
I/O Pro 812u Integration Guide



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Important changes are listed in **Document revision history** at the end of this document.

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What is this integration document about?

This document provides instructions on integrating the I/O Pro 812u into the Building Automation System (BAS), that speaks one of the following protocols:

- *BACnet over ARC156* (page 4)
- *BACnet MS/TP* (page 7)
- *BACnet PTP* (page 13)
- *BACnet over IP* (page 16)
- *BACnet over Ethernet* (page 21)
- *Modbus* (page 23)
- *N2* (page 30)
- *LonWorks* (page 34)

Assumption The controller has been configured by the factory and is functioning correctly. The factory should supply you, the site integrator, with an object listing which enables you to gather information from the controller.

What are protocols?

Protocols are the communication languages spoken by control devices. They communicate information in the most efficient method possible. Different protocols provide distinct information for different applications.

In the BAS application, many different protocols are used, depending on the manufacturer. It is advantageous for the entire facility to be linked together and presented in one front end.

For 2 devices to communicate with each other, they must speak the same protocol or have a protocol translator. All of our controllers have the ability to speak multiple protocols. No matter what controls are present in the rest of the building, our controller communicates with them without the added cost of a gateway.

How do protocols work?

Protocols are a set of formal rules describing how to transmit data, especially across a network. They are a language spoken between electronic devices. For 2 devices to communicate with each other, they must speak the same protocol or have a protocol translator. A protocol example is IP (Internet Protocol).

A low level protocol defines:

- Electrical and physical standards of the hardware
- Bit-and-byte-ordering
- Transmission, error detection, and correction of the bit stream

What is this integration document about?

A high level protocol deals with data formatting, including:

- Syntax of messages
- Terminal-to-computer dialogue
- Character sets
- Sequencing of messages

There are many different protocols because any 2 pieces of building management equipment can vary in application or protocol. Protocols make applications more efficient.

Benefits

- Manufacturers can provide a controller with their units, which can be seamlessly integrated into a BAS.
- Upgrade and expansion costs are competitive.
- Expensive gateways are eliminated.
- Field selection of the protocol requires less up-front coordination, which reduces manufacturing costs.
- Simple configuration and flexibility allow future additions and changes without additional costs.

What do you need for the integration?

The building owner must supply the integrator with the following information:

- Unit-specific object listing (for LonWorks, an XIF file may be required.) See *Obtaining LonWorks object mapping (XIF file)* (page 38).

After the integration is complete, the integrator supplies the building owner with:

- Device address(es)
- Network baud rate
- Network numbers (BACnet only)



CAUTIONS

- The I/O Pro 812u is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Do not power pilot relays from the same transformer that powers the I/O Pro 812u.
- OEMCtrl controllers can share a power supply as long as you:
 - Maintain the same polarity
 - Use the power supply only for OEMCtrl controllers
- The I/O Pro 812u has an operating range of 21.6 Vac to 26.4 Vac. If voltage measured at the I/O Pro 812u's input terminals is outside this range, the I/O Pro 812u may not work properly.

- Avoid running communication wires or sensor input wires next to AC power wires or the controller's relay output wires. The resulting noise can affect signal quality. Common sources of noise are:
 - Spark igniters
 - Radio transmitters
 - Variable speed drives
 - Electric motors (> 1hp)
 - Generators
 - Relays
 - Transformers
 - Induction heaters
 - Large contactors (i.e., motor starters)
 - Video display devices
 - Lamp dimmers
 - Fluorescent lights

Setting up and troubleshooting protocols



Do not apply line voltage (mains voltage) to the controller's comm ports.

BACnet

BACnet, which stands for Building Automation and Controls network, is a protocol developed by ASHRAE in response to industry concerns about increased networking of BAS components using proprietary communications methods. In the past, these proprietary communications severely limited the building owners' choices for system expansion, upgrade, and replacement. Every major controls vendor in North America, as well as academics, end users, consulting engineers, and government groups, participated in its development.

BACnet has been accepted as an open standard by the American National Standards Institute (ANSI) and the European CEN standards. It is also being adopted as an international ISO standard.

BACnet is designed to include all building systems, lighting, security, fire, heating, ventilation, and air conditioning. Its purpose is to promote interoperability - sharing data between systems made by different vendors.

It provides the necessary tools to develop a specification for systems that are interoperable. BACnet provides methods and standards for representing information, for requesting and interpreting information, and for transporting information.

NOTE The I/O Pro 812u's latest supported function codes and capabilities are listed on the associated Protocol Implementation Conformance Statement (PICS), *OEMCtrl BACnet PICS website* <http://www.bacnetinternational.net/catalog/index.php?m=47>.

BACnet over ARC156

ARCnet is an embedded networking technology well-suited for real-time control applications in both the industrial and commercial marketplaces. Its robust performance and the availability of low-cost silicon make it the network of choice in BAS's.

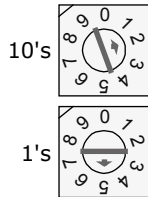
ARC156 is a unique implementation of ARCnet. ARC156 is similar to Master Slave/Token Passing (MS/TP). The main difference between them is speed. ARC156 baud rate is 156 kbps, whereas MS/TP tops out at 76.8 kbps.

Also, ARC156 uses a separate communications co-processor to handle the network traffic and a separate processor to handle the program execution. This provides faster processing of applications and handling of communications on the network. ARC156 is the standard communications method used by our controllers.

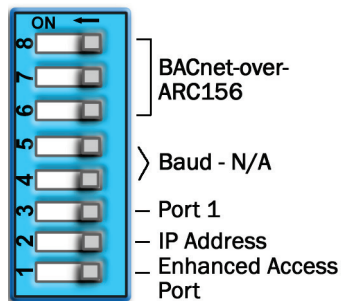
To set up the I/O Pro 812u for ARC156

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.

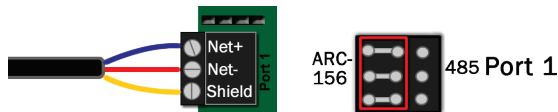


- 3 Comm selector DIP Switches **1 - 8** are all OFF.



- 4 Port 1 is the only port that speaks BACnet over ARC156. Connect the communications wiring to Port 1 in the screw terminals labeled **Net +**, **Net -**, and **Gnd**. Set Port 1 Mode jumper to ARC156.

NOTE Use the same polarity throughout the network segment.



Wiring specifications

The I/O Pro 812u network can consist of multiple network segments. Each segment of an I/O Pro 812u network must:

- Be wired in a daisy-chain configuration
- Be no longer than 2000 feet (610 meters)
- Have 32 or fewer devices (controllers and repeaters)

Have one of the following:

- A BT485 at each end (unless the segment is less than 10 feet [3 meters] long) to add bias and prevent signal distortions due to echoing.
- A 1/2 watt, 120 Ohm terminator at each end to prevent signal distortions due to echoing and one DIAG485 near the center of the network segment to add bias. You must put the DIAG485's **Bias** jumper in place.

- 5 Turn **on** the I/O Pro 812u's power.
- 6 Set the correct network number to the unique BACnet ARC156 network at the site.

Equipment Touch screen

BACnet Network Number	MAC Address
ARC156: 0	101
MSTP: 16160	0
Ethernet: 0	00-E0-C9-20-73-C9

Cancel Save

- 7 Set a unique Device Instance number.

Equipment Touch screen

BACnet Device Instance: 1616071

Auto Generate Device ID: Yes

Max Masters: 127

Max Info Frames: 10

Cancel Save

Troubleshooting ARC156 communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings

- ARC156 protocol DIP switches 6, 7, and 8
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 24XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

Software settings defined through the Equipment Touch device. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat.

BAS software settings - The two methods to interface with BACnet systems are Static Binding and auto-discovery. For Static Binding, the system integrator must know the Device Instance and Object listing before establishing communication. These are provided by the manufacturer. The device is set as a slave, which only speaks when asked questions directly. Dynamic Binding allows the system integrator to discover the device and its Object listing. The device is set as a master, which responds to a request when asked.

NOTE Certain systems can discover devices and Object listings, but may not save them permanently.

BAS reading or writing to the BACnet objects in the controller. The controller does not restrict communication to objects defined in the object listing or found through auto-discovery. If communication has been established, but you cannot write to an object, check the BACnet priority of the object (the device's default is 16).

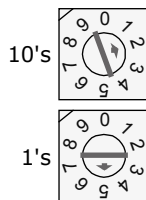
BACnet MS/TP

BACnet Master Slave/Token Passing or MS/TP is used for communicating BACnet over a sub-network of BACnet-only controllers. Each controller on the network has the ability to hear the broadcast of any other device on the network. The speed of an MS/TP network ranges from 9600 bps to 76.8 kbps.

To set up the I/O Pro 812u for BACnet MS/TP on Port 1

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



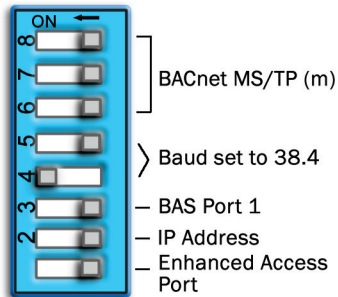
- 3 Set the Comm Selector DIP Switches **4** and **5** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate for all devices on the network segment.

Baud Rate	DIP Switch 4	DIP Switch 5
9600	Off	Off
19.2	Off	On
38.4	On	Off
76.8	On	On

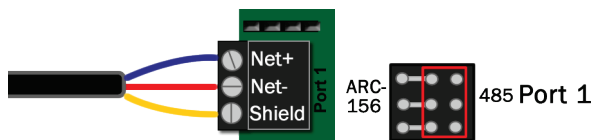
- 4 Set Comm Selector DIP Switch **3** OFF for BAS Port 1.
- 5 Set Comm Selector DIP Switches **6 - 8** OFF for MSTP (m).

The following example shows the DIP Switches set for 38.4k, Port 1, and MS/TP (m).



NOTE MS/TP (m) is recommended.

- 6 Connect the communications wiring to Port 1. Connect to **Net+**, **Net-**, and **Gnd**.
- 7 Set the Port 1 Mode jumper to 485.



Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Pro 812u

NOTE Use the same polarity throughout the network segment.

- 8 Turn **on** the I/O Pro 812u's power.
- 9 Set the correct network number to the unique BACnet MS/TP network at the site.

Equipment Touch screen

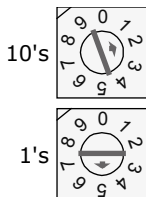
- 10 Set a unique Device Instance number.

Equipment Touch screen

To set up the I/O Pro 812u for BACnet MS/TP for Port 2a

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



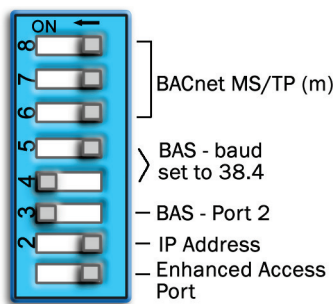
- 3 Set the Comm Selector DIP Switches **4** and **5** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate for all devices on the network segment.

Baud Rate	DIP Switch 4	DIP Switch 5
9600	Off	Off
19.2	Off	On
38.4	On	Off
76.8	On	On

- 4 Set Comm Selector DIP Switch **3** ON for Port 2.
- 5 Set Comm Selector DIP Switches **6 - 8** OFF for MSTP (m).

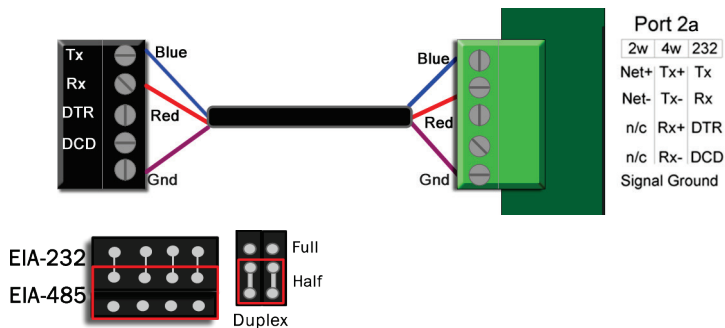
The following example shows the DIP Switches set for 38.4k, Port 2, and MS/TP (m).



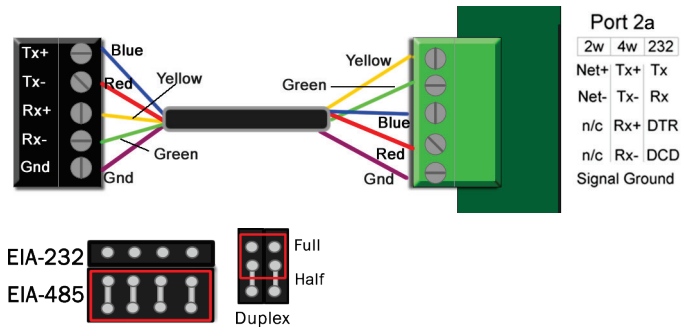
NOTE MS/TP (m) is recommended.

- 6 Connect the communications Port 2a wiring and set the jumpers.

- o **EIA-485, 2-wire**



- **EIA-485, 4-wire**



Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Pro 812u

NOTE Use the same polarity throughout the network segment.

- 7 Turn **on** the I/O Pro 812u's power.
- 8 Set the correct network number to the unique BACnet MS/TP network at the site.

Equipment Touch screen

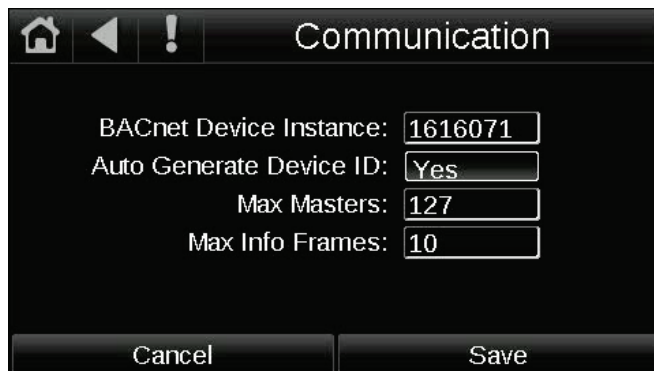
Router

BACnet Network Number	MAC Address
ARC156: 0	101
MSTP: 16160	0
Ethernet: 0	00-E0-C9-20-73-C9

Cancel Save

9 Set a unique Device Instance number.

Equipment Touch screen



Troubleshooting BACnet MS/TP communication

For detailed troubleshooting and a list of supported objects, get the controller's BACnet PICS from the *OEMCtrl BACnet PICS* website <http://www.bacnetinternational.net/catalog/index.php?m=47>. You must get your BACnet Object list from the manufacturer.

The most common communication problems are the result of not properly following the configuration steps outlined in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking BACnet MS/TP (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 4 and 5
- Protocol DIP switches 6, 7, and 8 Jumpers set to half duplex (2-wire) and EIA-485
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 24XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

BAS software settings - The two methods to interface with BACnet systems are Static Binding and auto-discovery. For Static Binding, the system integrator must know the Device Instance and Object listing before establishing communication. These are provided by the manufacturer. The device is set as a slave, which only speaks when asked questions directly. Dynamic Binding allows the system integrator to discover the device and its Object listing. The device is set as a master, which responds to a request when asked.

NOTE Certain systems can discover devices and Object listings, but may not save them permanently.

BAS reading or writing to the BACnet objects in the controller. The controller does not restrict communication to objects defined in the object listing or found through auto-discovery. If communication has been established, but you cannot write to an object, check the BACnet priority of the object (the device's default is 16).

It may be necessary to adjust the following MS/TP protocol timing settings using the Equipment Touch:

Max Masters - defines the highest MS/TP Master MAC address on the MS/TP network.

For example, if there are 3 master nodes on an MS/TP network, and their MAC addresses are 1, 8, and 16, then Max Masters would be set to 16 (since this is the highest MS/TP MAC address on the network).

This property optimizes MS/TP network communications by preventing token passes and “poll for master” requests to non-existent Master nodes.

In the above example, MAC address 16 knows to pass the token back to MAC address 1, instead of counting up to MAC address 127. Each MS/TP master node on the network must have their Max Masters set to this same value. The default is 127.

Max Info Frames - defines the maximum number of responses that will be sent when the I/O Pro 812u receives the token. Any positive integer is a valid number. The default is 10 and should be ideal for the majority of applications. In cases where the I/O Pro 812u is the target of many requests, this number could be increased as high as 100 or 200.

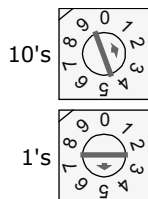
BACnet PTP

PTP is used to connect 2 distinct BACnet networks so that information can be shared between the networks. PTP uses an EIA-232 connection between 2 BACnet half-routers. This connection allows for 2 different BACnet networks to speak to each other, even at different baud rates.

To set up the I/O Pro 812u for BACnet PTP

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



- 3 Set the Comm Selector DIP Switches **4** and **5** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate for all devices on the network segment.

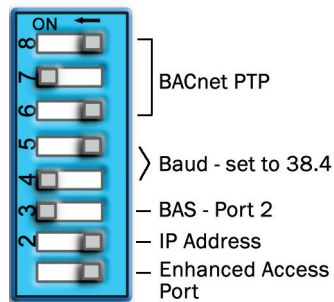
Baud Rate	DIP Switch 4	DIP Switch 5
9600	Off	Off
19.2	Off	On
38.4	On	Off
76.8	On	On

- 4 Set Comm Selector DIP Switch **3** to ON for Port 2.

NOTE Comm Selector DIP Switch **4** (Port 1) will be set by the manufacturer.

- 5 Set Comm Selector DIP Switch **6-8** for BACnet PTP.

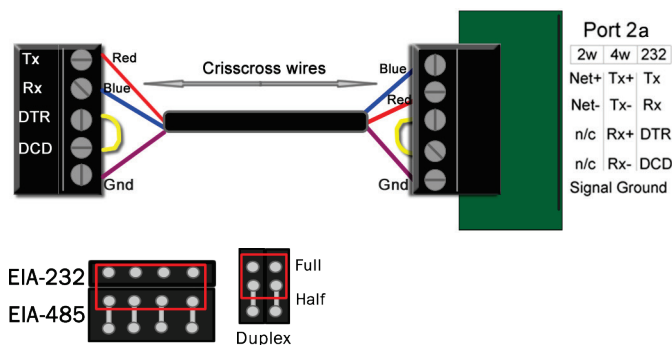
The following example shows the DIP Switches set for 38.4k, Port 2, and BACnet PTP.



- 6 Connect the communications wiring to Port 2a.

- o **EIA-232, 2-wire**

Connect to **Tx**, **Rx**, **DTR**, **DCD**, and **Gnd** using three wire termination with pins 3 and 4 jumpered. Wiring must go plus-to-minus and minus-to-plus, Gnd-to-Gnd.



Wire Specifications

- 18–28 AWG; twisted pair preferable
- 50 feet (15.24 meters) maximum length

NOTE Do not power the device from the same transformer that powers the I/O Pro 812u.

- 7 See table below to wire I/O Pro 812u to a modem.

Modem (25-pin)	Null Modem Cable	S2-DB9	Device
Null Modem Cable	(9-pin)	(9-pin)	(5 pin)
TX - pin 2	TX - pin 3	TX - pin 3	TX - pin 1
RX - pin 3	RX - pin 2	RX - pin 2	RX - pin 2
DTR - pin 20	DTR - pin 4	DTR - pin 4	DTR - pin 3
DCD - pin 8	DCD - pin 1	DCD - pin 1	DCD - pin 4
GND - pin 7	GND - pin 5	GND - pin 5	GND - pin 5

- 8 Set the following DIP switch settings on the modem:



NOTE US Robotics External Modem is highly recommended.

- 9 Turn **on** the I/O Pro 812u's power.

Troubleshooting BACnet PTP communication

For detailed troubleshooting and a list of supported objects, get the controller's BACnet PICS from the *OEMCtrl BACnet PICS website* <http://www.bacnetinternational.net/catalog/index.php?m=47>. You must get your BACnet Object list from the manufacturer.

The most common communication problems are the result of not properly following the configuration steps outlined in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking BACnet PTP (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 4 and 5
- Protocol DIP switches 6, 7, and 8 Jumper set to EIA-232
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

- Unique BACnet Device Instance numbers. Default is 24XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.
- Do not power the PTP-speaking device from the same transformer that powers the I/O Pro 812u.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.

Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

BAS reading or writing to the BACnet objects in the controller - The controller does not restrict communication to objects defined in the object listing or found by auto-discovery. If communication has been established but you cannot write to an object check the BACnet priority of the object, the device's default is 16.

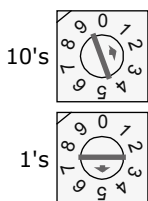
BACnet over IP

This is used for tunneling BACnet packets inside of IP (Internet Protocol) packets for carrying BACnet messages over wide-area networks and the Internet. This network layer offers the fastest speed and allows for communication of BACnet on the highest network layer. Although the speed is very fast, there is a lot of overhead required in this kind of network topology. Overhead refers to information inside the data packet/message being passed over the network, requiring expensive high speed computing processors.

To set up the I/O Pro 812u for BACnet over IP (default IP)

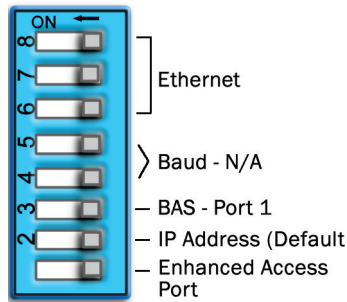
- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



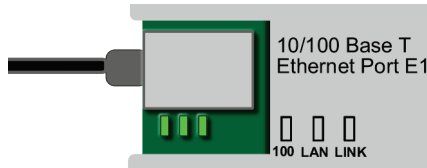
NOTE The default address is an intranet address. Data packets from this address are not routable to the Internet.

- 3 Set Comm Selector DIP Switches **1** through **8** to OFF.



NOTE The default address is an intranet address. Data packets from this address are not routable to the Internet.

- 4 Connect Port E1, which is the only port that speaks BACnet over IP.



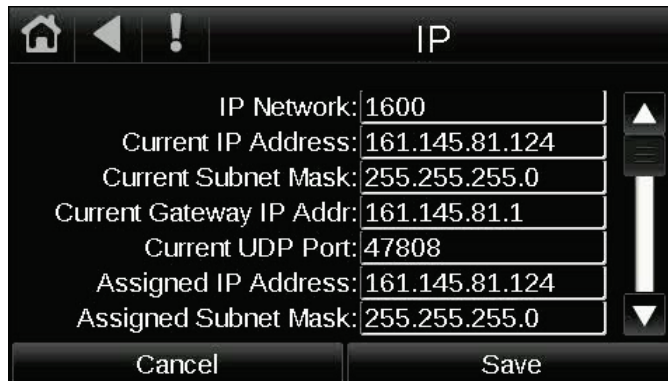
Wiring Specifications

- 328 feet (100 meters)
- Use one of the following CAT5 or higher Ethernet cables:
 - A cross-over cable to connect the I/O Pro 812u directly to the third-party device
 - A straight-through cable to connect the I/O Pro 812u to a hub or switch, and a second straight-through cable to connect the hub or switch to the third-party device

NOTE Use the same polarity throughout the network segment.

- 5 Turn **on** the I/O Pro 812u's power.
- 6 Set the IP address using an Equipment Touch, *Hyperterminal* (page 44), or *PuTTY* (page 46).

Equipment Touch screen

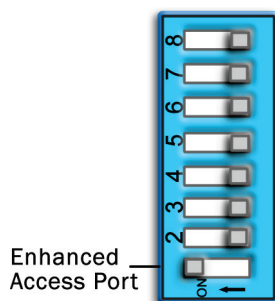


- 7 Set a unique Device Instance number.

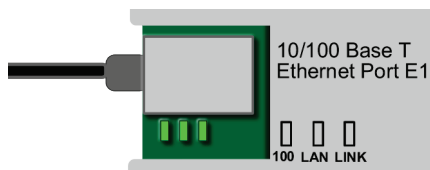
Equipment Touch screen

To set up the I/O Pro 812u for BACnet over IP (assign a custom IP)

- 1 Set Comm Selector DIP switch **1** and **2** to ON and all others to OFF.



- 2 Connect Port E1, which is the only port that speaks BACnet over IP.



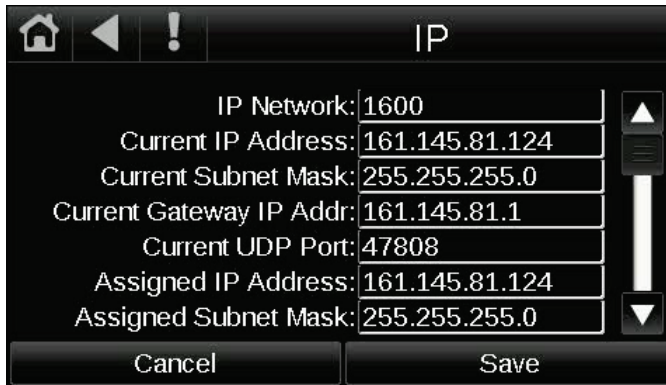
Wiring Specifications

- 328 feet (100 meters)
- Use one of the following CAT5 or higher Ethernet cables:
 - A cross-over cable to connect the I/O Pro 812u directly to the third-party device
 - A straight-through cable to connect the I/O Pro 812u to a hub or switch, and a second straight-through cable to connect the hub or switch to the third-party device

NOTE Use the same polarity throughout the network segment.

- 3 Obtain the IP address, subnet mask, and default gateway address for the controller from the facility network administrator.
- 4 Set the IP address using an Equipment Touch, *Hyperterminal* (page 44), or *PuTTY* (page 46).

Equipment Touch screen



The screenshot shows the 'IP' configuration screen. At the top, there is a header bar with a home icon, a back arrow, an exclamation mark, and the title 'IP'. Below the header, there are several input fields for network settings. To the right of these fields is a vertical scrollbar. At the bottom, there are two buttons: 'Cancel' and 'Save'.

IP Network:	1600
Current IP Address:	161.145.81.124
Current Subnet Mask:	255.255.255.0
Current Gateway IP Addr:	161.145.81.1
Current UDP Port:	47808
Assigned IP Address:	161.145.81.124
Assigned Subnet Mask:	255.255.255.0

- 5 Set a unique Device Instance number.

Equipment Touch screen



The screenshot shows the 'Communication' configuration screen. At the top, there is a header bar with a home icon, a back arrow, an exclamation mark, and the title 'Communication'. Below the header, there are several input fields for communication settings. At the bottom, there are two buttons: 'Cancel' and 'Save'.

BACnet Device Instance:	1616071
Auto Generate Device ID:	Yes
Max Masters:	127
Max Info Frames:	10

Troubleshooting BACnet over IP communication

For detailed troubleshooting and a list of supported objects, get the controller's BACnet PICS from the *OEMCtrl BACnet PICS website* <http://www.bacnetinternational.net/catalog/index.php?m=47>. You must get your BACnet Object list from the manufacturer.

The most common communication problems are the result of not properly following the configuration steps outlined in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking BACnet over IP:

- Proper connection wiring
- DIP switches set for default or custom IP address
- Confirm the correct IP address through the Equipment Touch, *HyperTerminal* (page 44), or *PuTTY* (page 46).
- Confirm the correct BACnet network number through the Equipment Touch, *HyperTerminal* (page 44), or *PuTTY* (page 46).
- BAS is sending requests to the proper BACnet address of the controller

Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

BAS software settings - The two methods to interface with BACnet systems are Static Binding and auto-discovery. For Static Binding, the system integrator must know the Device Instance and Object listing before establishing communication. These are provided by the manufacturer. The device is set as a slave, which only speaks when asked questions directly. Dynamic Binding allows the system integrator to discover the device and its Object listing. The device is set as a master, which responds to a request when asked.

NOTE Certain systems can discover devices and Object listings, but may not save them permanently.

BAS reading or writing to the BACnet objects in the controller. The controller does not restrict communication to objects defined in the object listing or found through auto-discovery. If communication has been established, but you cannot write to an object, check the BACnet priority of the object (the device's default is 16).

BACnet over Ethernet

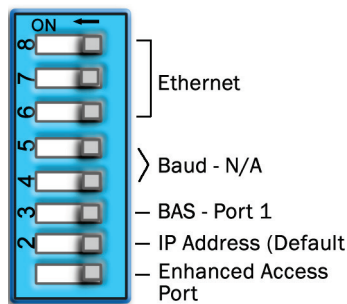
This is used for communicating BACnet packets to the device's specific MAC (Media Access Control) addresses. These specific device addresses allow BACnet messages to be sent over wide-area networks. This network layer offers the fastest speed and allows for communication of BACnet on the highest network layer. Although the speed is very fast, there is a lot of overhead required in this kind of network topology. Overhead refers to information inside the data packet/message being passed over the network, requiring expensive high speed computing processors.

To set up the I/O Pro 812u for BACnet over Ethernet

- 1 Turn **off** the I/O Pro 812u's power.

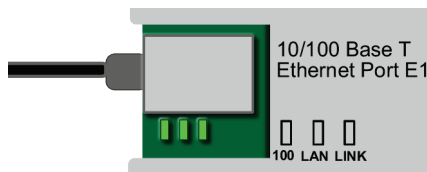
NOTE The controller reads the address each time you turn it on.

- 2 Set Comm Selector DIP Switches **1** through **8** to OFF.



NOTE The default address is an intranet address. Data packets from this address are not routable to the Internet.

- 3 Connect Port E1, which is the only port that speaks BACnet over Ethernet.



Wiring Specifications

- 328 feet (100 meters)
- Use one of the following CAT5 or higher Ethernet cables:
 - A cross-over cable to connect the I/O Pro 812u directly to the third-party device
 - A straight-through cable to connect the I/O Pro 812u to a hub or switch, and a second straight-through cable to connect the hub or switch to the third-party device

NOTE Use the same polarity throughout the network segment.

- 4 Turn **on** the I/O Pro 812u's power.

- 5 Set the IP address using an Equipment Touch, *Hyperterminal* (page 44), or *PuTTY* (page 46).

Equipment Touch screen

Router	
BACnet Network Number	MAC Address
ARC156: 0	101
MSTP: 16160	0
Ethernet: 0	00-E0-C9-20-73-C9
<div> Cancel Save </div>	

- 6 Set a unique Device Instance number.

Equipment Touch screen

Communication	
BACnet Device Instance:	1616071
Auto Generate Device ID:	Yes
Max Masters:	127
Max Info Frames:	10
<div> Cancel Save </div>	

Troubleshooting BACnet over Ethernet communication

For detailed troubleshooting and a list of supported objects, get the controller's BACnet PICS from the *OEMCtrl BACnet PICS* website <http://www.bacnetinternational.net/catalog/index.php?m=47>. You must get your BACnet Object list from the manufacturer.

The most common communication problems are the result of not properly following the configuration steps outlined in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking BACnet over Ethernet (8 Data bits, No Parity, and 1 Stop bit):

- Proper connection wiring
- Confirm the correct BACnet network number through the Equipment Touch, *HyperTerminal* (page 44), or *PuTTY* (page 46).
- BAS is sending requests to the proper BACnet address of the controller

Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

BAS software settings - The two methods to interface with BACnet systems are Static Binding and auto-discovery. For Static Binding, the system integrator must know the Device Instance and Object listing before establishing communication. These are provided by the manufacturer. The device is set as a slave, which only speaks when asked questions directly. Dynamic Binding allows the system integrator to discover the device and its Object listing. The device is set as a master, which responds to a request when asked.

NOTE Certain systems can discover devices and Object listings, but may not save them permanently.

BAS reading or writing to the BACnet objects in the controller. The controller does not restrict communication to objects defined in the object listing or found through auto-discovery. If communication has been established, but you cannot write to an object, check the BACnet priority of the object (the device's default is 16).

Modbus

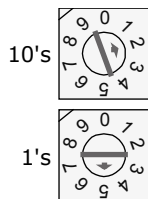
The Modbus protocol is used mostly in the industrial process market to communicate between PLCs (Programmable Logic Controllers). Although there is no official standard, there is extensive documentation on Modbus and most companies who choose to interface using this protocol follow the same format.

Modbus is not a protocol that is particularly well suited for building management because of its limited master/slave structure. However, many companies offer Modbus as an open protocol solution because it is relatively easy to construct an interface.

To set up the I/O Pro 812u for Modbus RTU or ASCII on Port 1

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



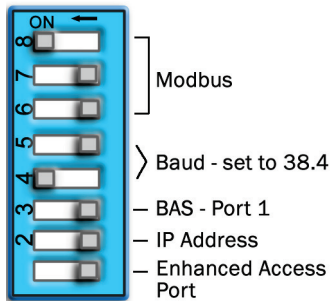
- 3 Set the Comm Selector DIP Switches **4** and **5** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate for all devices on the network segment.

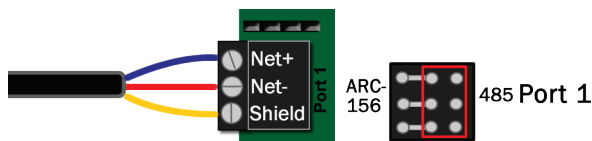
Baud Rate	DIP Switch 4	DIP Switch 5
9600	Off	Off
19.2	Off	On
38.4	On	Off
76.8	On	On

- 4 Set Comm Selector DIP Switch **3** OFF for BAS Port 1.
- 5 Set Comm Selector DIP Switches **6 - 7** to OFF and **8** to ON for Modbus RTU or ASCII.

The following example shows the DIP Switches set for 38.4k, Port 1, and Modbus.



- 6 Connect the communications wiring to Port 1. Connect to **Net+**, **Net-**, and **Gnd**.



Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Pro 812u

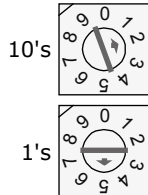
NOTE Use the same polarity throughout the network segment.

- 7 Turn **on** the I/O Pro 812u's power.

To set up the I/O Pro 812u for Modbus RTU or ASCII on Port 2a

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



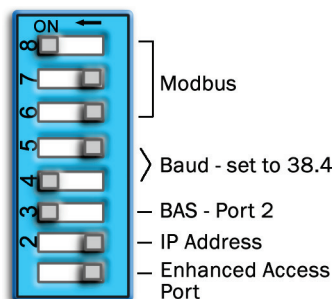
- 3 Set the Comm Selector DIP Switches **4** and **5** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate for all devices on the network segment.

Baud Rate	DIP Switch 4	DIP Switch 5
9600	Off	Off
19.2	Off	On
38.4	On	Off
76.8	On	On

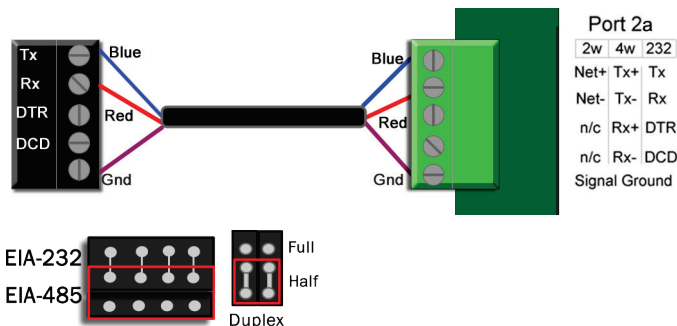
- 4 Set Comm Selector DIP Switch **3** to ON for Port 2.
- 5 Set Comm Selector DIP Switches **6 - 8** OFF for Modbus RTU or ASCII.
- 6 Set Comm Selector DIP Switches **5 - 8** for Modbus.

The following example shows the DIP Switches set for 38.4k, Port 2, and Modbus.

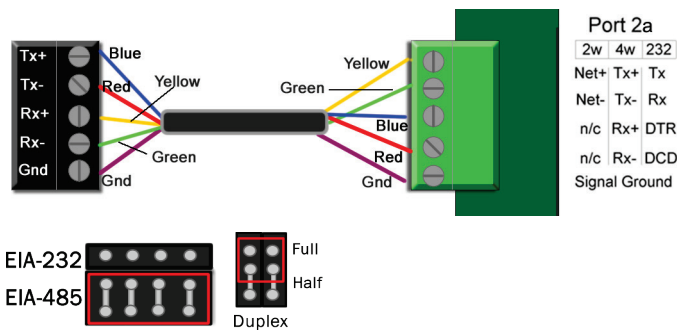


7 Connect the communications port and jumper wiring to Port 2a.

○ **EIA-485, 2-wire**



○ **EIA-485, 4-wire**



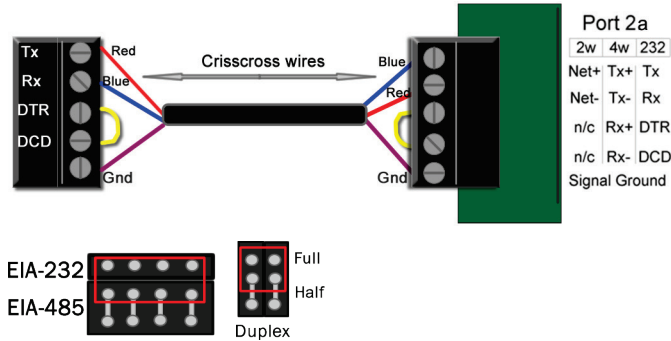
Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Pro 812u

NOTE Use the same polarity throughout the network segment.

- **EIA-232, 2-wire**

Connect to **Tx**, **Rx**, **DTR**, **DCD**, and **Gnd** using three wire termination with pins 3 and 4 jumpered. Wiring must go plus-to-minus and minus-to-plus, Gnd-to-Gnd.



Wire Specifications

- 18–28 AWG; twisted pair preferable
- 50 feet (15.24 meters) maximum length

NOTE Do not power the device from the same transformer that powers the I/O Pro 812u.

- 8 Turn **on** the I/O Pro 812u's power.

Troubleshooting Modbus RTU or ASCII communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking Modbus (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 4 and 5
- Protocol DIP switches 6, 7, and 8 Jumper set correctly to EIA-232 or EIA-485
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.

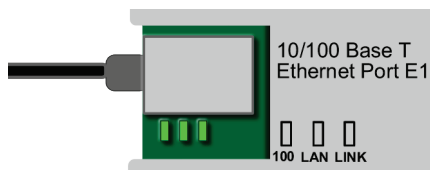
Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

Modbus Exception Codes that might be returned from this controller

Codes	Name	Description
01	Illegal Function	The Modbus function code used in the query is not supported by the controller.
02	Illegal Data Address	The register address used in the query is not supported by the controller.
04	Slave Device Failure	The Modbus Master has attempted to write to a non-existent register or a read-only register in the controller.

To set up the I/O Pro 812u for Modbus over IP

- 1 Turn **off** the I/O Pro 812u's power.
 - 2 Check the communications wiring for shorts and grounds.
 - 3 Connect Port E1 to the third-party device.
- NOTE** Port E1 will still be capable of BACnet communication.



Wiring Specifications

- 328 feet (100 meters)
- Use one of the following CAT5 or higher Ethernet cables:
 - A cross-over cable to connect the I/O Pro 812u directly to the third-party device
 - A straight-through cable to connect the I/O Pro 812u to a hub or switch, and a second straight-through cable to connect the hub or switch to the third-party device

NOTE Use the same polarity throughout the network segment.

- 4 Turn **on** the I/O Pro 812u's power.

Troubleshooting Modbus over IP communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking Modbus over IP:

- Proper connection wiring
- Confirm the IP address, subnet mask, and default gateway address for your router with the manufacturer
- Confirm the correct IP address through the Equipment Touch, *HyperTerminal* (page 44), or *PuTTY* (page 46).

Modbus Exception Codes that might be returned from this controller

Codes	Name	Description
01	Illegal Function	The Modbus function code used in the query is not supported by the controller.
02	Illegal Data Address	The register address used in the query is not supported by the controller.
04	Slave Device Failure	The Modbus Master has attempted to write to a non-existent register or a read-only register in the controller.

Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

BAS settings can affect proper network communication. Adjust the following settings:

- Poll rate default is 250 ms. You must change to 1000 ms.
- Write commands performs every 250 ms. Change this to COV, change of value.

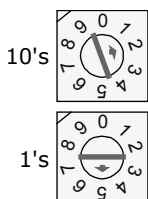
N2

N2 was created by Johnson Controls, Inc.. Though not a standard protocol, N2 is open and available to the public. Johnson Controls is the only company to use N2 bus as their standard network protocol. Because it is open and still prevalent within the industry, N2 is a standard offering for our controllers.

To set up the I/O Pro 812u for N2 on Port 1

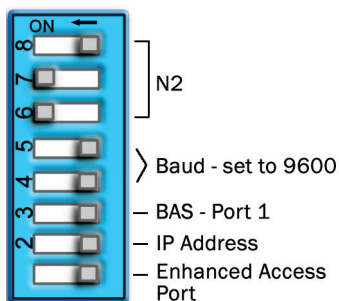
- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.

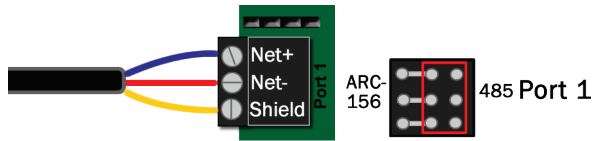


- 3 Set the Comm Selector DIP Switches **1 - 8** for baud rate, port number, wiring, and protocol.
 - 4 Set the Comm Selector DIP Switches **4** and **5** for 9600 bps.
- NOTE** Use the same baud rate for all devices on the network segment.
- 5 Set Comm Selector DIP Switch **3** OFF for BAS Port 1.
 - 6 Set the Comm Selector DIP Switches **6** through **8** for N2.

The following example shows the DIP Switches set for 9600 baud, Port 1, and N2.



- 7 Connect the communications wiring to Port 1a. Connect to **Net+**, **Net-**, and **Gnd**.



Wiring specifications

- A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- 2000 feet (610 meters) for 76.8 kbps
- 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- Devices should be daisy chained and not star wired
- If the controller is at either end of a network segment, connect a BT485 to the I/O Pro 812u

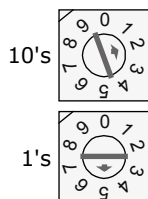
NOTE Use the same polarity throughout the network segment.

- 8 Turn **on** the I/O Pro 812u's power.

To set up the I/O Pro 812u for N2 on Port 2a

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



- 3 Set the Comm Selector DIP Switches **4** and **5** for 9600 bps.

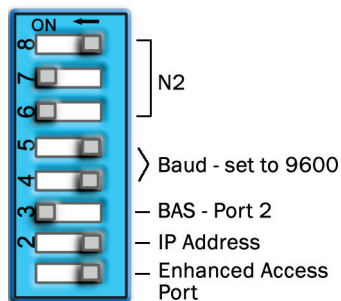
NOTE Use the same baud rate for all devices on the network segment.

- 4 Set Comm Selector DIP Switch **3** to ON for Port 2.

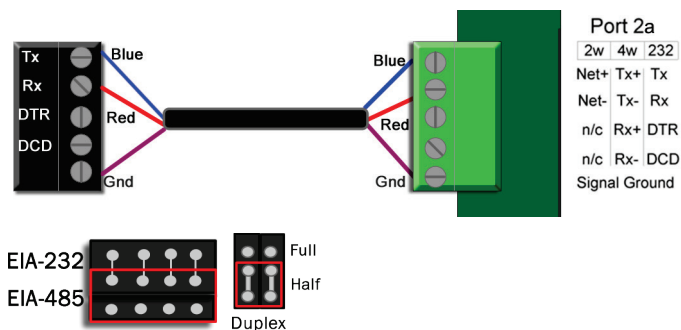
NOTE Comm Selector DIP Switch **4** (Port 1) will be set by the manufacturer.

- 5 Set the Comm Selector DIP Switches **6** through **8** for N2.

The following example shows the DIP Switches set for 38.4k, Port 2, and N2.



- o **EIA-485, 2-wire**



Wiring specifications

- o A dedicated 24 AWG to 18 AWG twisted pair wire (EIA-485)
- o 2000 feet (610 meters) for 76.8 kbps
- o 3000 feet (914.4 meters) for 9600 bps, 19.2 or 38.4 kbps, before needing a Repeater
- o Devices should be daisy chained and not star wired
- o If the controller is at either end of a network segment, connect a BT485 to the I/O Pro 812u

NOTE Use the same polarity throughout the network segment.

- 6 Turn **on** the I/O Pro 812u's power.

Troubleshooting N2 communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking N2 (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 4 and 5
- Protocol DIP switches 6, 7, and 8
- Jumpers set to half duplex (2-wire) and EIA-485
- Proper connection wiring
- BAS is configured to speak 2-wire EIA-485 to the controller.
- BAS is sending requests to the proper slave address of the controller.
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

NOTES

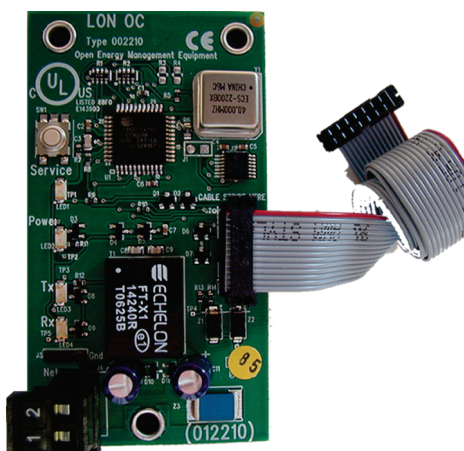
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.

Software settings defined through the Equipment Touch display. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to Modstat.

LonWorks®

LonWorks is an open protocol that was developed by Echelon Corporation. It is now maintained by Echelon in collaboration with members of the LonMark Interoperability Association. It requires the use of Echelon's Neuron microprocessor to encode and decode the LonWorks packets.

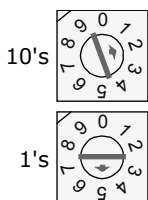
The LonWorks protocol is based on the concept of using standardized functional profiles to control similar pieces of equipment. OEMCtrl controllers are LonWorks-compatible devices, but are not LonMark devices. A LonMark device has been thoroughly tested by Echelon (LonMark.org) and has been given the LonMark logo indicating compliance with the LonWorks profile specification. All LonMark devices require the use of proprietary hardware manufactured by Echelon Corporation. In order to reduce the cost of adding that hardware on every controller, OEMCtrl formats the data packets in a manner specified by the LonWorks documentation and hands them off to the LonWorks Option Card.



To set up the I/O Pro 812u for LonWorks Option Card

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set a unique address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

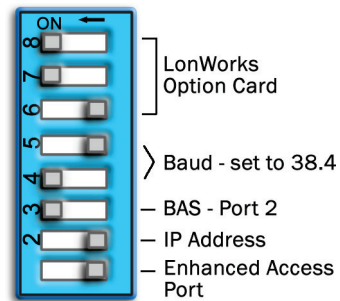
EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



3 Set the Comm Selector DIP Switches **1-8** for baud rate, port number, wiring, and protocol.

- Set the Communication mode for Port 2 using DIP Switch **3**
- Set the Comm Selector DIP Switches **6** through **8** for LonWorks Option Card

The following example shows the DIP Switches set for 38.4k baud, Port 1, and LonWorks Option Card.

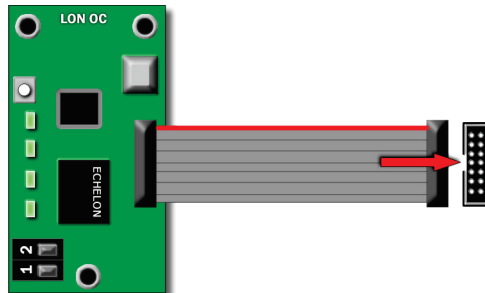


4 Plug the 's ribbon cable into the Option Port on the I/O Pro 812u.



CAUTIONS

- You **MUST** ground the I/O Pro 812u to earth ground, using the Rnet Gnd connector.
- The controller must be **OFF** before being connected.



5 Connect the LonWorks network to the LonWorks Option Card's 2-pin **Net** port.

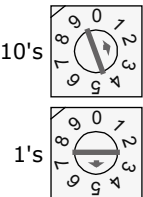
NOTE The 2-pin **Net** port provides TP/FT-10 channel compatibility. The TP/FT-10 or "Free Topology" network type is **polarity insensitive**. Use 24 to 16 AWG twisted pair wire.

6 Turn **on** the I/O Pro 812u's power.

To set up the I/O Pro 812u for LonTalk via SLTA

- 1 Turn **off** the I/O Pro 812u's power.
- 2 Using the rotary switches, set the controller's address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.

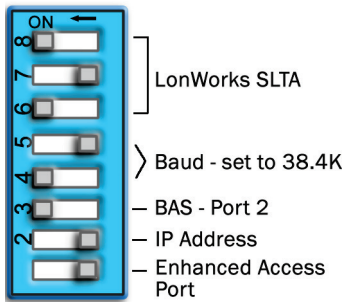


- 3 Set the Comm Selector DIP Switches **4** and **5** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

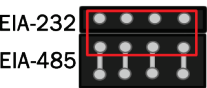
NOTE Use the same baud rate for all devices on the network segment.

Baud Rate	DIP Switch 4	DIP Switch 5
9600	Off	Off
19.2	Off	On
38.4	On	Off
76.8	On	On

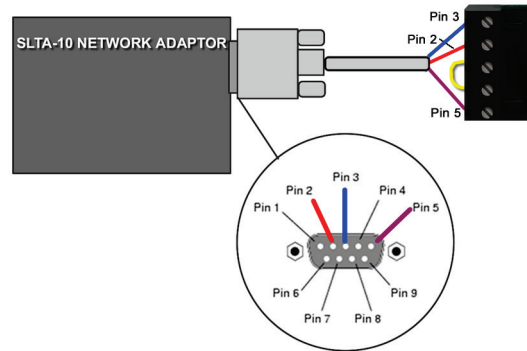
- 4 Set Comm Selector DIP Switch **3** to ON for Port 2a.
- 5 Set Comm Selector DIP Switch **6 - 8** for LonWorks SLTA. The following example shows the DIP Switches set for 38.4k, Port 2, and LonWorks SLTA.



- 6 Set the Port 2a jumper to EIA-232.



- 7 Connect the communications wiring to Port 2a.



Wire Specifications

- 18–28 AWG; twisted pair preferable
- 50 feet (15.24 meters) maximum length

NOTE Do not power the device from the same transformer that powers the I/O Pro 812u.

- 8 Set the following SLTA-10 DIP Switch settings.



- 9 Turn **on** the I/O Pro 812u's power.

Commissioning the I/O Pro 812u for LonWorks

Before a device can communicate on a LonWorks network, it must be commissioned. Commissioning allows the system integrator to associate the device hardware with the LonWorks system's network layout diagram. Together, the I/O Pro 812u and its LonWorks Option Card serve as a single LonWorks device or node. This is done using the device's unique Neuron ID.

A network management tool such as Echelon's LonMaker is used to commission each device, as well as to assign addressing. Specific instructions regarding the commissioning of LonWorks devices should be obtained from documentation supplied with the LonWorks Network Management Tool.

When a new device is first commissioned onto the LonWorks network, you must upload the device's External Interface File (XIF) information. LonWorks uses the XIF to determine the points (network variables) that are available from a device. The I/O Pro 812u has a set of predefined network variables. These variables can be bound or accessed by the network management tool. See *Obtaining LonWorks object mapping (XIF file)* (page 38).

The network variables defined on the I/O Pro 812u Network Variables Property pages determine its XIF information. If any information is changed, added, or deleted on the Network Variable Property pages, the I/O Pro 812u must be removed from the network management tool's database and recommissioned, including uploading the XIF information again.

There are some issues with LonWorks that should be considered when using the I/O Pro 812u:

Device Configuration Information (XIF)

- When members of the object cache are modified, you must modify the device configuration information (XIF) from that originally imported into the LonWorks Network Management Tool. The new information will not be recognized by the Network Management Tool until it is imported again from the I/O Pro 812u.
- The user must first undefine all of the network variable bindings and the device, recommission the device, and establish the network variable bindings again.
- Modifications to the object cache should be avoided once the device is fully commissioned and operational. Any modifications to the addressing schemes should also be avoided once the I/O Pro 812u is commissioned.

Address parameters

- If the address parameters are modified, the LonWorks Option Card will be set to **Node Offline**, and **Unconfigured**, which means it no longer communicates with the LonWorks network.
- This does not require deletion or importing the device configuration information again, but does require the device to be recommissioned by the Network Management Tool.

Point configuration

- When the I/O Pro 812u is first commissioned onto the LonWorks network, you should use the **Browse** features of the Network Management Tool to check the data that is available from the controller.
- Any changes in point count and point configuration should be made prior to performing any further system integration.
- I/O Pro 812u may be deleted and re-imported as many times as necessary to ensure that the points are correct.

NOTE For these reasons, all parameters on the module driver parameter page should be configured prior to connecting this device to a LonWorks network.

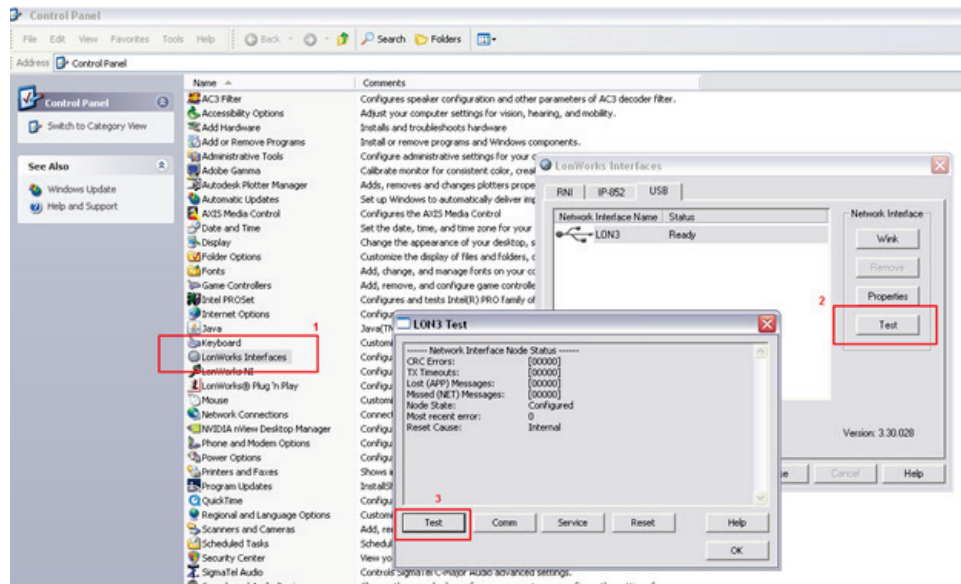
The **Browse** feature of the Network Management Tool also allows you to read real-time values from the I/O Pro 812u. The Tool allows you to test integration prior to binding the I/O Pro 812u's network variables to other LonWorks nodes.

See *Obtaining LonWorks object mapping (XIF) file* (page 38).

Obtaining LonWorks object mapping (XIF file)

- 1 Install Echelon U10 network interface device using supplied drivers (or visit the *Echelon website* (<http://www.echelon.com>) for driver downloads).
- 2 Verify proper installation of Echelon U10 network interface device.
 - a) Navigate to **Control Panel** and select **LonWorks Interfaces**.
 - b) Select the **USB** tab for a list of available USB network interface devices. Take note of the **Network Interface Name** to use later (**LON3** is the network interface name in the example shown below).
 - c) Click **Test** in the **LonWorks Interfaces** dialog box.

- d) Click **Test** in the **LON3 Test** dialog box. Correct installation and test shown below.



NOTE If U10 installation problems occur, consult your U10 documentation or visit the *Echelon* website (<http://www.echelon.com>) for more assistance.

- 3 From Windows command prompt, launch **nodeutil** from NodeUtil install directory. Include **-D** and network interface device name in syntax.

The example below shows **LON3** as the network interface device name.

```
C:\BEF\OEM\NodeUtil>nodeutil -DLON3
```

```
Echelon Node Utility Release 1.82
Successfully installed IP/FT-10 network interface.
Welcome to the Echelon Node Utility application.
Activate the service pin on remote device to access it.
Enter one of the following commands by typing the indicated letter:

A -- (A)dd device to list.
D -- Set the (D)omain of the network interface.
E -- (E)xit this application.
F -- (F)ind devices in the current domain.
I -- Find devices in all (I)-byte domains.
G -- (G)o to device menu...
H -- (H)elp with commands.
I -- Redirect (I)npout from a file.
L -- Display device (L)ist.
M -- Change device (M)ode or state.
O -- Redirect (O)utput to a file.
P -- Send a service (P)in message.
R -- (R)ebboot 3150 device.
S -- Report device (S)tatus and statistics.
T -- (T)ransceiver parameters.
U -- Control (U)erbose modes.
W -- (W)ink a device.
Z -- Shell out to command prompt.
NodeUtil>
```

- 4 Press service pin on the Lon device to see the **Program ID** for the device. (OEMCtrl Program ID defaults to **PROG_ID**.)

```
NodeUtil> Received an ID message from device 1.
Program ID is OEM_Demo
NodeUtil>
```

- 5 Type **G** to go to device menu. You may be asked to **Enter node id for Neuron data structures (0-1)** - select the Lon device you wish to access, likely node **1**.

```
NodeUtil> <G>o to device menu...
Node ID Neuron ID Program ID
0 04 30 23 E4 01 00 USBLTA *** network interface
1 04 5D 1E E5 02 00 OEM_Demo
Enter node id for Neuron data structures <0-1> [1] :1
```

- 6 Type **X** for **Create device Interface XIF file** in the device menu for the program in the controller.

```
Enter one of the following commands:
A -- Device <A>address table.
B -- <B>uffer configuration.
C -- Application <C>onfiguration structures.
D -- Device <D>omain table.
E -- <E>xit this menu and return to main menu.
F -- Configuration <F>iles.
G -- <G>o to another device.
H -- <H>elp with device commands.
I -- Network variable al<I>as table.
J -- <J>am network variable type.
K -- Chec<K> Neuron executable.
L -- <L>ist network variables.
M -- Change device <M>ode or state.
N -- <N>etwork Variable configuration table.
O -- Redirect <O>utput to a file.
P -- <P>oll network variable.
Q -- <Q>uickly send a message.
R -- <R>ead device memory.
S -- Report device <S>tatus and statistics.
T -- <T>ransceiver parameters.
U -- <U>pdate input network variable.
V -- Control <V>erbse modes.
W -- <W>rite device memory.
X -- Create device interface <<X>IF> file.
Y -- Download Neuron executable.
DEVICE:1> Create device interface <<X>IF> file

Self documentation structure length = 308, version number = 0
Number of declared NUs = 17, total NUs = 17, message tags = 3
Enter output filename :[OEM_Demo.XIF]
```

- 7 Modify output file name as required and/or click **Enter**. The default file name is **PROG_ID.xif** and the file will be saved to the nodeutil install directory. If you changed the **Program ID** parameter on the **Protocol Setup** page in the WebCTRL® for OEMs application, the default XIF file name changes accordingly. When completed, distribute file to the controls contractor as necessary.

```
File OEM_DEMO.XIF created successfully
DEVICE:1>
```

Troubleshooting LonWorks communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for speaking LonWorks (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2 set to 38.4 kbps
- Protocol DIP switches 6, 7, and 8
- Jumper set to EIA-485 2-wire when using the LonWorks Option Card
- Jumper set to EIA-232 when using the LON-SLTA

- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

Software settings defined through the Equipment Touch display. LonWorks network number and device instance. To confirm settings, obtain a Modstat of the device through the Equipment Touch.

Communication LED's

The **Module Status** LED can display the following error codes.

Error Code...	Indicates...	Possible solutions
0	The control program or driver has not been downloaded.	Download memory to the I/O Pro 812u.
1	A control program error	Obtain a Module Status Report (Modstat) and look for error conditions. If you cannot determine the error from the Modstat, send a screenshot of the Modstat to Technical Support.
2	The controller's memory is full	In the WebCTRL® for OEMs application, reduce the amount of trend data being stored in the controller. In SiteBuilder, reduce the amount of control programs.
3	A setup error	Verify: <ul style="list-style-type: none"> • The address has been set on the rotary switches. See Addressing the I/O Pro 812u. • The address is unique on the network • DIP switches are set correctly
4	A system error	Obtain a Module Status Report (Modstat) and look for error messages. If you cannot determine the error from the Modstat, send a screenshot of the Modstat to Technical Support.
8	The controller is formatting	If this number displays continuously or flashes intermittently with another number, try each of the following: <ul style="list-style-type: none"> • Turn the I/O Pro 812u's power off, then on. • Restore factory defaults • Download memory to the I/O Pro 812u.* • Replace the I/O Pro 812u.* * Contact the manufacturer or OEM Technical Support.

Other LED's show the status of certain functions.

If this LED is on...	Status is...
Power	The I/O Pro 812u has power.
Link	The controller is connected to the Ethernet
LAN	The Ethernet port is transmitting or receiving data
100	The connection speed is 100 Mbps. If LED is not lit, the connection speed is 10 Mbps.
Port 1 transmit	The I/O Pro 812u is transmitting data from Port 1
Port 1 receive	The I/O Pro 812u is receiving data on Port 1
Archive Valid	The controller's memory backup is valid

If this LED is on...	Status is...
Port 2a transmit	The I/O Pro 812u is transmitting data from Port 2a
Port 2a receive	The I/O Pro 812u is receiving data on Port 2a
Brownout	Incoming power is low
Battery low	The battery is low

Using Hyperterminal

- 1 Start Windows HyperTerminal located under **Start > Programs > Accessories > Communications**.
NOTE This option is not available in Windows v7 or later. You can download it from the Internet.
- 2 In the **Name** field, type a name for the local access port; for example, `Access port`.
NOTE If you do not see the **Name** field, select **File > New Connection**.
- 3 Select an icon for this connection file, then click **OK**.
- 4 Connect a computer to the I/O Pro 812u's **Rnet Local Access** port using a USB-L cable.
- 5 Turn the I/O Pro 812u's power **Off**, then **On**.
- 6 Start Windows HyperTerminal located under **Start > Programs > Accessories > Communications**.
NOTE This option is not available in Windows v7 or later. You can download it from the Internet.
- 7 In the **Name** field, type a name for the local access port; for example, `Access port`.
NOTE If you do not see the **Name** field, select **File > New Connection**.
- 8 Select an icon for this connection file, then click **OK**.
- 9 In the **Connect to** dialog box, set the **Connect using** field to **ComX**, where **X** is the number of the computer's Com port that the APT cable is connected to, then click **OK**.
- 10 In the **Com Properties** dialog box, set the **Port Settings** for your local access port, then click **OK**.

Port Setting	Value
Bits per second	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

- 11 From the main HyperTerminal screen, click **Enter** to view a router configuration screen like the one below.

```

BACnet Router, Ethernet MAC address = 00-E0-C9-00-4E-B8
1) Restart
2) Display Modstat
3) IP Address [192.168.168.1]
4) Subnet Mask [255.255.255.0]
5) Default Gateway [0.0.0.0]
6) BACnet/IP UDP Port [0xBAC0]
7) BACnet/IP Network [4824+]
8) BACnet/Ethernet Network [4829]
9) BACnet/ARCNET Network [4825]
10) BACnet/MSTP Network [4834]
11) Display B/IP PAD Table
12) Add B/IP PAD Table Entry
13) Delete B/IP PAD Table Entry
14) Clear B/IP PAD Table
15) Set baud rate for MSTP [76800]
16) Set baud rate for PTP [38400]

+ The HOME network is updated each time a network number
  is changed (#7-10).

Enter selection: _

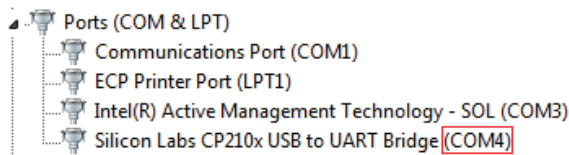
```

- 12 Type the number of the property you want to change or the action you want to take, then press **Enter**.
- 13 When finished, set the I/O Pro 812u's **Enhanced Access** DIP switch to **OFF** to restore normal functionality to the **Local Access** port.
- 14 Turn the I/O Pro 812u's power **Off**, then **On**.

Using PuTTY

- 1 Download and install PuTTY from the *PuTTY website* (<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>).
- 2 Turn off the controller's power, make sure the **Enhanced Access Port** DIP switch is set to **ON**, then turn the power on again.
- 3 Set the controller's **IP Address** DIP switch to **Assigned**.
- 4 Start PuTTY.
- 5 Under **Serial line**, COMX, replacing X with the computer's port number that the USB Link Kit cable is connected to.

NOTE To find the port number, select **Start > Control Panel > System > Hardware > Device Manager > Ports (Com & LPT)**. The COM port number is beside **CP210x USB to UART Bridge Controller**.



- 6 In the **Speed** field, type the appropriate baud rate.
- 7 Under **Connection type**, select **Serial**.
- 8 Under **Category > Connection**, select **Serial**.
- 9 Under **Options controlling local serial lines**, verify the following settings.

Field	Value
Serial line to connect to	The COM port number you entered in step 5
Speed (baud)	The speed you entered in step 6.
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None

- 10 Click **Open**. A window similar to the one below appears.

```
BACnet Router, Ethernet MAC address = 00-E0-C9-00-4E-B8
1) Restart
2) Display Modstat
3) IP Address [192.168.168.1]
4) Subnet Mask [255.255.255.0]
5) Default Gateway [0.0.0.0]
6) BACnet/IP UDP Port [0xBAC0]
7) BACnet/IP Network [4824+]
8) BACnet/Ethernet Network [4829]
9) BACnet/ARCNET Network [4825]
10) BACnet/MSTP Network [4834]
11) Display B/IP PAD Table
12) Add B/IP PAD Table Entry
13) Delete B/IP PAD Table Entry
14) Clear B/IP PAD Table
15) Set baud rate for MSTP [76800]
16) Set baud rate for PTP [38400]

+ The HOME network is updated each time a network number
  is changed (#7-10).

Enter selection: _
```

- 11 Type the number of the address field, then press **Enter**.
- 12 Type the new address, then press **Enter**.
- 13 Type **1**, then press **Enter** to restart the controller.
- 14 Close PuTTY.
- 15 Turn off the controller's power, set its **Enhanced Access Port** DIP switch to **OFF**, then turn its power on again..

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
8/24/18	To set up the I/O Pro 812u for the LonWorks Option Card	Corrected wiring specifications.	O-TS-JM-E
	Entire document	BACview references removed.	O-D
5/13/15	Troubleshooting Modbus over IP communication	Added information on changing BAS settings.	O-TS-PK-E
9/5/14	Configuring the I/O Pro 812u for BACnet over IP (default IP) Configuring the I/O Pro 812u for BACnet over IP (assign a custom IP) Configuring the I/O Pro 812u for BACnet over Ethernet Configuring the I/O Pro 812u for Modbus over IP	Wiring Specifications Corrected the typing error "A cross-over A straight-through cable...." to "A straight-through cable...."	O-TS-PK-F
7/16/14	Configuring the I/O Pro 812u the LonTalk via SLTA	Corrected error - DIP switch must be set to Port 2 and not Port 1.	O-TS-PK-E
5/29/14	Configuring the I/O Pro 812u for the LonTalk via SLTA	Added step for setting Port 2a jumper to EIA-232.	O-D-LJ

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