Hex)	***Address (Dec)***	***Modicon Modbus Addressing***	***Type***	***Description***	***Notes***
0x1120	4384	44385	Read/Write	Watchdog Timer Value, (ms)	Default Value = 1000 Disable Timer = 0
0x1121	4385	44386	Read/Write	Watchdog Reset Register	Reset Command: Write 0xBECF then write 0xAFFE
0x1122	4386	44387	Read/Write	Watchdog Type	Read/Write message Watchdog = 1(default) Write message Watchdog = 0
0x100C	4108	44109	Read Only	Bus Coupler Status	Bit 15 = Fieldbus Error Watchdog time elapsed
0x1020	4128	44129	Read Only	Watchdog, current time (ms)	Time elapsed since last Modbus Message after Watchdog is active

The Watchdog Timer Value is stored in the Read/Write Modbus address 0x1120 (4384 dec.) in the coupler. The value can be read at any time using a Modbus Read message. However the value can only be written to prior to the Watchdog being made active by a Modbus Write message to one of the configured output addresses and it can only be written to if the Bus Coupler is not in a watchdog fault state. If a Modbus Write message is attempted during either of these states a Modbus fault 02 Illegal Data Address will be returned from the Bus Coupler. The watchdog timer value can also be changed using the Protos X Configuration software.

NOTE: *If you only have Inputs, the Watchdog settings do not matter since without an Output to write to, the Watchdog cannot be enabled.*

Reset the watchdog timer and clear the error condition in order to change the watchdog timer value. Read the Bus Coupler status register (bit 15 of register 0x100C) in order to see if the Bus Coupler watchdog timer has elapsed. Bit 15 will clear after a successful Watchdog Reset Command write sequence. The Watchdog Reset Command consists of writing the value 0xBECF (48847 dec.) to address 0x1121 and then writing the value 0xAFFE (45054 dec.) to address 0x1121. See timing chart below.

During the watchdog timer elapsed state, Modbus writes to the Bus Coupler will fail with Modbus Exception Error Code 4 (SLAVE DEVICE ERROR).

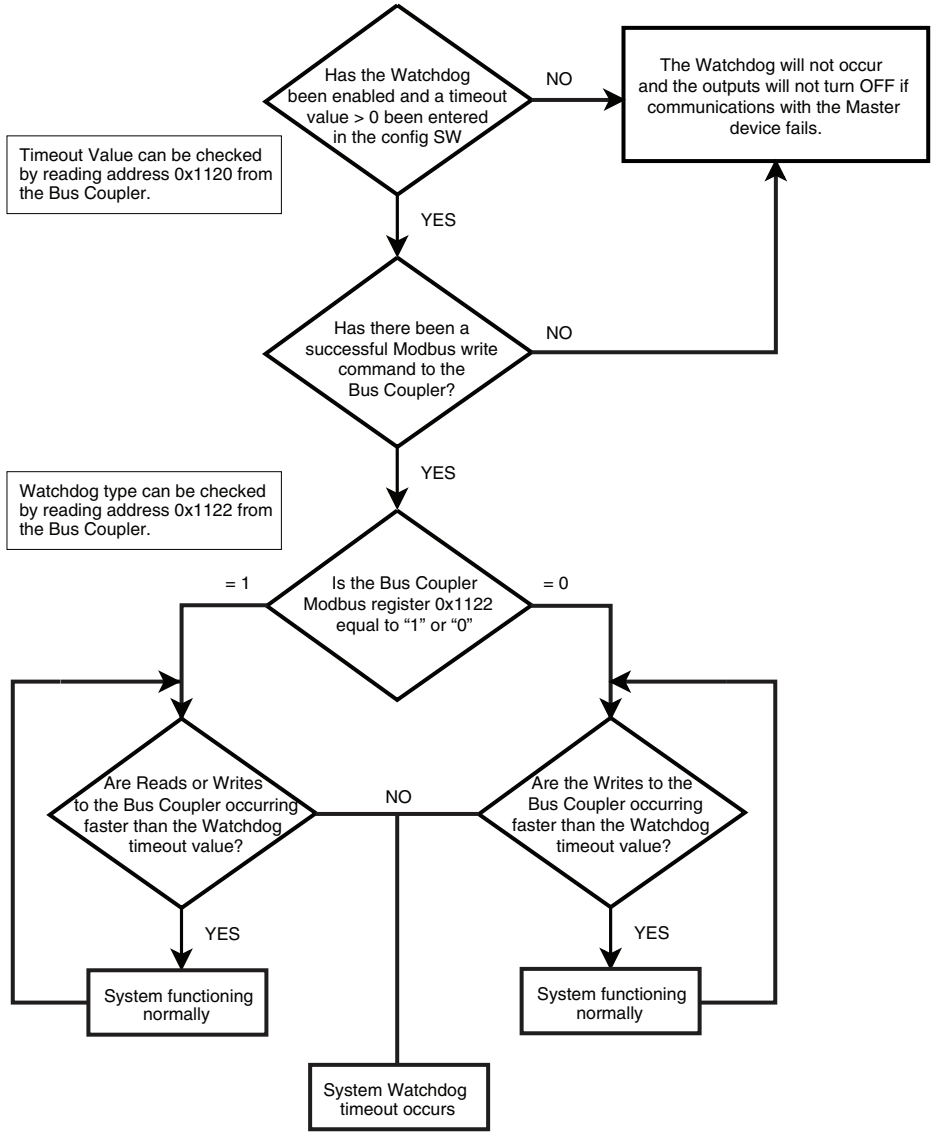


The Watchdog Type determines how you want the Watchdog fault to work. If there is a "1" in this register a Modbus Write message will initiate the Watchdog timer and the Watchdog will become active. In this mode, any read or write message will keep the Watchdog active as long as they happen before the Watchdog timeout value has been exceeded. If there is a "0" in this register a Modbus Write message will initiate the Watchdog timer and another Modbus Write must be performed before the Watchdog timeout value has been exceeded to keep the coupler from having a Watchdog Fault.

To monitor the current time elapsed in the Watchdog timer a Modbus Read message can be used to get the value in Modbus register 0x1020 (4128 dec.). This value will show how much time has elapsed since a Modbus message has reset the Watchdog Timer last. If this time reaches or exceeds the value in the Watchdog Timer Value a Watchdog Fault will occur.

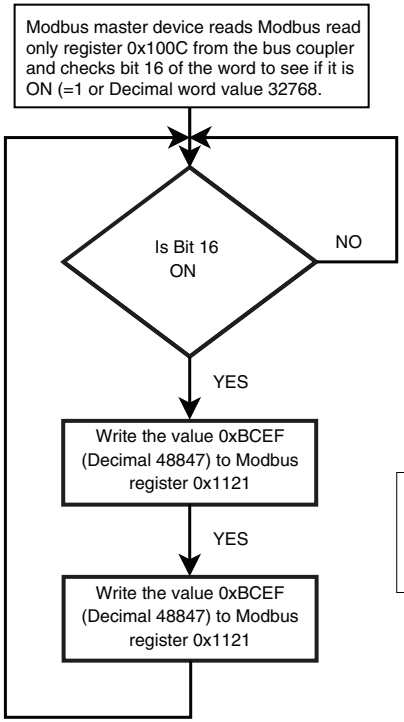
The PX-MOD will not allow Modbus Read or Write messages to the I/O data if the bus coupler is in the Watchdog timeout condition. The PX-TCP1 and PX-TCP2 will allow Modbus Reads of inputs, but Modbus Writes to Outputs will fail if the bus coupler is in the Watchdog timeout condition.

Watchdog Enable/Activate



When the Watchdog occurs the PX-MOD will not allow Modbus Reads or Writes to Inputs or Outputs. When a Watchdog occurs, the PX-TCP1 and PX-TCP2 bus couplers will still allow Modbus Reads from Inputs to work, but all Modbus Writes to Outputs will fail. Bus coupler registers can continue to be read from or written to with all bus coupler models.

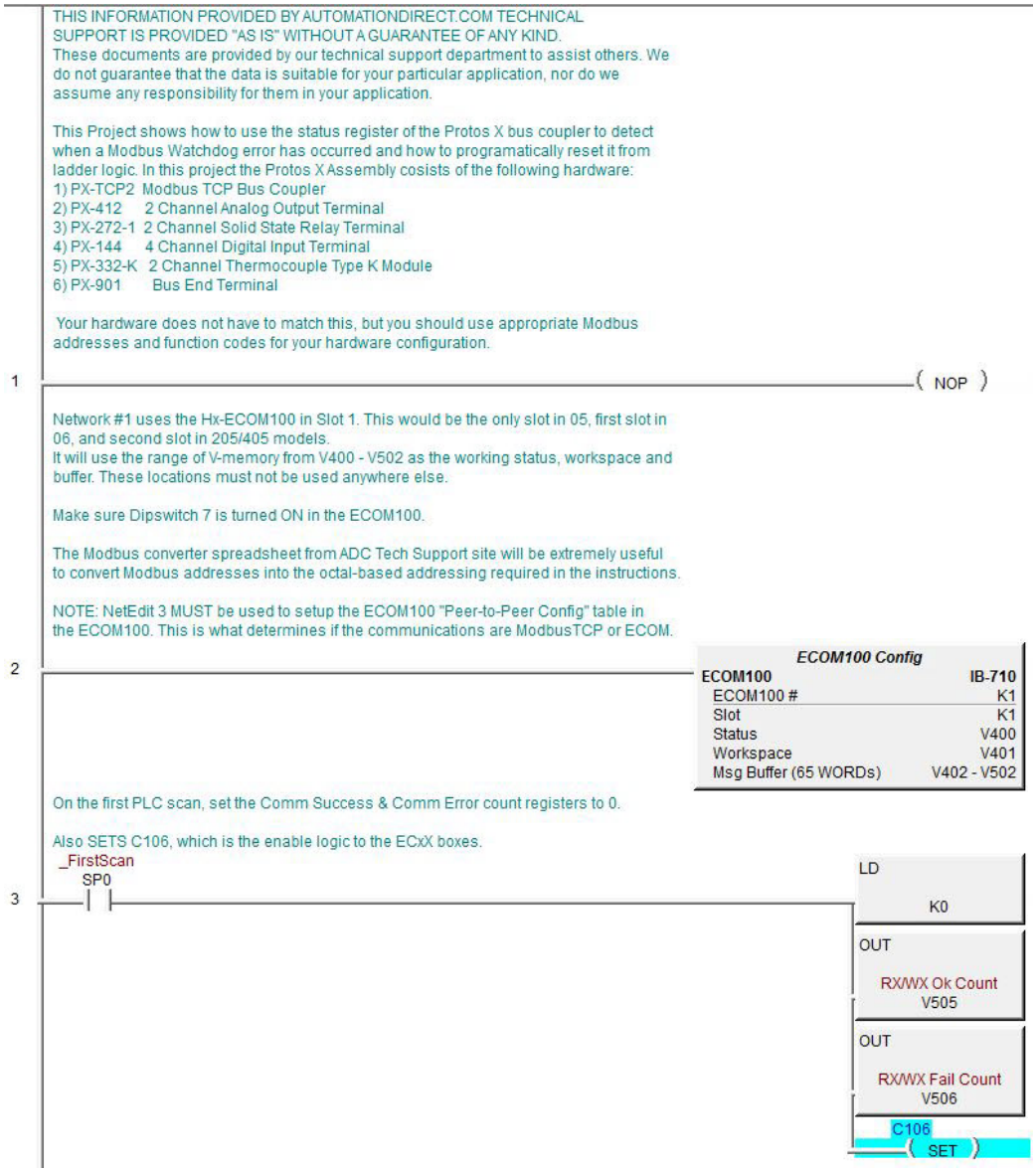
Resetting Watchdog Errors



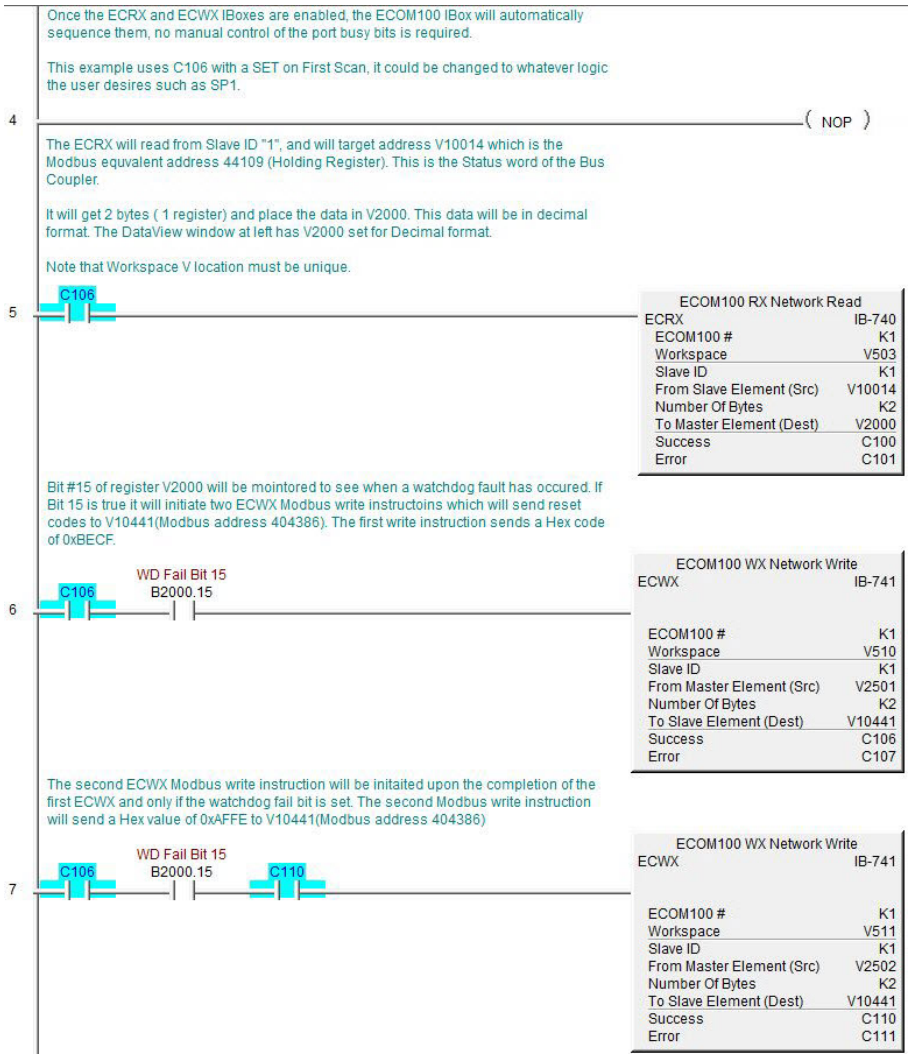
When using Decimal register use Unsigned Integer data types to read and write to bus coupler registers. When writing to the bus coupler, make sure to write to a single register so data is only written to the target register.

Resetting Watchdog Errors

DirectLOGIC PLC Ladder Example



Resetting Watchdog Errors - DirectLOGIC PLC Ladder Example, continued



Resetting Watchdog Errors - DirectLOGIC PLC Ladder Example, continued

The ECWX will write to Slave ID "1", and will target address V4010 which is the Modbus equivalent of 42057 third Holding Register.

It will write 2 bytes (1 registers) from the PLC addresses V2500 . This address will be displayed as decimal in dataview, but it will represent the binary value of the bits of the word. If the value is "1" then bit "1" will be true, if the value is "2" bit "2 will be true, if the value is "3" then bits "1" and "2" will be true. Any decimal value that have bits "1" or "2" will turn on the outputs of the terminal.

Note that Workspace location must be unique.

8 C106

ECOM100 WX Network Write	
ECWX	IB-741
ECOM100 #	K1
Workspace	V504
Slave ID	K1
From Master Element (Src)	V2500
Number Of Bytes	K2
To Slave Element (Dest)	V4010
Success	C102
Error	C103

The ECRX will read from Slave ID "1", and will target address TA5 (V2005) which is the Modbus equvalent address 40006 (Holding Register).

It will get 2 bytes (1 registers) and place the data in V2001. This data will be in decimal format. The DataView window at left has V2001 (CH1 Temp) set for Decimal format.Since the value is coming from a temperature module and the data is in Celcius format it needs to be converted to Fahrenheit. So it must be changed to the Real format to display decimal places. To do this we load V2001 into the accumualtor, perform a Binary to Real conversion and then output the converted value to V2002 - V2003. We then use a Math Real instruction to run the Celcius to Fahrenheit conversin formula on the data and put it into V2004 - V2005.

Note that Workspace V location must be unique.

9 C106

ECOM100 RX Network Read	
ECRX	IB-740
ECOM100 #	K1
Workspace	V507
Slave ID	K1
From Slave Element (Src)	TA5
Number Of Bytes	K2
To Master Element (Dest)	V2001
Success	C104
Error	C105

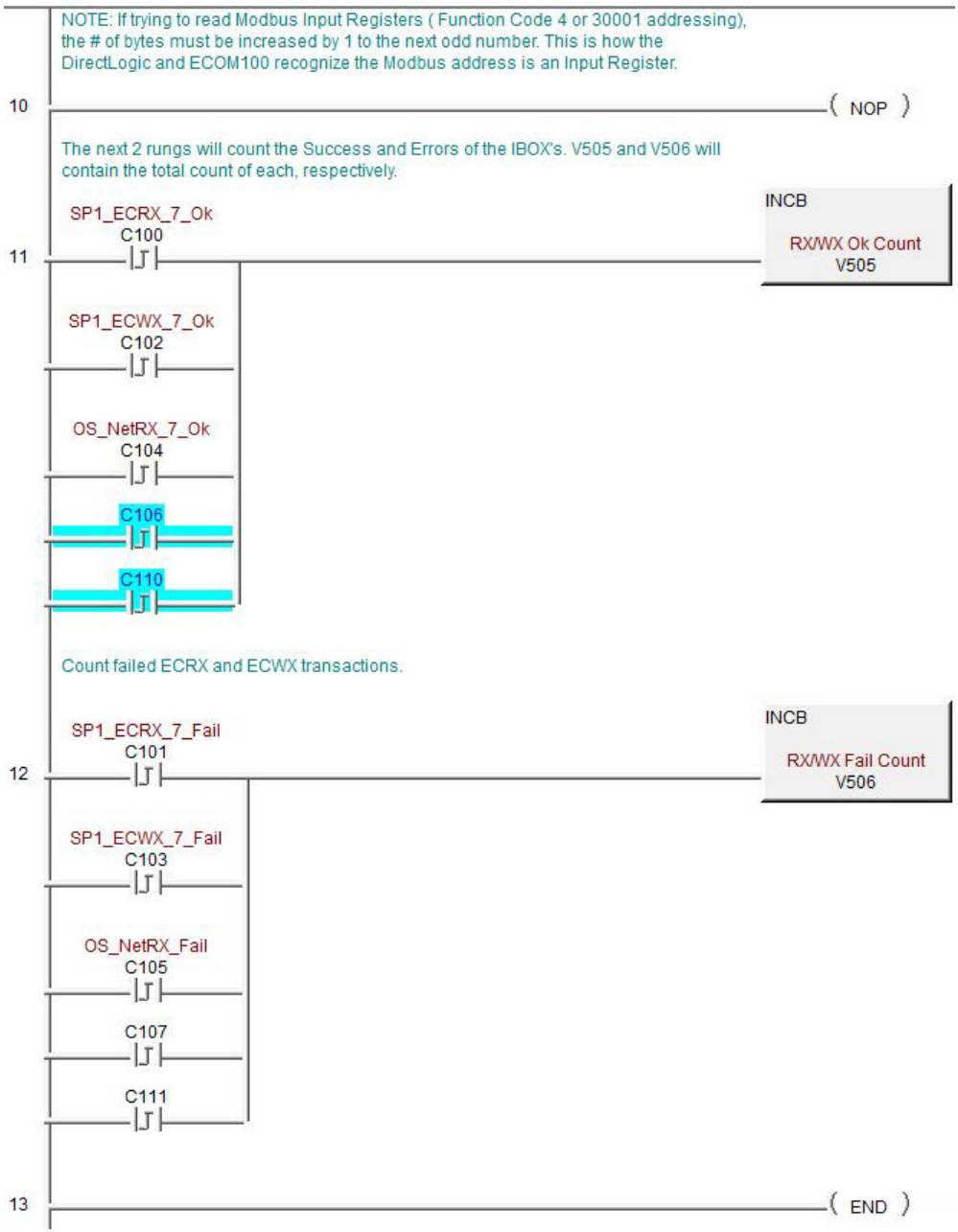
LD
CH1 Temp
V2001

BTOR

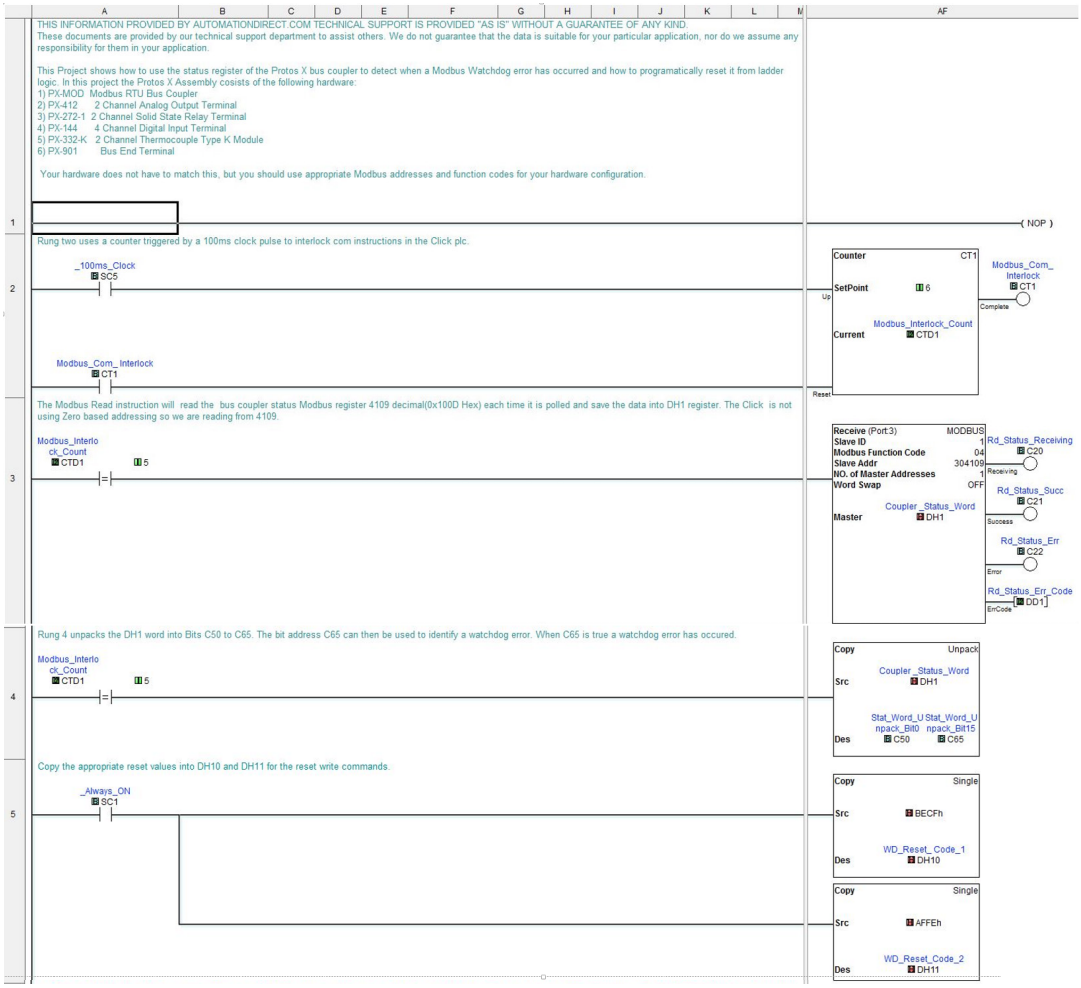
OUTD
V2002

Math - Real	
MATHR	IB-541
Result	70.34
Expression	((R9 / R5) * V2002 * R0.1) + R32

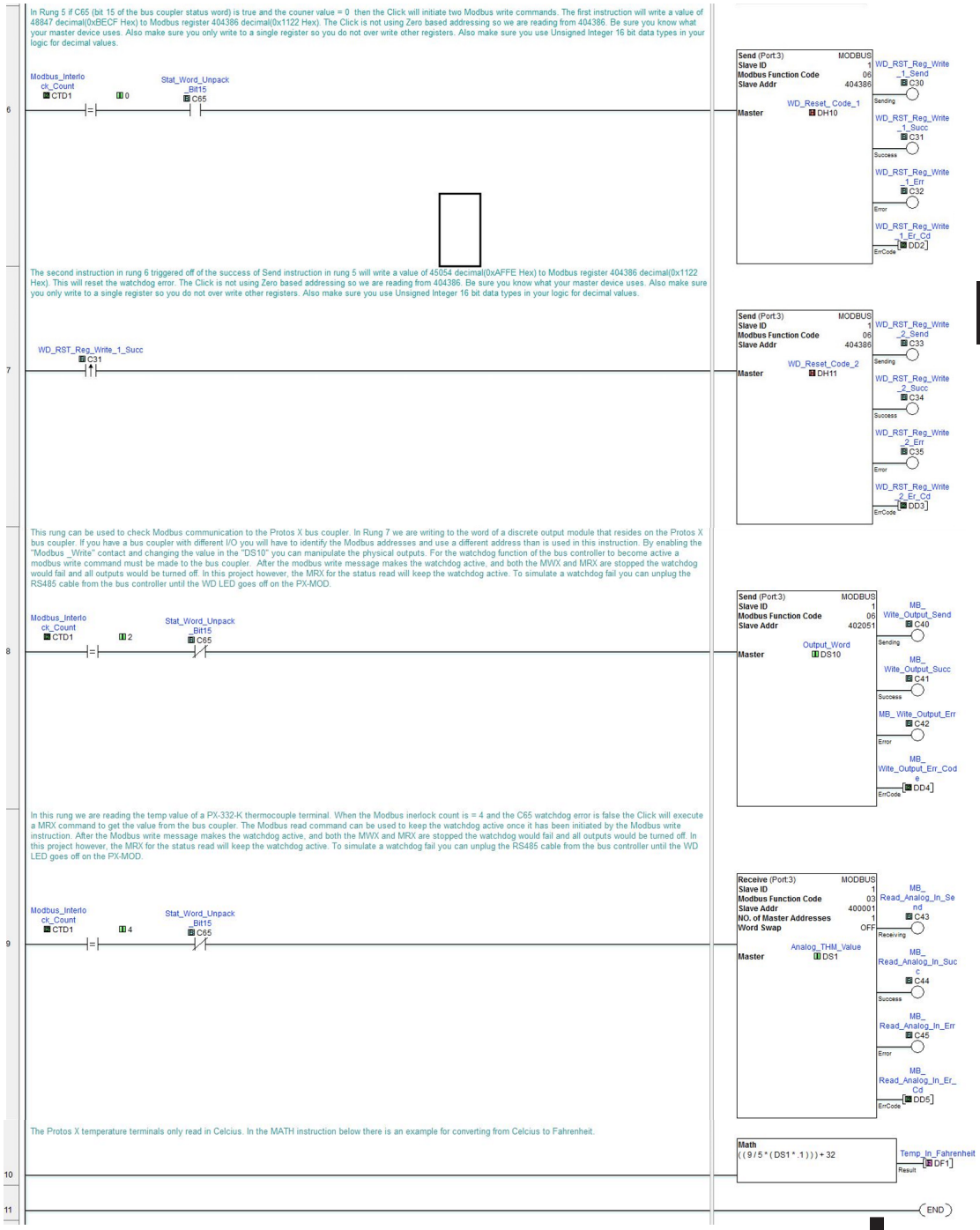
Resetting Watchdog Errors - DirectLOGIC PLC Ladder Example, continued



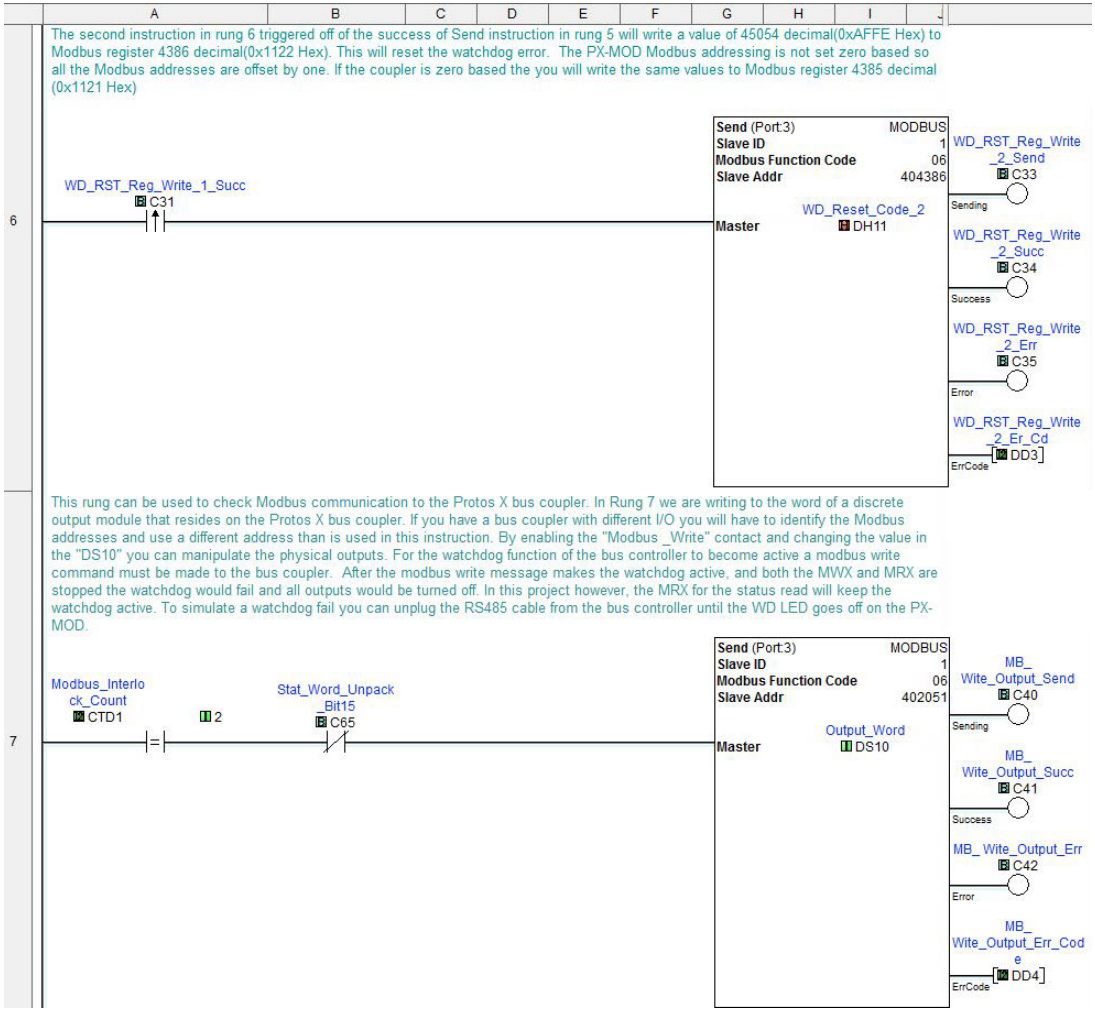
Resetting Watchdog Errors, continued - CLICK Ladder Example



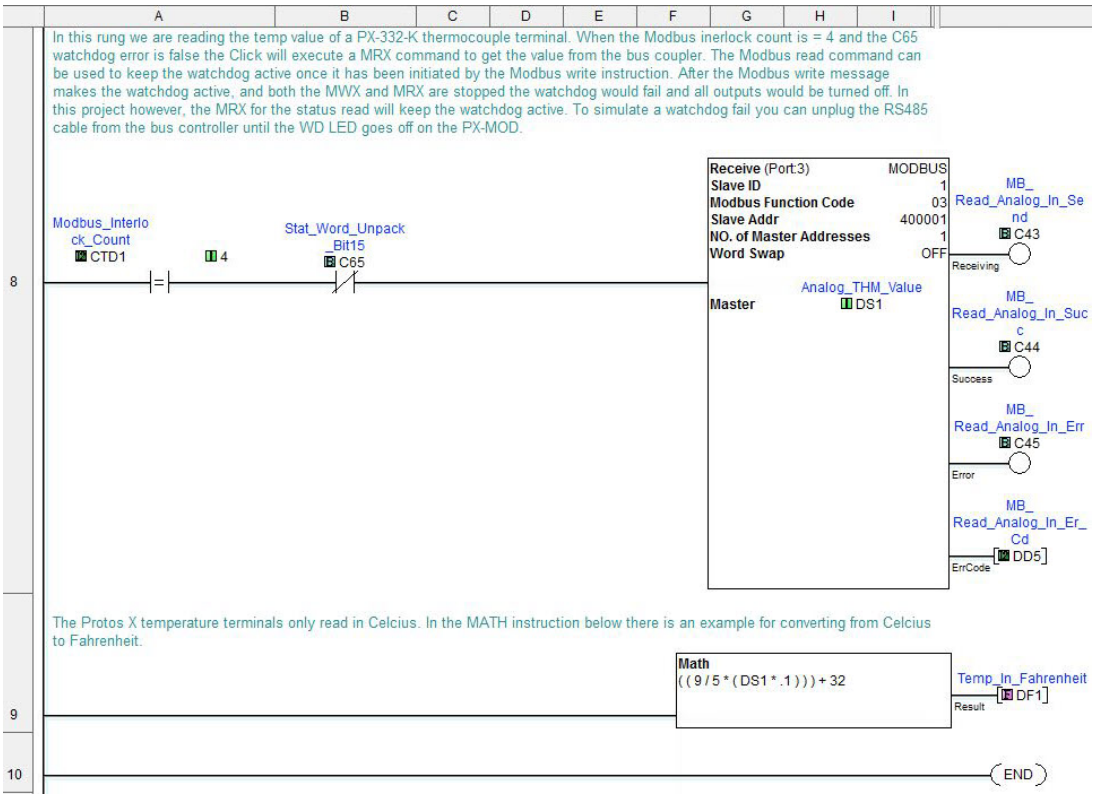
Resetting Watchdog Errors, continued - CLICK Ladder Example, continued



Resetting Watchdog Errors, continued - CLICK Ladder Example, continued



Resetting Watchdog Errors, continued - CLICK Ladder Example



Resetting Watchdog Errors, continued - Do-more Ladder Example

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This Project shows how to use the status register of the Protos X bus coupler to detect when a Modbus Watchdog error has occurred and how to programatically reset it from ladder logic. In this project the Protos X Assembly cosists of the following hardware:
1) PX-TCP2 Modbus TCP Bus Coupler
2) PX-412 2 Channel Analog Output Terminal
3) PX-272-1 2 Channel Solid State Relay Terminal
4) PX-144 4 Channel Digital Input Terminal
5) PX-332-K 2 Channel Thermocouple Type K Module
6) PX-901 Bus End Terminal

Your hardware does not have to match this, but you should use appropriate Modbus addresses and function codes for your hardware configuration.

1 NOP

The Modbus Read instruction will continually read the bus coupler status Modbus register 4109 decimal(0x100D Hex and save the data into V2000 register. Bit # 15 of word V2000 will represent the watchdog error. If this bit is true a watchdog error has occurred. The PX-TCP2 Modbus addressing is not set to zero based so all the Modbus addresses are offset by one. If the coupler is set zero based and your controller supports it then you will read from Modbus register 4108 decimal(0x100C Hex).

2

MRX	Modbus Network Read
Device	@IntModTCPClient
IP Address	10.1.32.16
TCP Port Number	502
Unit ID	255
Function Code	3 - Read Holding Registers
Modbus Address 4...	+ offset value entered below
From Modbus Offset Address	4109
Number of Modbus Registers	1
To Do-more Memory Address	V2000
Continuous at Interval	0.100s
On Success, Set bit	C1
On Error, Set bit	C2

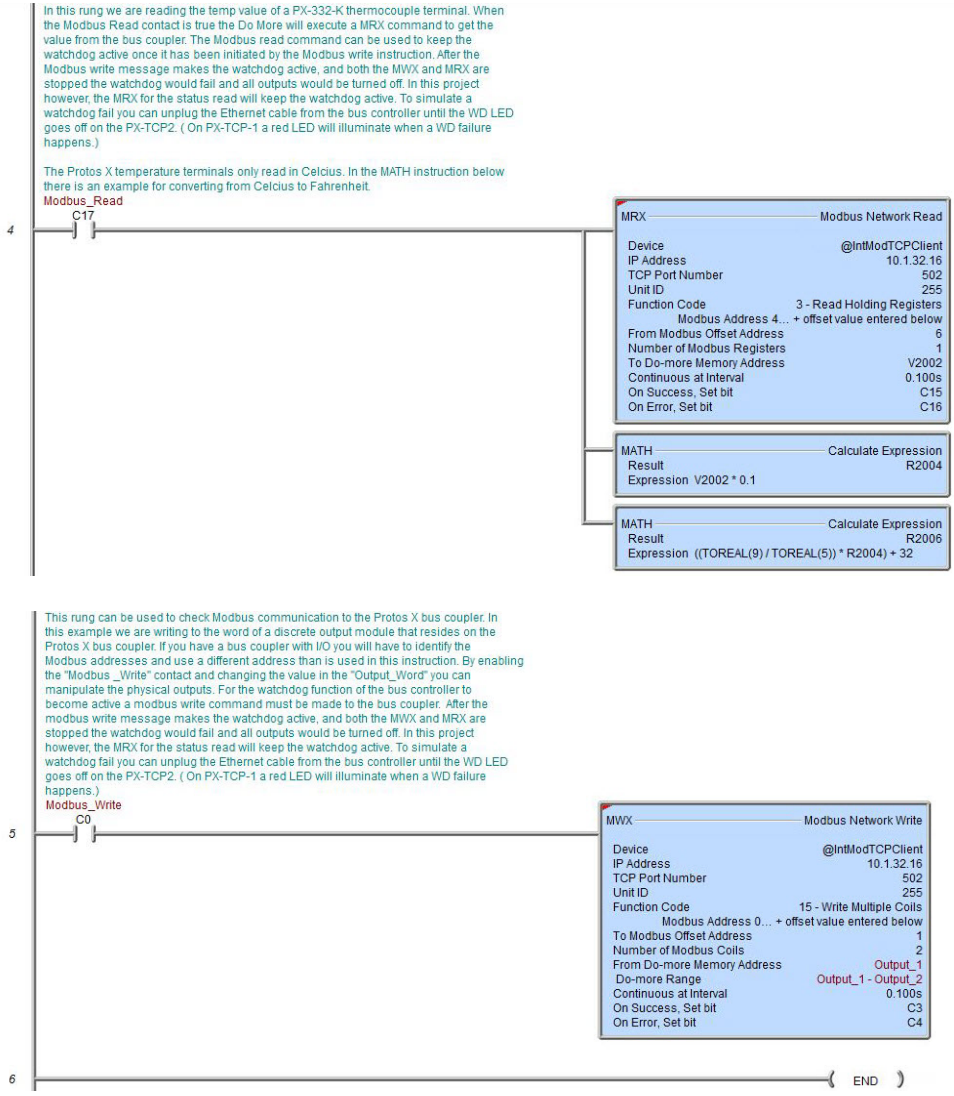
In this logic if V2000:15 (bit 15 of the bus coupler status word) is true then the Do More will initiate two Modbus write commands. The first instruction will write a value of 48847 decimal(0xBECF Hex) to Modbus register 4386 decimal(0x1122 Hex). The second instruction will write a value of 45054 decimal(0xAFFE Hex) to Modbus register 4386 decimal(0x1122 Hex). This will reset the watchdog error. The PX-TCP2 Modbus addressing is not set zero based so all the Modbus addresses are offset by one. If the coupler is zero based the you will write the same values to Modbus register 4385 decimal (0x1121 Hex)

3 V2000:15

MWX	Modbus Network Write
Device	@IntModTCPClient
IP Address	10.1.32.16
TCP Port Number	502
Unit ID	255
Function Code	6 - Write Single Register
Modbus Address 4...	+ offset value entered below
To Modbus Offset Address	4386
Constant	0xBECF
On Success, Set bit	C5
On Error, Set bit	C6

MWX	Modbus Network Write
Device	@IntModTCPClient
IP Address	10.1.32.16
TCP Port Number	502
Unit ID	255
Function Code	6 - Write Single Register
Modbus Address 4...	+ offset value entered below
To Modbus Offset Address	4386
Constant	0xAFFE
On Success, Set bit	C7
On Error, Set bit	C8

Resetting Watchdog Errors, continued - Do-more Ladder Example, continued



Resetting Watchdog Errors - P3000 Ladder Example

1 2 3 4 5 6 7 8 9 10 11

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This Project shows how to use the status register of the Protos X bus coupler to detect when a Modbus Watchdog error has occurred and how to programatically reset it from ladder logic. In this project the Protos X Assembly cosists of the following hardware:
1) PX-TCP2 Modbus TCP Bus Coupler
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4) PX-144 4 Channel Digital Input Terminal
5) PX-332-K 2 Channel Thermocouple Type K Module
6) PX-901 Bus End Terminal

Your hardware does not have to match this, but you should use appropriate Modbus addresses and function codes for your hardware configuration.

1 NOP

The Modbus Read instruction will continually read the bus coupler status Modbus register 4109 decimal(0x100D Hex and unpack the data into bits. Bit # 15 will represent the watchdog error. If this bit is true a watchdog error has occurred. The PX-TCP2 Modbus addressing is not set to zero based so all the Modbus addresses are offset by one. If the coupler is set to zero based and the controller messaging it supports zero based then you will read from Modbus register 4108 decimal(0x100C Hex).

PX-TCP2 Status Register

2 Enable

MODBUS READ
Ethernet Port CPU-ETH-Ext
IP Address 10.1.32.16
TCP Port Number 502
Slave Node Number 255
Automatic Polling 500 / 0
Don't Skip Execution
Word Swap
No 32 Bit to 16 Bit Mapping
Slave Modbus Starting Address 4109
Modbus Decimal Addressing
Modbus Function Code
3: Read Holding Registers
Tag Name Mapping
Non-Array Tag
PX_TCP2_Satus
In Progress Read_1.InProgress
Complete Read_1.Complete
Success Read_1.Success
Error Read_1.Error
Timeout Read_1.Timeout
Exception
Response String Read_1.ExcResponse

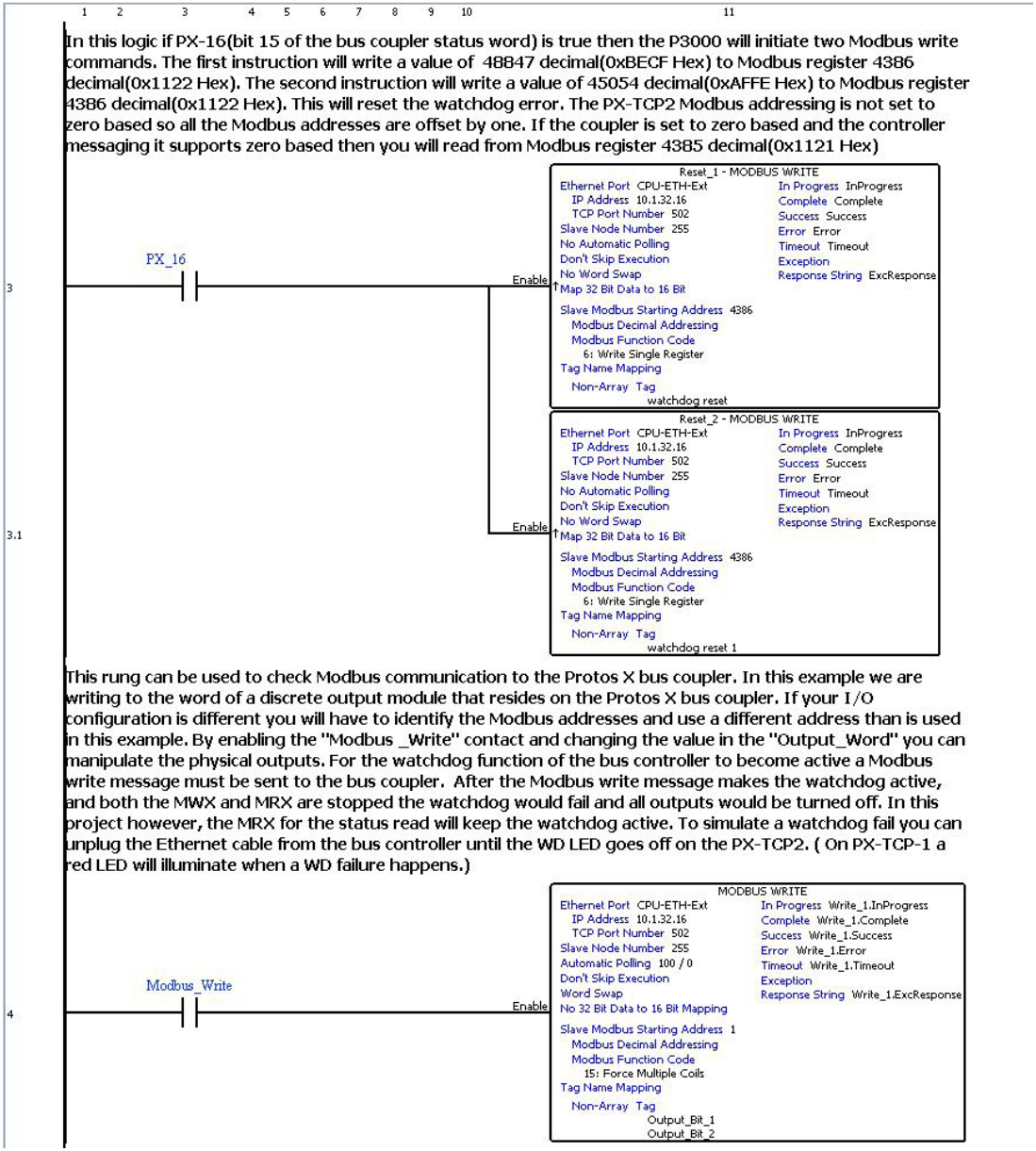
Un pack bits from PX-TCP-2 Status Register

2.1 Enable

UNPACK BITS
Input PX_TCP2_Satus

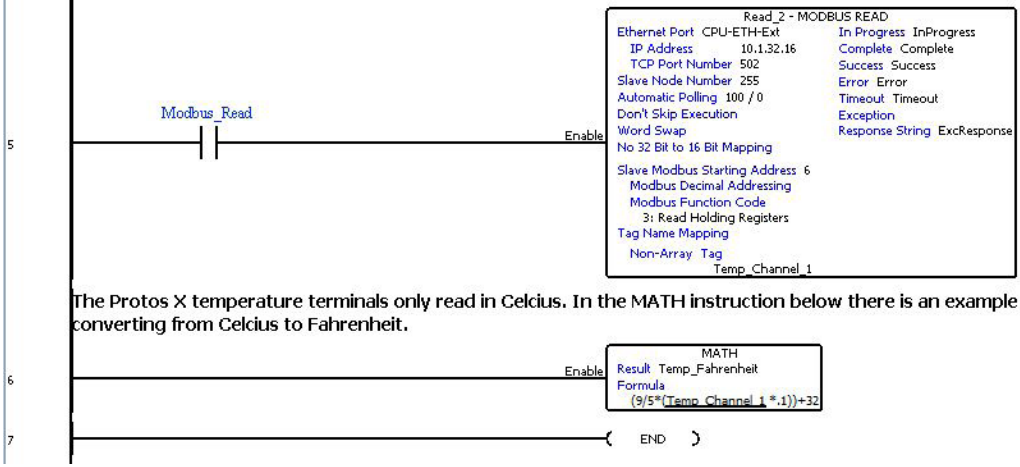
Bit Number	Output
1	PX_1
2	PX_2
3	PX_3
4	PX_4
5	PX_5
6	PX_6
7	PX_7
8	PX_8
9	PX_9
10	PX_10
11	PX_11
12	PX_12
13	PX_13
14	PX_14
15	PX_15
16	PX_16

Resetting Watchdog Errors - P3000 Ladder Example, continued



Resetting Watchdog Errors - P3000 Ladder Example, continued

In this rung we are reading the temp value of a PX-332-K thermocouple terminal. When the Modbus Read contact is true the P3000 will execute a MRX command to get the value from the bus coupler. The Modbus read command can be used to keep the watchdog active once it has been initiated by the Modbus write instruction. After the Modbus write message makes the watchdog active, and both the MWX and MRX are stopped the watchdog would fail and all outputs would be turned off. In this project however, the MRX for the status read will keep the watchdog active. To simulate a watchdog fail you can unplug the ethernet cable from the bus controller until the WD LED goes off on the PX-TCP2. (On PX-TCP-1 a red LED will illuminate when a WD failure happens.)



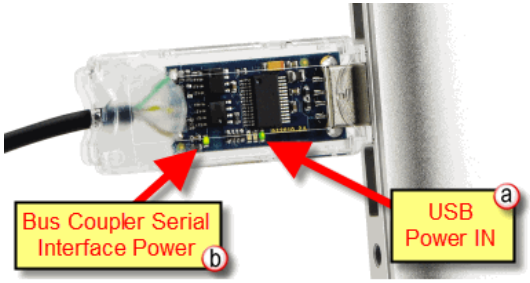
The Protos X temperature terminals only read in Celcius. In the MATH instruction below there is an example for converting from Celcius to Fahrenheit.

Protos X Configuration Software Troubleshooting

If the Protos X configuration software has been started, a connect has been attempted, and the dialog box displaying the hardware configuration does not display, use the troubleshooting steps below.

Confirm Power Supply to USB Device

Make sure the PX-USB-232 serial cable green LEDs are illuminated as shown below.



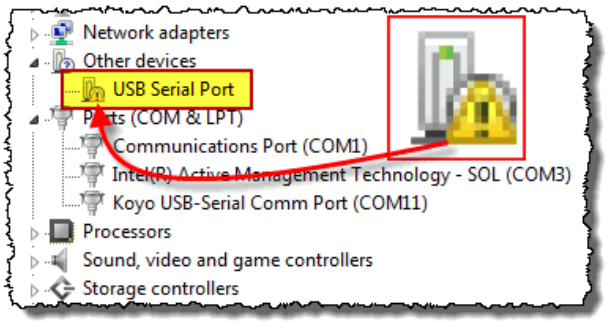
a. The USB Power IN LED should be green if the USB device is in a good USB port being powered by the PC.

b. The Bus Coupler Serial Interface Power LED should be green if the Bus Coupler is powered up and the connection is good.

Verify the PX-USB-232 Driver Installation

Ensure that the PX-USB-232 USB Driver was installed properly. To verify the installation follow these steps:

1. Go to the Device Manager on your PC and verify the USB Device is in the list under Ports. If there are multiple devices listed and if not sure which one is the device, unplug the PX-USB-232 and see if any of the listed devices go away. If so, plug the PX-USB-232 device back in and verify it shows up under the Ports list.
2. If the driver does not show up under the Ports list look elsewhere in the Device Manager. If the driver for this device did not install correctly it will usually show up under Other Devices or Universal Serial Bus Controllers with an exclamation point beside it as shown below.

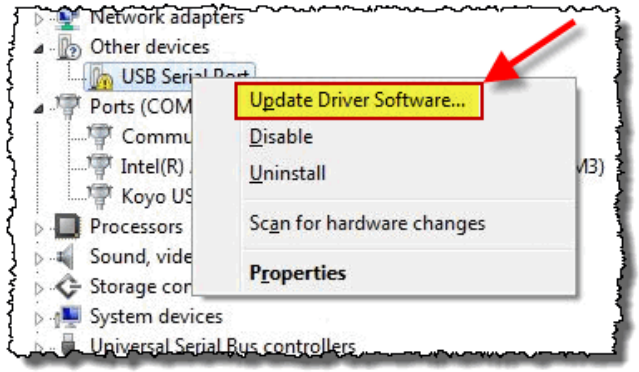


3. If the driver shows up in the Device Manager with the exclamation symbol, or anywhere other than the Ports level, you have two options. You can uninstall and reinstall the software, making sure any antivirus software is disabled and the UAC on your PC is set to "Never Notify" (Win 7 and 8), or you must manually update the driver for the USB device.

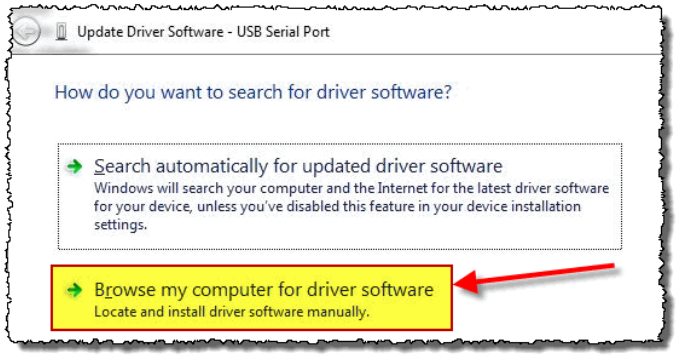
   To update the USB driver:

   a. Go to Device Manager and find the device as explained in the preceding steps.

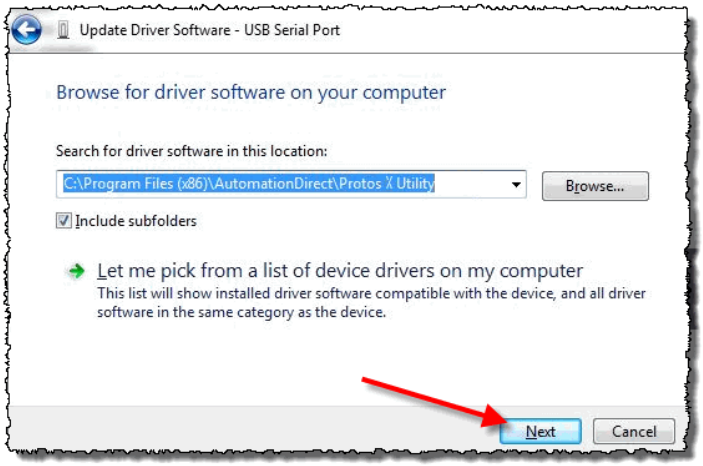
   b. Select and Right Click on the device. This will open the drop down menu shown below.



   c. From the drop down menu, select "Update Driver Software". A window will open with the choices shown below.

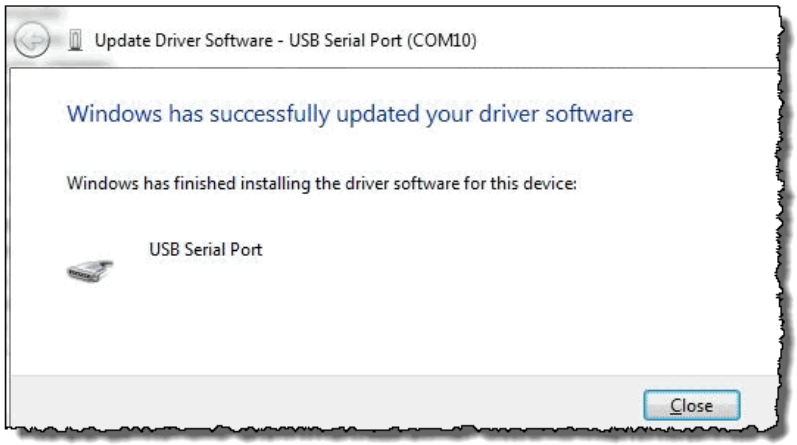


   d. From this window, click on "Browse my computer for driver software". This will open a window where you can select the location of the Driver software.

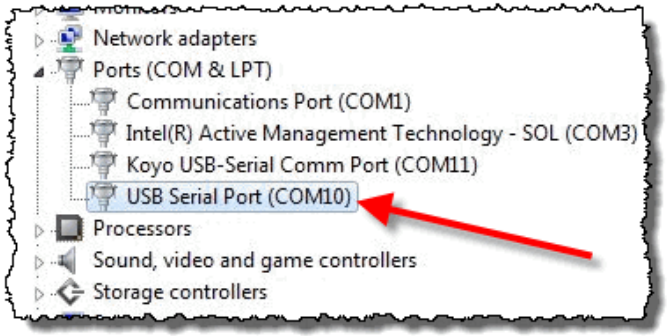


e. Use the Browse box to go to the location shown on the graphic above: C:\ Program Files (x86)\AutomationDirect\Protos X Utility or the directory where the software was installed to.

f. Click on "Next" and the driver should install. Once installation is complete the following dialog will display:



4. If the Driver Update was successful, go back to your Device Manger in the Control Panel and check that the device is properly installed. The device should be under the Ports section as shown on the following page (COM number might be different).

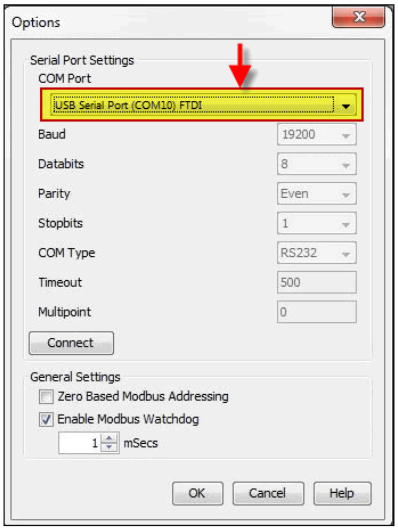


Cannot Connect After Verifying Previous Steps

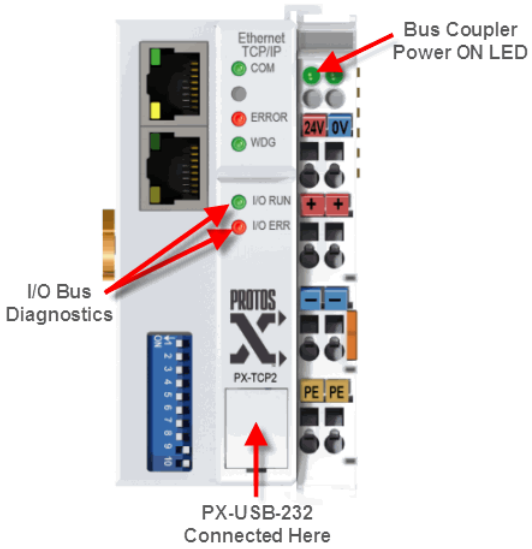
If you still cannot connect, the dialog box shown below should display.

In this case try the following steps:

1. Click on "OK" to close the error window and confirm that the COM Port matches the one identified in the Device Manager. For example, in the graphic on Step 4 above, COM10 is displayed. Go to the Options window (see below), and verify the selected COM Port matches the COM Port (COM10) shown in the Device Manager.



2. If the connection still fails, make sure the PX-USB-232 serial cable is connected to the Protos X Bus Coupler and the power to the Coupler is ON.



3. On the Bus Coupler the green I/O Run LED should be blinking quickly and the red I/O Error LED should NOT be flashing. If the red LED is flashing, verify that the Bus End Terminal is in place.

NOTES:

GLOSSARY

Bus Controller

Provides interface to the fieldbus via serial or Ethernet communications using Modbus protocol or EtherNet/IP network. Sends data to the I/O Bus and provides power to the Terminal Power Bus. Includes status LEDs.

Bus End Terminal

Required at the end of a terminal assembly and is used to terminate the I/O bus. Not required if using a bus expansion end terminal.

Bus Expansion Coupler Terminal

Used in place of the Bus Controller in an expansion assembly when expanding to a Terminal Group. If used in the first expansion assembly of a group, connect to a Bus Expansion End Terminal via RJ45 port. If used in any other expansion assembly, connect to the preceding Bus Expansion Coupler Terminal via one port, and to an additional Bus Expansion Coupler Terminal through a second port.

Bus Expansion End Terminal

Used at the end of the Bus Controller terminal assembly when expanding to a Terminal Group. Connects to a Bus Expansion Coupler Terminal via RJ45 port.

I/O Bus

Provides a data path across the terminal assembly. Requires a Bus End Terminal at the end of the assembly to terminate the I/O Bus.

I/O Bus Contacts

Six contacts located on the upper right side of a Bus Coupler or Terminals to pass the I/O bus data.

Power Terminals

Used to introduce, separate or distribute power along the Terminal Power Bus.

Terminal Assembly

Comprised of a Bus Controller, up to 64 Terminals, and a Bus End Terminal.

Terminal Group

Comprised of two or more Terminal Assemblies.

Terminal Power Bus

Provides power to the Terminals.

Terminal Power Bus Contacts

Three spring contacts located on the lower right side of a Bus Coupler or Terminal pass power through three blade contacts located on the lower left side of adjoining Terminals.