PATTERSON-KELLEY

ProtoNode FPC-N34 and ProtoNode FPC-N35 Startup Guide

For Interfacing Patterson-Kelley Products: ENVI Control Systems, Love Controller and Nuro To Building Automation Systems: BACnet MS/TP, BACnet/IP, Modbus TCP/IP, Metasys N2 and LonWorks

APPLICABILITY & EFFECTIVITY

Explains ProtoNode FPC-N34 and FPC-N35 hardware and how to install it.

The instructions are effective for the above as of September 2015

sierra monitor

Document Revision: 13
Auto Discovery
Template Revision: 46

Technical Support:

Thank you for purchasing the ProtoNode for Patterson-Kelley, LLC.

Please call Patterson-Kelley for Technical support of the ProtoNode product.

SMC does not provide direct support. If Patterson-Kelley needs to escalate the concern, they will contact Sierra Monitor Corporation for assistance.

Support Contact Information:

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Website: www.pattersonkelley.com

A Quick Start Guide

1. Record the information about the unit. (Section 2.1)
2. Set the device's Modbus RTU serial settings (i.e. baud rate, parity, stop bits) and Modbus Node-ID for each of the devices that will be connected to ProtoNode FPC-N34 or FPC-N35. (Section 2.3)
3. ProtoNode FPC-N34 units: Select the Field Protocol (BACnet MS/TP, BACnet/IP, Modbus TCP/IP or Metasys N2) on the S Bank Dip Switches. (Section 2.4.1)
4. Enable the ProtoNode "Auto Discovery" mode on Dip Switch Bank S. (Section 2.4.2)
5. BACnet MS/TP (FPC-N34): Set the MAC Address on DIP Switch Bank A. (Section 2.5.1)
6. BACnet MS/TP or BACnet IP (FPC-N34): Set the BACnet Device Instance. (Section 2.5.2)
7. Metasys N2 or Modbus TCP/IP (FPC-N34): Set the Node-ID. (Section 2.5.3)
8. BACnet MS/TP (FPC-N34): Set the BAUD rate of the BACnet MS/TP Field Protocol on DIP Switch Bank B. (Section 2.5.4)
9. Connect ProtoNode's 6 pin RS-485 connector to the Modbus RS-485 network that is connected to each of the devices. (Section 3.2)
10. **Connect ProtoNode FPC-N34's** 3 pin RS-485 port to the Field Protocol cabling, (Section 3.3)
    or connect ProtoNode FPC-N35's 2 pin LonWorks port to the Field Protocol cabling. (Section3.4)
11. Connect Power to ProtoNode's 6 pin connector. (Section 3.5)
12. When power is applied it will take about 3 minutes for all the devices to be discovered, and the configuration file to be built. Once Auto-Discovery is complete turn OFF the S3 DIP Switch to save the configuration settings. (Section 3.5.1)
13. BACnet/IP or Modbus TCP/IP (FPC-N34): Use the ProtoNode's embedded tool which is accessed with a browser, referred to in this manual as the Web Configurator, to change the IP address. No changes to the configuration file are necessary. (Section 4)
14. LonWorks (FPC-N35): The ProtoNode must be commissioned on the LonWorks Network. This needs to be done by the LonWorks administrator using a LonWorks Commissioning tool. (Section 7)

Certifications

§ BTL MARK – BACNET TESTING LABORATORY

The BTL Mark on ProtoNode RER is a symbol that indicates that a product has passed a series of rigorous tests conducted by an independent laboratory which verifies that the product correctly implements the BACnet features claimed in the listing. The mark is a symbol of a high-quality BACnet product. Go to http://www.BACnetInternational.net/btl/ for more information about the BACnet Testing Laboratory. Click here for BACnet PIC Statement

§ LONMARK CERTIFICATION

LonMark International is the recognized authority for certification, education, and promotion of interoperability standards for the benefit of manufacturers, integrators and end users. LonMark International has developed extensive product certification standards and tests to provide the integrator and user with confidence that products from multiple manufacturers utilizing LonMark devices work together. FieldServer Technologies has more LonMark Certified gateways than any other gateway manufacturer, including the ProtoCessor, ProtoCarrier and ProtoNode for OEM applications and the full featured, configurable gateways.

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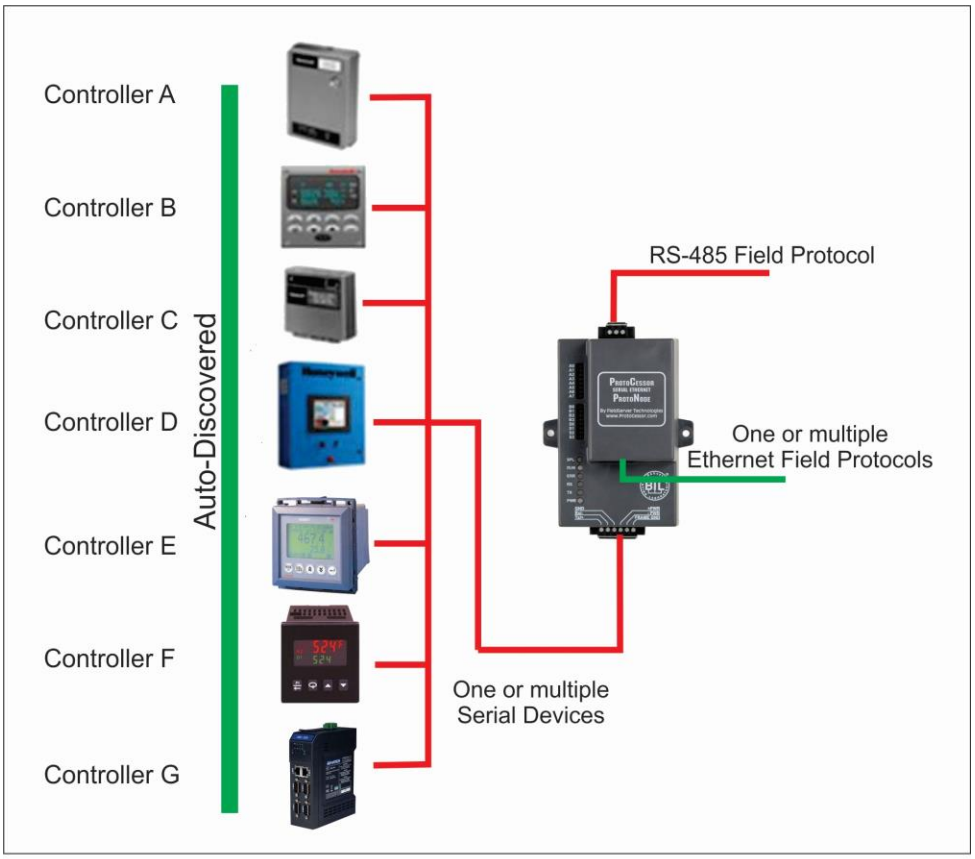
1 INTRODUCTION

1.1 ProtoNode Gateway

ProtoNode is an external, high performance **Building Automation multi-protocol gateway** that is preconfigured to Auto-Discover any of Patterson-Kelley's products (hereafter called "device") connected to the ProtoNode and automatically configures them for BACnet®[1]MS/TP, BACnet/IP, Metasys®[2] N2 by JCI, Modbus TCP/IP or LonWorks®[3].

It is not necessary to download any configuration files to support the required applications. The ProtoNode is pre-loaded with tested Profiles/Configurations for the supported devices.



[1] BACnet is a registered trademark of ASHRAE
[2] Metasys is a registered trademark of Johnson Controls Inc.
[3] LonWorks is a registered trademark of Echelon Corporation

2 BACNET/LONWORKS SETUP FOR PROTOCESSOR PROTONODE FPC-N34/FPC-N35

2.1 Record Identification Data

Each ProtoNode has a unique part number located on the side or the back of the unit. This number should be recorded, as it may be required for technical support. The numbers are as follows:

Model	Part Number
ProtoNode N34, Level 1	FPC-N34-0710
ProtoNode N35, Level 1	FPC-N35-0771

Figure 1: ProtoCessor Part Numbers

- FPC-N34 units have the following 3 ports: RS-485 + Ethernet + RS-485
- FPC-N35 units have the following 3 ports: LonWorks + Ethernet + RS-485

2.2 Point Count Capacity and Registers per Device

The total number of Modbus Registers presented by all of the devices attached to the ProtoNode cannot exceed:

Part number	Total Registers
FPC-N34-0710, Level 1	1,500
FPC-N35-0771, Level 1	1,500

Figure 2: Supported Point Count Capacity

Devices	Registers Per Device
Envi	53
Love	40
Nuro	31

Figure 3: Modbus Registers per Device

2.3 Configuring Device Communications

2.3.1 Set Modbus COM setting on all of the Devices connected to the ProtoNode

- All of the Serial devices connected to ProtoNode **MUST have the same Baud Rate, Data Bits, Stop Bits, and Parity settings.**
- Figure 4 specifies the device serial port settings required to communicate with the ProtoNode.
- Set the Modbus COM settings on the devices now. When mixing devices, the selected baud rates are required to match the slowest device (ENVI=9600). When there are no ENVI units present, the baud rate could be set faster (LOVE end NURO support 19200 and 38400).
    - The ProtoNode's default settings are 9600 / None / 8 /1
    - Ability to change the ProtoNode's Device COM settings are offered later in Section 2.5.1
- The Selected device COM settings need to be documented.

Serial Port Setting	ENVI	LOVE	NURO
Protocol	Modbus RTU	Modbus RTU	Modbus RTU
Baud Rate	9600	9600, 19.2k, 38.4k	9600, 19.2k, 38.4k
Parity	None	None	None
Data Bits	8	8	8
Stop Bits	1	1 or 2	1 or 2[4]

Figure 4: Modbus RTU COM Settings

2.3.2 Set Modbus RTU Node-ID for each of the Devices attached to the ProtoNode

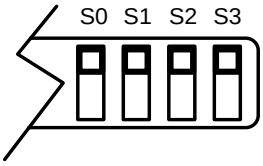
- Set Modbus Node-ID for each of the devices attached to ProtoNode. The Modbus Node-ID's need to be uniquely assigned between 1 and 255.
    - **The Modbus Node-ID that is assigned for each device needs to be documented.**
        - The Modbus Node-ID's assigned are used for designating the Device Instance for BACnet/IP and BACnet MS/TP (Section 2.5.2)
- The Metasys N2 and Modbus TCP/IP Node-ID will be set to same value as the Node-ID of the Modbus RTU device.

[4] Adding option for 1 stop bit; Q1 2015?

2.4 Selecting the Desired Field Protocol and Enabling Auto-Discovery

2.4.1 Selecting Desired Field Protocol

- ProtoNode FPC-N34 units use the "S" bank of DIP switches (S0 – S2) to select the Field Protocol.
  - See the table in figure 4 for the switch settings to select BACnet MS/TP, BACnet/IP, Modbus TCP/IP, or Metasys N2.
  - The OFF position is when the DIP switches are set closest to the outside of the box.
- ProtoNode FPC-N35 units do not use the "S" bank DIP switches (S0 – S2) to select a Field Protocol.
  - On ProtoNode FPC-N35 units, these switches are disabled; the Field Protocol is always LonWorks.



S0 – S3 DIP Switches

S Bank DIP Switch Location

ProtoNode FPC-N34	S Bank DIP Switches		
Profile	**S0**	**S1**	**S2**
BACnet/IP	Off	Off	Off
BACnet MS/TP	On	Off	Off
Metasys N2	Off	On	Off
Modbus TCP/IP	On	On	Off
BACnet MS/TP (single node)	Off	Off	On

BACnet MS/TP, BACnet/IP, Modbus TCP/IP, and Metasys N2 Settings for ProtoNode FPC-N34 (BACnet)

Figure 5: S Bank DIP Switches

2.4.2 Enabling Auto-Discovery

NOTE:

If Modbus TCP/IP was selected in Section 2.4.1 for the Field/BMS protocol, skip this section. Auto-Discovery is NOT used for Modbus TCP/IP.

- The S3 DIP switch is used to both enable Auto-Discovery of known devices attached to the ProtoNode, and to save the recently discovered configuration.
  - See the table in **Figure 6** for the switch setting to enable Auto-Discovery.
  - If the ProtoNode is being installed for the first time, set S3 to the ON position to enable Auto-Discovery.
  - The ON position is when the DIP switches are set closest to the inside of the box.

S3 DIP Switch Auto-Discovery Mode	S3
Auto-Discovery ON – Build New Configuration	On
Auto-Discover OFF – Save Current Configuration	Off

Figure 6: S3 DIP Switch setting for Auto Discovering Devices

2.5 BMS Network Settings: MAC Address, Device Instance and Baud Rate

2.5.1 BACnet MS/TP (FPC-N34): Setting the MAC Address for BMS Network

- Only 1 MAC address is set for ProtoNode regardless of how many devices are connected to ProtoNode.
- Set the BACnet MS/TP MAC addresses of the ProtoNode to a value between 1 to 127 (MAC Master Addresses); this is so that the BMS Front End can find the ProtoNode via BACnet auto discovery.
- **Note: Never set a BACnet MS/TP MAC Address from 128 to 255**. Addresses from 128 to 255 are Slave Addresses and can not be discovered by BMS Front Ends that support auto discovery of BACnet MS/TP devices.
- Set "A" bank DIP switches A0 – A7 to assign a MAC Address to the ProtoNode for BACnet MS/TP.
- Please refer to **Appendix C.1** for the complete range of MAC Addresses and DIP switch settings.

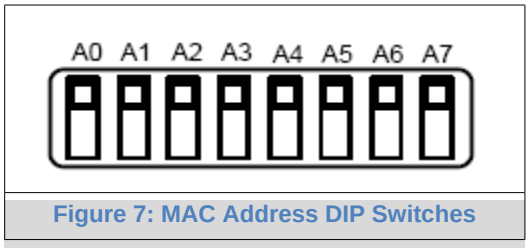


Figure 7: MAC Address DIP Switches

NOTE: When setting DIP Switches, please ensure that power to the board is OFF.

2.5.2 BACnet MS/TP and BACnet/IP (FPC-N34): Setting the Device Instance

- The BACnet Device Instances will be calculated by adding the Node_Offset (default value is 50,000) to the device's Modbus Node ID (that was assigned in Section 2.2).
- The BACnet Device Instance can range from 1 to 4,194,303.
- **To assign specific Device Instance values, change the Node_Offset value. (Section 2.5.2.1)**

For example:

  - Node_Offset value (default) = 50,000
  - Device 1 has a Modbus Node-ID of 1
  - Device 2 has a Modbus Node-ID of 22
  - Device 3 has a Modbus Node-ID of 33
  - **Given that: Device Instance = Node_Offset + Modbus Node_ID**
  - Device Instance, Device 1 = 50,000 + 1 = 50,001
  - Device Instance, Device 2 = 50,000 + 22 = 50,022
  - Device Instance, Device 3 = 50,000 + 33 = 50,033

2.5.2.1 BACnet MS/TP or BACnet/IP: Assigning Specific Device Instances

- With the default Node_Offset value of 50,000 the Device Instances values generated will be within the range of 50,001 to 50,127.
- The values allowed for a BACnet Device Instance can range from 1 to 4,194,303.
- To assign a specific Device Instance (or range), change the Node_Offset value.
- **Methods for changing the Node_Offset value are provided in Section 4.2**
  - This step cannot be performed until after the unit is connected and powered.

2.5.3 Metasys N2 or Modbus TCP/IP (FPC-N34): Setting the Node-ID

- The Modbus RTU Node-ID's assigned to the devices attached to the ProtoNode in Section 2.2 will be the Metasys N2 or Modbus TCP/IP Node_ID's to the field protocols.
- Metasys N2 and Modbus TCP/IP Node-ID Addressing: Metasys N2 and Modbus TCP/IP Node-ID's range from 1-255.

2.5.4 BACnet MS/TP (FPC-N34): Setting the Baud Rate for BMS Network

- "B" bank DIP switches B0 – B3 can be used to set the Field baud rate of the ProtoNode to match the baud rate required by the Building Management System for BACnet MS/TP.
- The baud rate on ProtoNode for Metasys N2 is set for 9600. "B" bank DIP switches B0 – B3 are disabled for Metasys N2 on ProtoNode FPC-N34.
- "B" bank DIP switches B0 – B3 are disabled on ProtoNode FPC-N35 (FPC-N35 LonWorks).

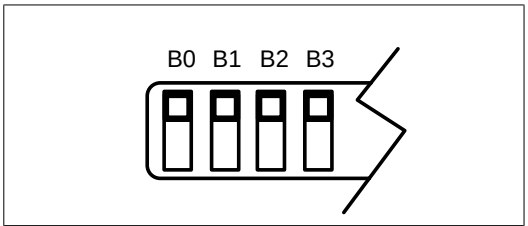


Figure 8: BMS Baud Rate DIP Switches

2.5.4.1 Baud Rate DIP Switch Selection

Baud	B0	B1	B2	B3
9600	On	On	On	Off
19200	Off	Off	Off	On
38400*	**On**	**On**	**Off**	**On**
57600	Off	Off	On	On
76800	On	Off	On	On

Figure 9: BMS Baud Rate

* Factory default setting = 38,400

3 INTERFACING PROTONODE TO DEVICES

3.1 ProtoNode FPC-N34 and FPC-N35 Showing Connection Ports

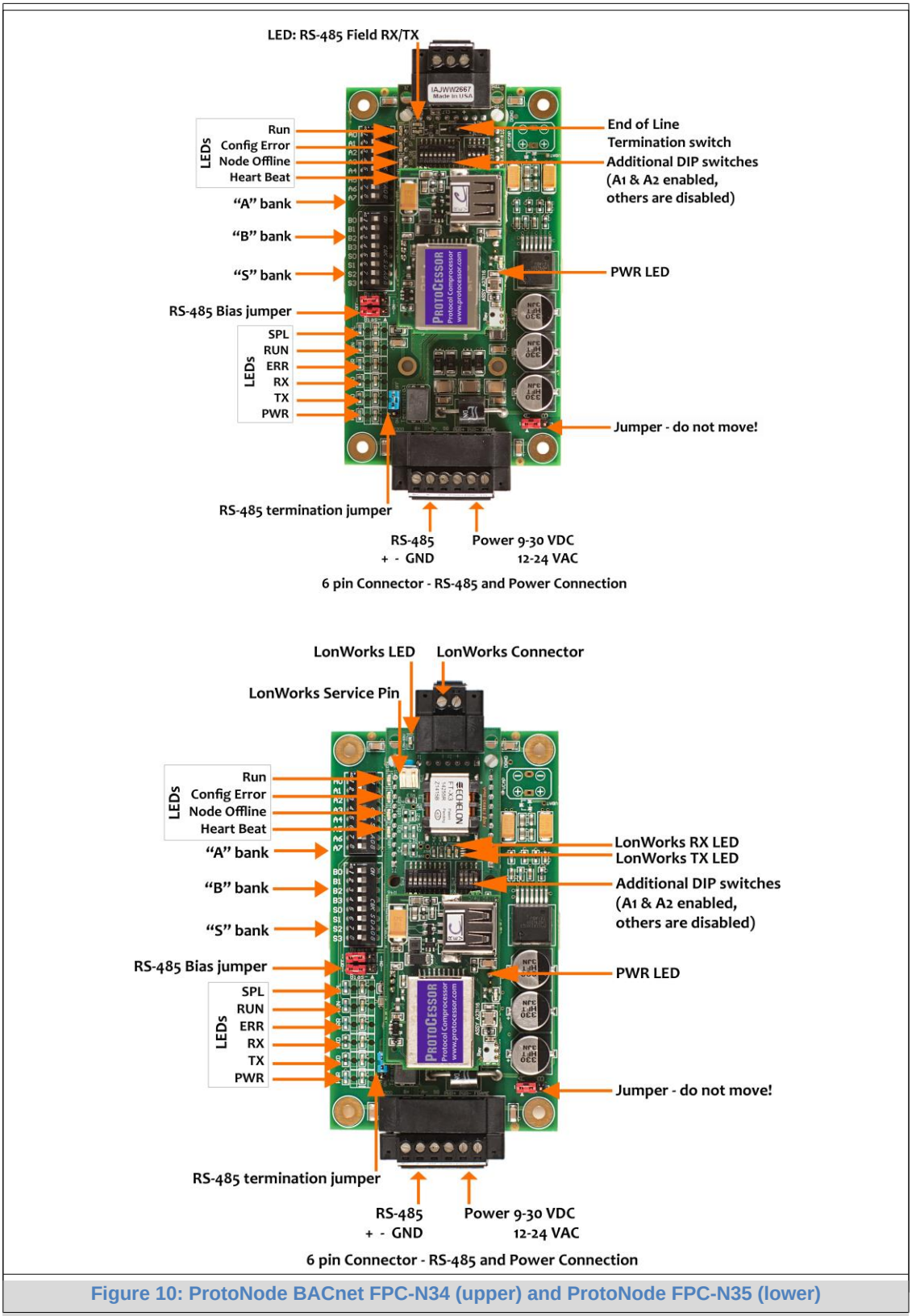


Figure 10: ProtoNode BACnet FPC-N34 (upper) and ProtoNode FPC-N35 (lower)

3.2 Device Connections to ProtoNode

ProtoNode 6 Pin Phoenix connector for RS-485 Devices

- The 6 pin Phoenix connector is the same for ProtoNode FPC-N34 (BACnet) and FPC-N35 (LonWorks).
- Pins 1 through 3 are for Modbus RS-485 devices.
  - The RS-485 GND (Pin 3) is not typically connected.
- Pins 4 through 6 are for power. **Do not connect power** (wait until Section 3.5).

3.2.1 Connecting NURO Modbus RTU Boilers to the ProtoNode's RS-485

- Connect NURO's Modbus COM A to ProtoNode's pin 1 labeled Tx/+ on the Phoenix 6 pin connector.
- Connect NURO's Modbus COM B to ProtoNode's pin 2 labeled Rx/- on the Phoenix 6 pin connector.
- Do not connect Ground between NURO and the ProtoNode's RS-485 Ground.

3.2.2 Connecting LOVE Modbus RTU Boilers to the ProtoNode's RS-485

- Connect LOVE's Modbus DATA+ to ProtoNode's pin 1 labeled Tx/+ on the Phoenix 6 pin connector.
- Connect LOVE's Modbus DATA- to ProtoNode's pin 2 labeled Rx/- on the Phoenix 6 pin connector.
- Do not connect Ground between LOVE and the ProtoNode's RS-485 Ground.

3.2.3 Connecting ENVI Modbus RTU Boilers to the ProtoNode's RS-485

- Connect ENVI's Modbus COM 1A (RS-485+) to ProtoNode's pin 1 labeled B+ (RS-485+) on the Phoenix 6 pin connector.
- Connect ENVI's Modbus COM 1B (RS-485-) to ProtoNode's pin 2 labeled A- (RS-485-) on the Phoenix 6 pin connector.
- Do not connect Ground between ENVI and the ProtoNode's RS-485 Ground.

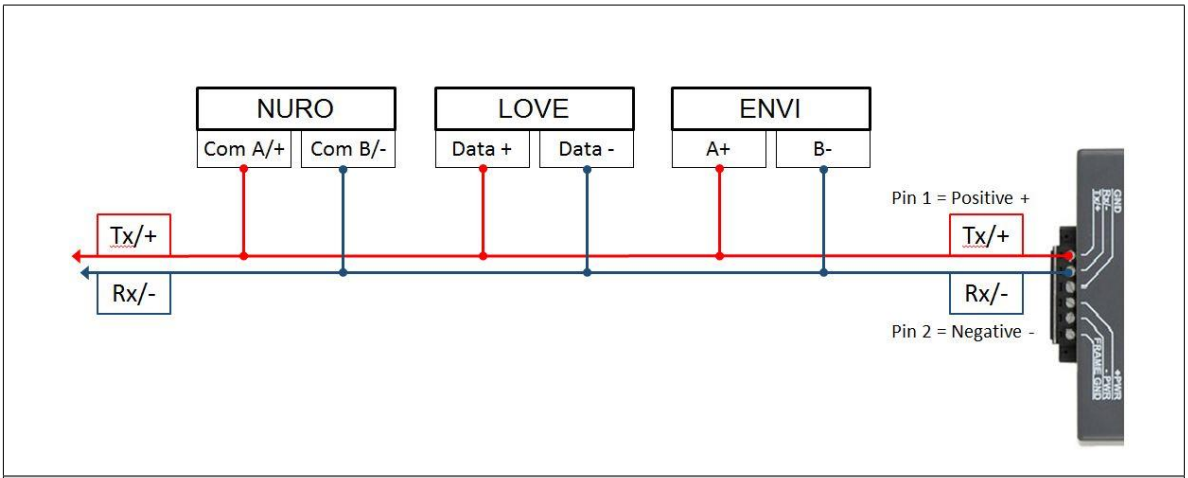


Figure 11: Wiring diagram for Modbus RTU RS-485 connections to the ProtoNode's RS-485 port

3.2.4 Biasing the Modbus RS-485 Device Network

- An RS-485 network with more than one device needs to have biasing to ensure proper communication. The biasing only needs to be done on one device.
- None of the ENVI's support biasing. The ProtoNode is required to bias the RS-485 network.
- The ProtoNode has 510 Ohm resistors that can be used to set the biasing. The ProtoNode's default positions from the factory for the Biasing jumpers are OFF.
- The OFF position is when the 2 RED biasing jumpers straddle the 4 pins closest to the outside of the board of the ProtoNode. See **Figure 12**.
- **Only turn biasing ON:**
  - **IF the BMS cannot see more than one device connected to the ProtoNode**
  - **AND you have checked all the settings (Modbus COM settings, wiring, and DIP switches).**
- To turn biasing ON, move the 2 RED biasing jumpers to straddle the 4 pins closest to the inside of the board of the ProtoNode.

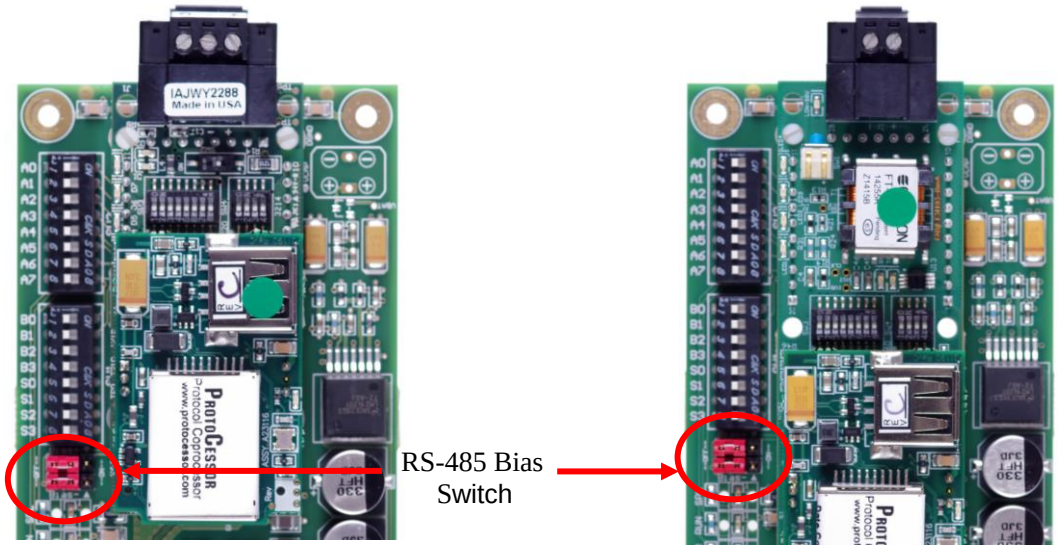


Figure 12: Modbus RS-485 Biasing Switch on the ProtoNode N34 (left) and ProtoNode N35 (right)

3.2.5 End of Line Termination Switch for the Modbus RS-485 Device Network

- On long RS-485 cabling runs, the RS-485 trunk must be properly terminated at each end.
- The ProtoNode has an End Of Line (EOL) blue jumper. The default setting for this Blue EOL switch is OFF with the jumper straddling the pins closest to the inside of the board of the ProtoNode.
    - On short cabling runs the EOL switch does not to need to be turned ON.
- **If the ProtoNode is placed at one of the ends of the trunk, set the blue EOL jumper to the ON position straddling the pins closest to the outside of the board of the ProtoNode.**
- **Always leave the single Red Jumper in the A position (default factory setting).**

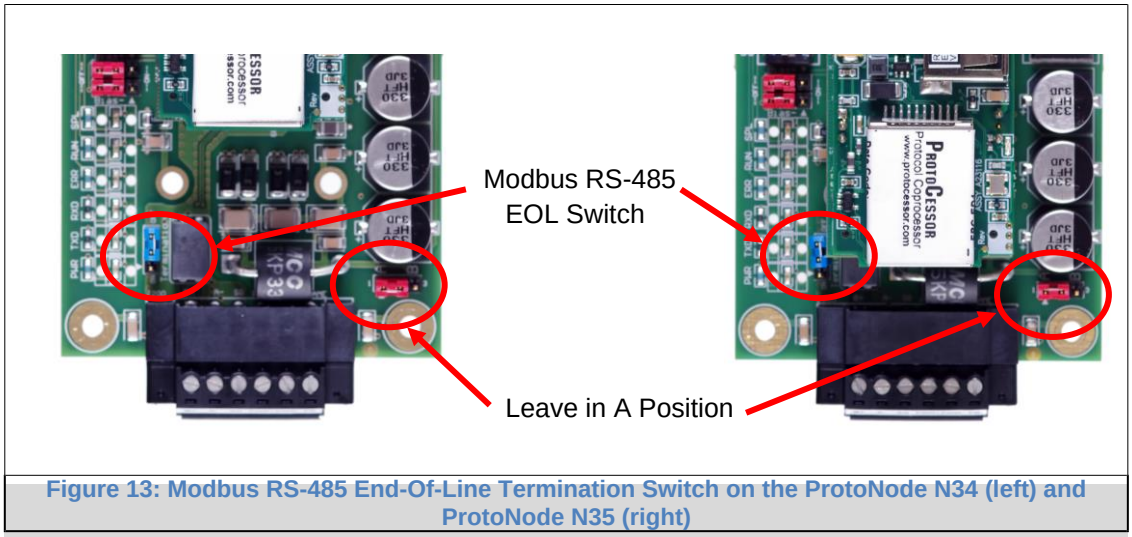


Figure 13: Modbus RS-485 End-Of-Line Termination Switch on the ProtoNode N34 (left) and ProtoNode N35 (right)

3.3 BACnet MS/TP or Metasys N2 (FPC-N34): Wiring Field Port to RS-485 BMS Network

- Connect the BACnet MS/TP or Metasys N2 RS-485 network wires to the 3-pin RS-485 connector on ProtoNode FPC-N34 as shown below in **Figure 14**.
  - The RS-485 GND (Pin 3) is not typically connected.
- See **Section 5** for information on connecting to BACnet/IP network.
- If the ProtoNode is the last device on the BACnet MS/TP or Metasys N2 trunk, then the End-Of-Line Termination Switch needs to be enabled (**Figure 15**).
  - The default setting from the factory is OFF (switch position = right side).
  - To enable the EOL Termination, turn the EOL switch ON (switch position = left side).

BMS RS-485 Wiring	ProtoNode Pin #	Pin Assignment
RS-485 +	Pin 1	RS-485 +
RS-485 -	Pin 2	RS-485 -
-	Pin 3	RS-485 GND

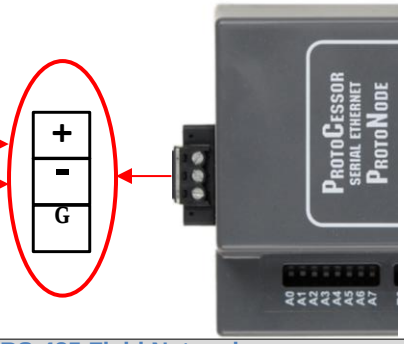


Figure 14: Connection from ProtoNode to RS-485 Field Network

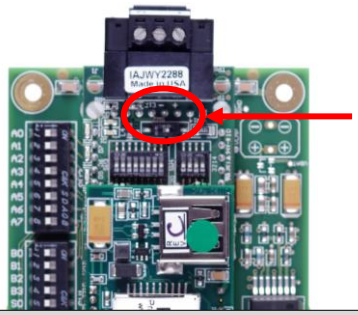


Figure 15: RS-485 BMS Network EOL Switch

3.4 LonWorks (FPC-N35): Wiring Field Port to LonWorks Network

- Connect ProtoNode to the field network with the LonWorks terminal using a twisted pair non-shielded cable. LonWorks has no polarity.

Figure 16: LonWorks Terminal

3.5 Power-Up ProtoNode

Apply power to ProtoNode as show below in **Figure 18.** Ensure that the power supply used complies with the specifications provided in **Appendix D.1**.

- ProtoNode accepts either 9-30VDC or 12-24 VAC on pins 4 and 5.
- **Frame GND should be connected.**

Power Requirement for ProtoNode External Gateway			
	Current Draw Type		
ProtoNode Family	12VDC/VAC	24VDC/VAC	30VDC
FPC – N34 (Typical)	170mA	100mA	80mA
FPC – N34 (Maximum)	240mA	140mA	100mA
FPC – N35 (Typical)	210mA	130mA	90mA
FPC – N35 (Maximum)	250mA	170mA	110mA
Note: These values are 'nominal' and a safety margin should be added to the power supply of the host system. A safety margin of 25% is recommended.			

Figure 17: Required current draw for the ProtoNode

Power to ProtoNode		
Power In (+)	Pin 4	V +
Power In (-)	Pin 5	V -
Frame Ground	Pin 6	FRAME GND

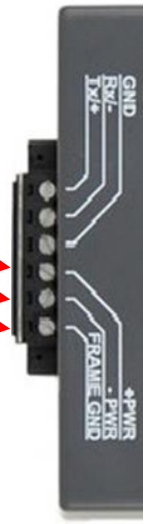


Figure 18: Power Connections

3.5.1 Auto-Discovery: After Completion – Turn Off to Save Configuration

NOTE:

If Modbus TCP/IP was selected in Section 2.4.1 for the Field/BMS protocol, skip this section. Auto-Discovery is NOT used for Modbus TCP/IP.

The S3 DIP Switch for Enabling Auto-Discovery should have been set in section 2.3.2 before applying power to the ProtoNode.

Do not Enable Auto-Discovery when the unit is powered.

- When power is applied to a ProtoNode that is set to Enable Auto-Discovery, it will take 3 minutes to complete the discovery of all of the RS-485 devices attached to the ProtoNode.
- **Once the ProtoNode has discovered all of the RS-485 devices, set the S3 DIP switch to the OFF position to save the current configuration.**

ProtoNode FPC-N34 and FPC-N35	
S3 DIP Switch Auto-Discovery Mode	**S3**
Auto-Discovery ON – Build New Configuration	On
Auto-Discover OFF – Save Current Configuration	Off

Figure 19: S3 DIP Switch setting for Auto Discovering Devices

4 BACNET/IP OR MODBUS TCP/IP: CHANGE THE PROTONODE IP ADDRESS

4.1 Connect the PC to ProtoNode via the Ethernet Port

- Connect a Cat 5 Ethernet cable (Straight through or Cross-Over) between the PC and ProtoNode.
- The Default IP Address of ProtoNode is **192.168.1.24**, Subnet Mask is **255.255.255.0**. If the PC and ProtoNode are on different IP Networks, assign a static IP Address to the PC on the 192.168.1.xxx network.
- Go to 

> 

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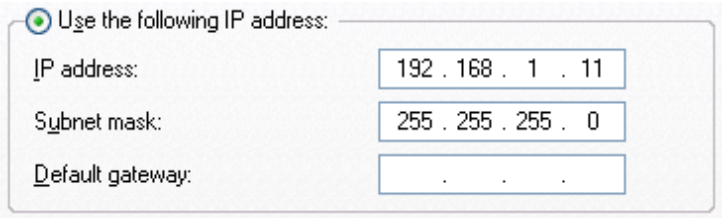
- Right-click on Local Area Connection > Properties
- Highlight 

> 

- Select: Use the following IP address



- Click 

twice

4.2 BACnet/IP and Modbus TCP/IP: Setting IP Address for Field Network

- After setting your PC to be on the same subnet as the ProtoNode (Section 4.1), open a web browser on your PC and enter the IP address of the ProtoNode; the default address is 192.168.1.24.
- The Web Configurator will be displayed as your landing page. (Figure 20)
- Below the Active Profiles heading you should see profiles listed for connected devices. If no profiles are present, then the wiring, baud rate, and DIP switch settings must be checked, because there is a problem with device communications. All the active profiles must show the correct Node-ID's before proceeding.
- **To access the FST Web GUI, click on the "Diagnostics & Debugging" button** in the bottom right side of the page.

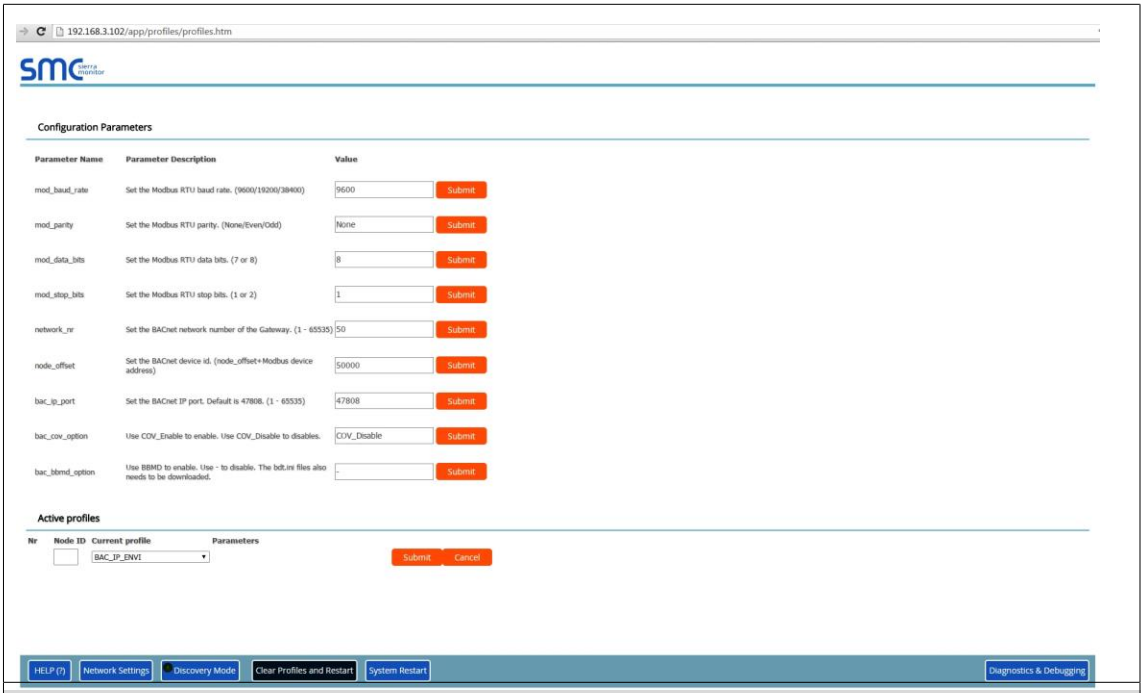


Figure 20: Web Configurator screen with Active Profiles

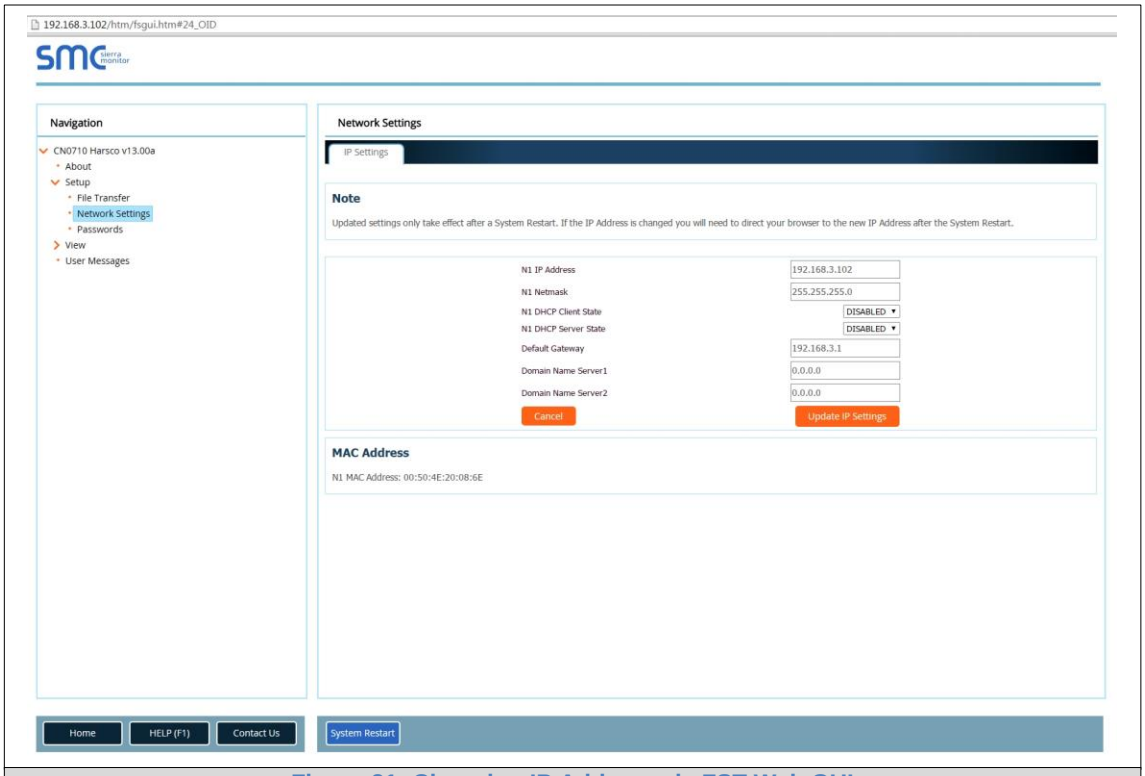


Figure 21: Changing IP Address via FST Web GUI

- From the FST Web GUI's landing page, click on "Setup" to expand the navigation tree and then select "Network Settings" to access the IP Settings menu. (**Figure 21**)
- Modify the IP address (N1 IP address field) of the ProtoNode Ethernet port.
- If necessary, change the Netmask (N1 Netmask field).
- Type in a new Subnet Mask
- If necessary, change the IP Gateway (Default Gateway field)
- Type in a new IP Gateway
- Note: If the ProtoNode is connected to a router, the IP Gateway of the ProtoNode should be set to the IP address of the router that it is connected to.
- Reset ProtoNode
- Unplug Ethernet cable from PC and connect it to the network hub or router
- **Record the IP address assigned to the ProtoNode for future reference.**

5 BACNET MS/TP AND BACNET/IP: SETTING NODE_OFFSET TO ASSIGN SPECIFIC DEVICE INSTANCES

- After setting your PC to be on the same subnet as the ProtoNode (Section 4.1), open a web browser on your PC and enter the IP address of the ProtoNode; the default address is 192.168.1.24.
- If the IP address of the ProtoNode has been changed by previous configuration, you will need to get the assigned IP address from the network administrator.
- The Web Configurator will be displayed as your landing page. (Figure 22)
- Node_Offset field will be presented displaying the current value (default = 50,000).
- Change the value of Node_Offset to establish the desired Device Instance values, and click SUBMIT.
    - **Given that: Node_Offset + Modbus Node_ID = Device Instance**
    - Then: **Node_Offset (required) = Device Instance (desired) – Modbus Node_ID**

For example:

- Device 1 has a Modbus Node-ID of 1
- Device 2 has a Modbus Node-ID of 22
- Device 3 has a Modbus Node-ID of 33
- Desired Device Instance for 1st device = 1,001
- **Node_Offset (required) = 1,001 – (Modbus Node_ID) = 1,001 – 1 = 1,000**
- The Node_Offset value will be applied to all devices.
- Device 1 Instance will then be = 1,000 + Modbus Node_ID = 1,000 + 1 = 1,001
- Device 2 Instance will then be = 1,000 + Modbus Node_ID = 1,000 + 22 = 1,022
- Device 3 Instance will then be = 1,000 + Modbus Node_ID = 1,000 + 33 = 1,033

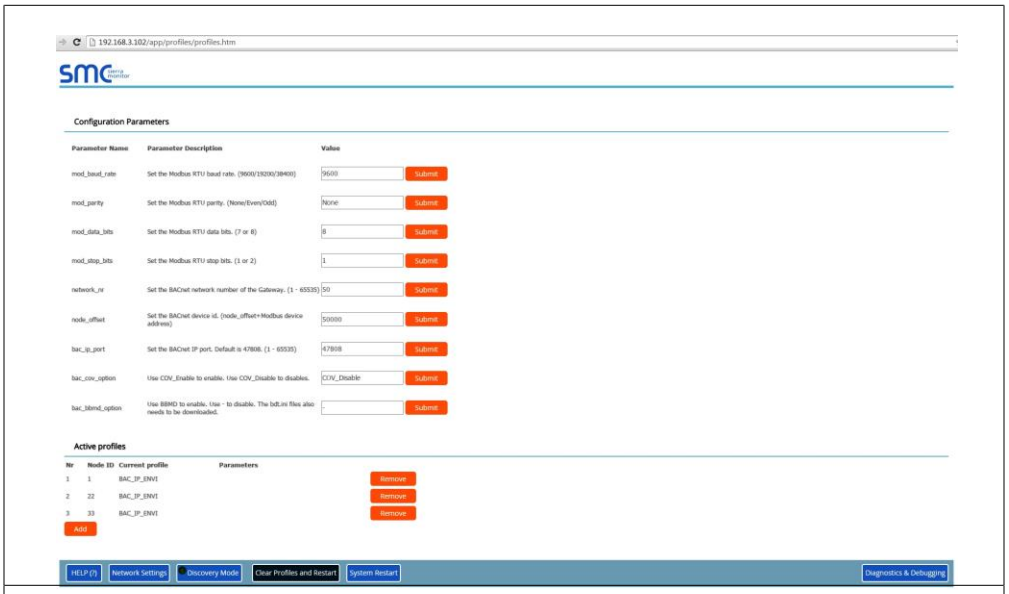


Figure 22: Web Configurator screen

6 HOW TO START THE INSTALLATION OVER: CLEARING PROFILES

- After setting your PC to be on the same subnet as the ProtoNode (Section 4), open a web browser on your PC and enter the IP address of the ProtoNode; the default address is 192.168.1.24.
- If the IP address of the ProtoNode has been changed by previous configuration, you will need to get the assigned IP address from the network administrator.
- The Web Configurator will be displayed as your landing page.
- **At the bottom-left of the page, click the "Clear Profiles and Restart" button.**
- Once restart is complete, all the past profiles that were discovered and or added via the Web configurator will be delete. The unit is now ready to be reinstalled.

7 LONWORKS (FPC-N35): COMMISSIONING PROTONODE ON A LONWORKS NETWORK

Commissioning may only be performed by the LonWorks administrator.

7.1 Commissioning ProtoNode FPC-N35 on a LonWorks Network

The User will be prompted by the LonWorks Administrator to hit the Service Pin on the ProtoNode FPC-N35 at the correct step of the Commissioning process which is different for each LonWorks Network Management Tool.

- If an XIF file is required, see steps in Section 7.1.1 to generate XIF

Figure 23: LonWorks Service Pin Location

7.1.1 Instructions to Download XIF File from ProtoNode FPC-N35 Using Browser

- Connect a Cat 5 Ethernet cable (Straight through or Cross-Over) between the PC and ProtoNode.
- The Default IP Address of ProtoNode is **192.168.1.24**, Subnet Mask is **255.255.255.0**. If the PC and ProtoNode are on different IP Networks, assign a static IP Address to the PC on the 192.168.1.xxx network
- For Windows XP:

  Go to start > Control Panel > Network Connections

  Right-click on Local Area Connection > Properties

  Highlight Internet Protocol (TCP/IP) > Properties

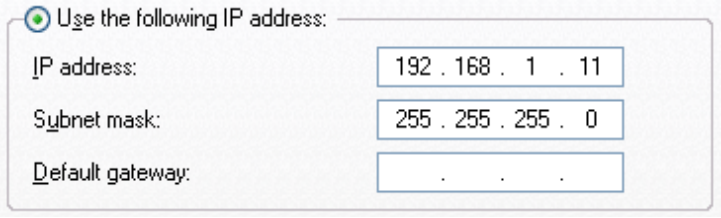
- For Windows 7:

  Go to > Control Panel > Network and Internet > Network and Sharing Center > Change adapter settings

  Right-click on Local Area Connection > Properties

  Highlight Internet Protocol Version 4 (TCP/IPv4) > Properties

- For Windows XP and Windows 7, select: Use the following IP address



- Click OK twice
- Open a web browser and go to the following address: IP address of ProtoCessor/fserver.xif
- Example: 192.168.1.24/fserver.xif
- If the web browser prompts you to save file, save the file onto the PC. If the web browser displays the xif file as a web page, save the file on your PC as fserver.xif

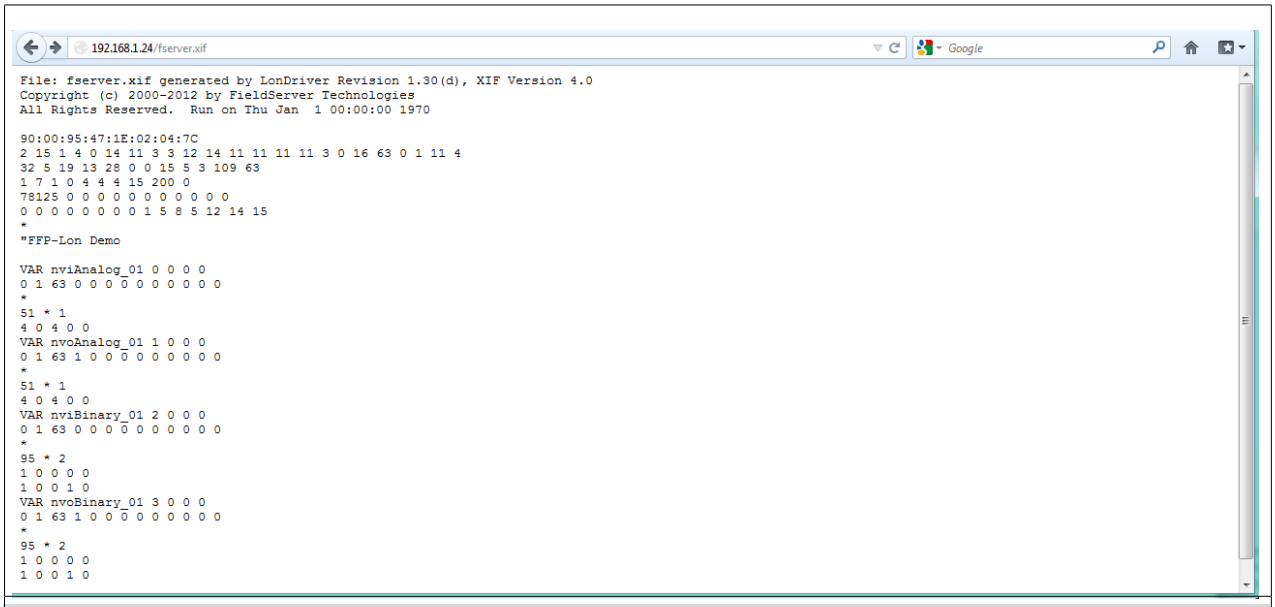


Figure 24: Sample of Fserver.XIF File Being Generated

8 CAS BACNET EXPLORER FOR VALIDATING PROTONODE IN THE FIELD

ProtoCessor has arranged a complementary 2 week fully functional copy of CAS BACnet Explorer (through Chipkin Automation) that can be used to validate BACnet MS/TP and/or BACnet/IP communications of ProtoNode in the field without having to have the BMS Integrator on site. A Serial or USB to RS-485 converter is needed to test BACnet MS/TP.

8.1 Downloading the CAS Explorer and Requesting an Activation Key

- To request the complementary BACnet CAS key, go to http://app.chipkin.com/activation/twoweek/ and fill in all the information. **Enter Vendor Code "Harsco12".** Once completed, the email address that was submitted will be registered.

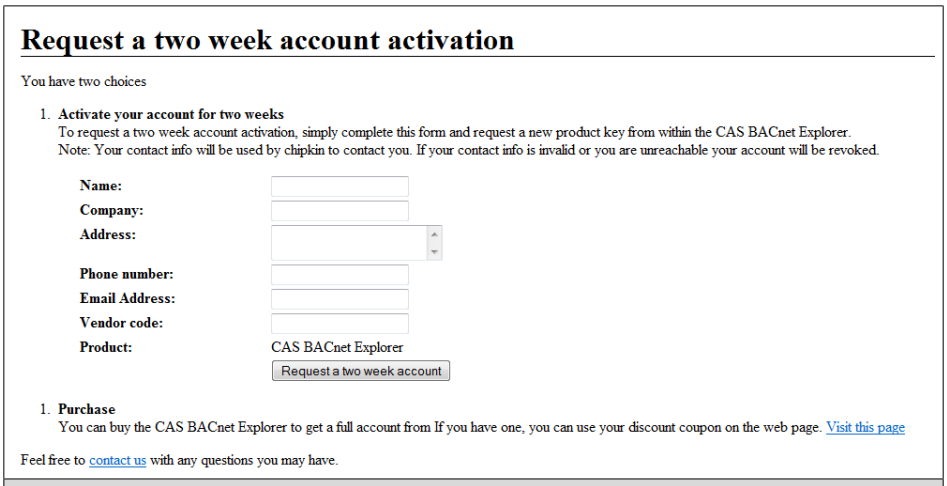


Figure 25: Downloading the CAS Explorer

- Go to the following web site, download and install the CAS BACnet Explorer to your PC: http://www.chipkin.com/technical-resources/cas-bacnet-explorer/
- Open CAS BACnet Explorer; in the CAS Activation form, enter the email address that was registered and click on "Request a key". The CAS key will then be emailed to the registered address. Cut/paste key from email into the Product key field and click "Activate".

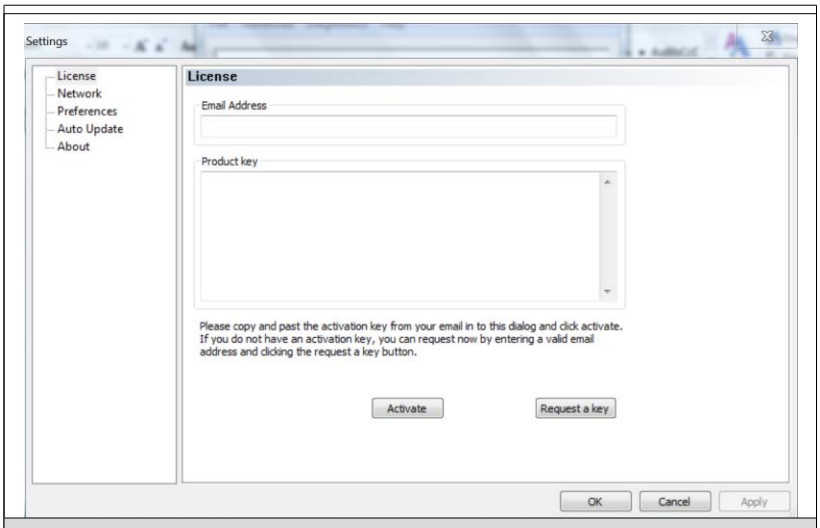


Figure 26: Requesting CAS Activation Key

8.2 CAS BACnet Setup

These are the instructions to set CAS Explorer up for the first time on BACnet MS/ST and BACnet/IP.

8.2.1 CAS BACnet MS/TP Setup

- Using the Serial or USB to RS-485 converter, connect it to your PC and the 3 Pin BACnet MS/TP connector on ProtoNode FPC-N34.
- In CAS Explorer, do the following:
  - Click on settings
  - Check the BACnet MS/TP box and uncheck the BACnet/IP and BACnet Ethernet boxes
  - Set the BACnet MS/TP MAC address to 0
  - Set the BACnet MS/TP Baud Rate to 38400
  - Click Ok
  - On the bottom right-hand corner, make sure that the BACnet MS/TP box is green
  - Click on discover
  - Check all 4 boxes
  - Click Send

8.2.2 CAS BACnet BACnet/IP Setup

- See Section **4.2** to set the IP address and subnet of the PC that will be running the CAS Explorer.
- Connect a straight through or cross Ethernet cable from the PC to ProtoNode.
- In CAS Explorer, do the following:
  - Click on settings
  - Check the BACnet/IP box and uncheck the BACnet MS/TP and BACnet Ethernet boxes
  - In the "Select a Network Device" box, select the network card of the PC by clicking on it
  - Click Ok
  - On the bottom right-hand corner, make sure that the BACnet/IP box is green
  - Click on discover
  - Check all 4 boxes
  - Click Send

Appendix A. Troubleshooting

Appendix A.1. Viewing Diagnostic information

- Type the IP address of the ProtoNode into your web browser or use the FieldServer Toolbox to connect to the ProtoNode.
- Click on Diagnostics and Debugging Button, then click on view, and then on connections.

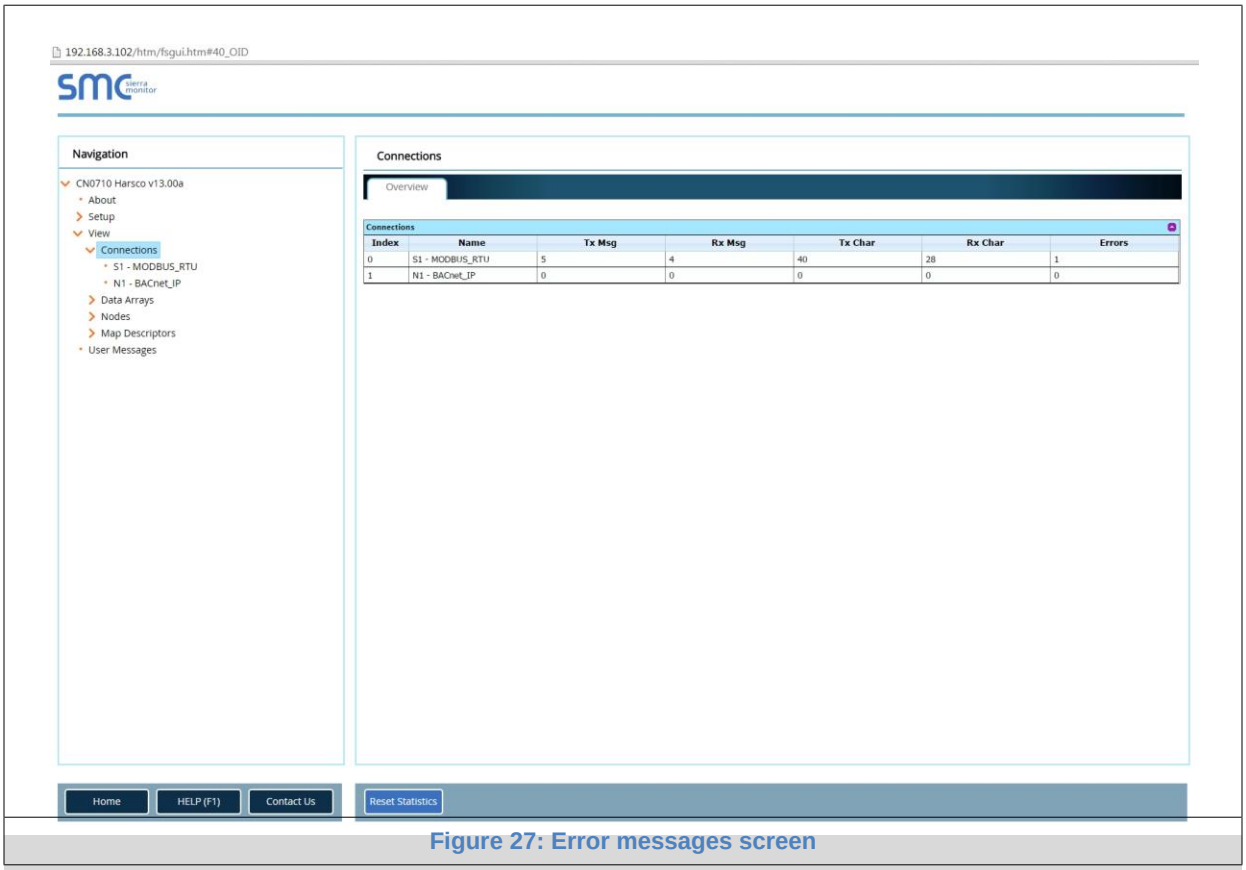


Figure 27: Error messages screen

- If there are any errors showing on the Connection page, please refer to **Appendix A.2** for the relevant wiring and settings.

Appendix A.2. Check Wiring and Settings

- No COMS on Modbus RTU side. If Tx/Rx are not flashing rapidly then there is a COM issue on the Modbus side and you need to check the following things:
  - Visual observations of LEDs on ProtoNode. (**Appendix A.5**)
  - Check baud rate, parity, data bits, stop bits
  - Check Modbus device address
  - Verify wiring
  - Verify all the Modbus RTU devices that were discovered in FST Web Configurator. (Section **5**)
- Field COM problems:
  - Visual observations of LEDs on ProtoNode. (**Appendix A.5**)
  - Visual dipswitch settings (using correct baud rate and device instance)
  - Verify IP address setting
  - Verify wiring

If the problem still exists, a Diagnostic Capture needs to be taken and sent to Sierra Monitor Corporation. (Appendix A.3)

Appendix A.3. Take Diagnostic Capture With the FieldServer Utilities

- **Once the Diagnostic Capture is complete, email it to support@sierramonitor.com. The Diagnostic Capture will allow us to rapidly diagnose the problem.**
- Ensure that FieldServer Toolbox is Loaded on the PC that is currently being used, or download FieldServer-Toolbox.zip on the Sierra Monitor Corporation webpage, under Customer Care: Resource Center, Software Downloads:
  http://www.sierramonitor.com/customer-care/resource-center?filters=software-downloads
- Extract the executable file and complete the installation.

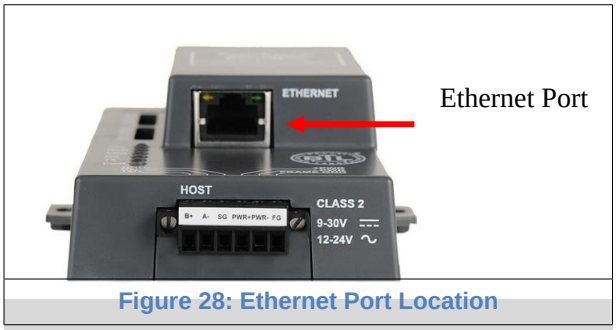
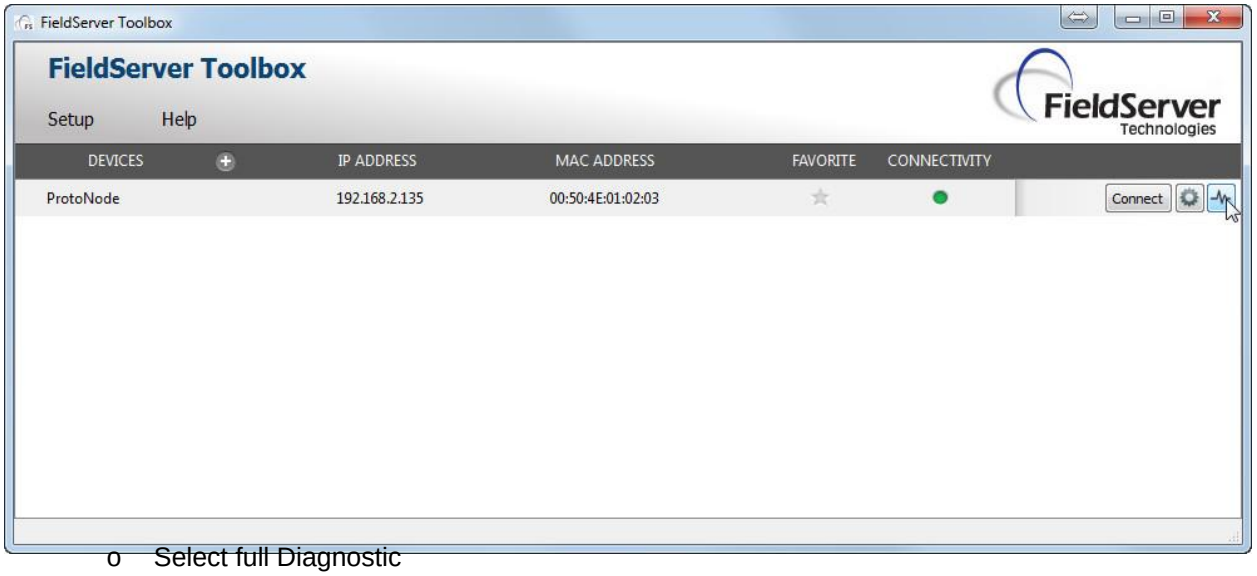


Figure 28: Ethernet Port Location

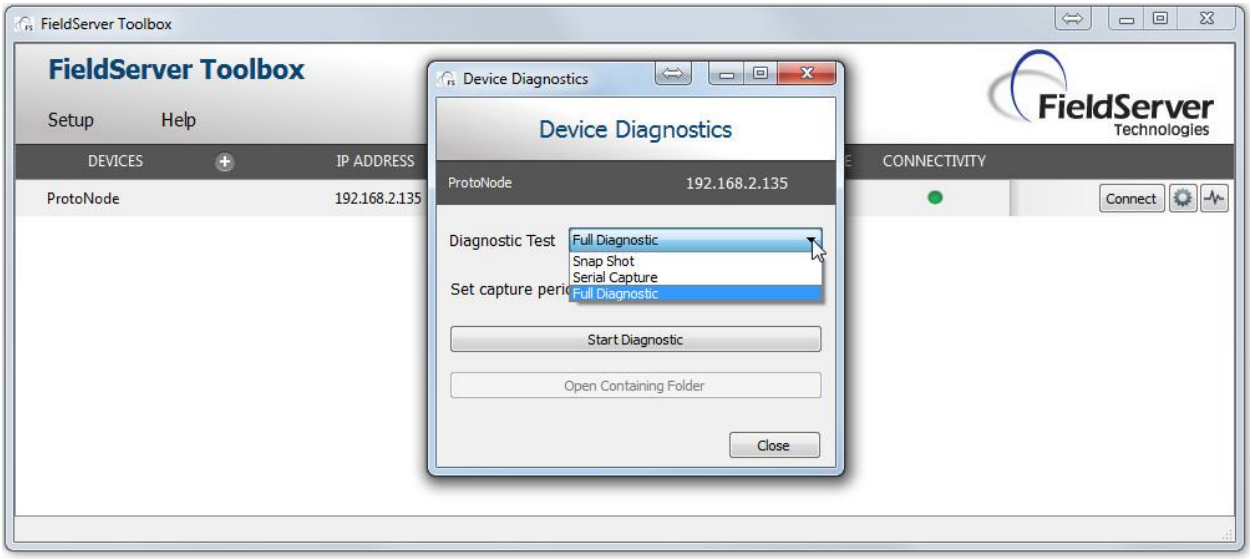
- Disable any wireless Ethernet adapters on the PC/Laptop
- Disable firewall and virus protection software if possible
- Connect a standard cat5 Ethernet cable between the PC and ProtoNode
- Double click on the FS Toolbox Utility

Step 1: Take a Log

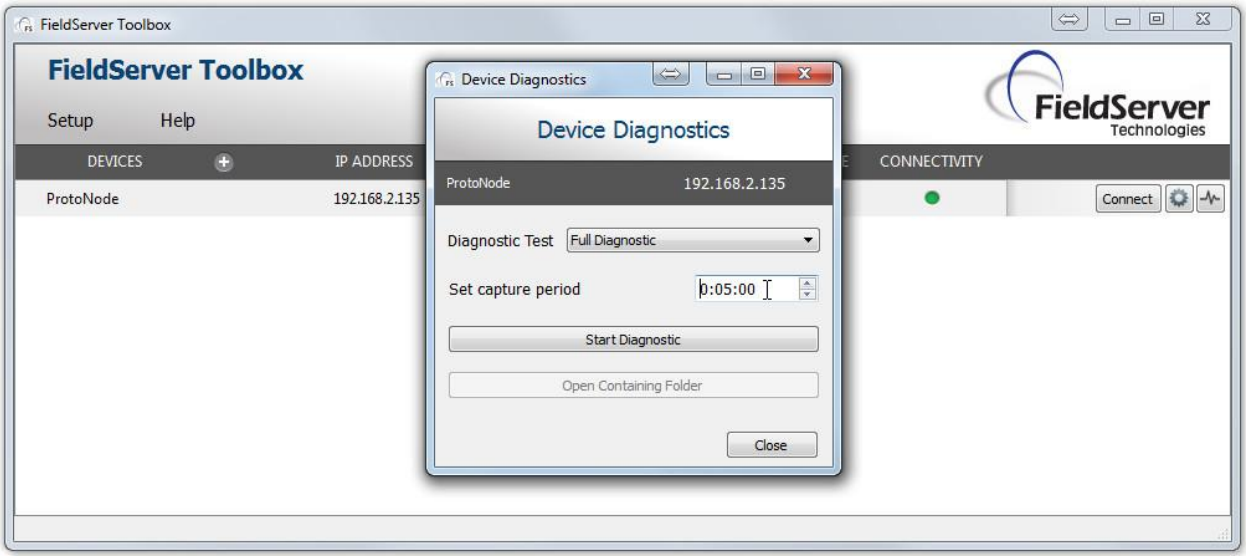
- Click on the diagnose icon of the desired device.



- Select full Diagnostic

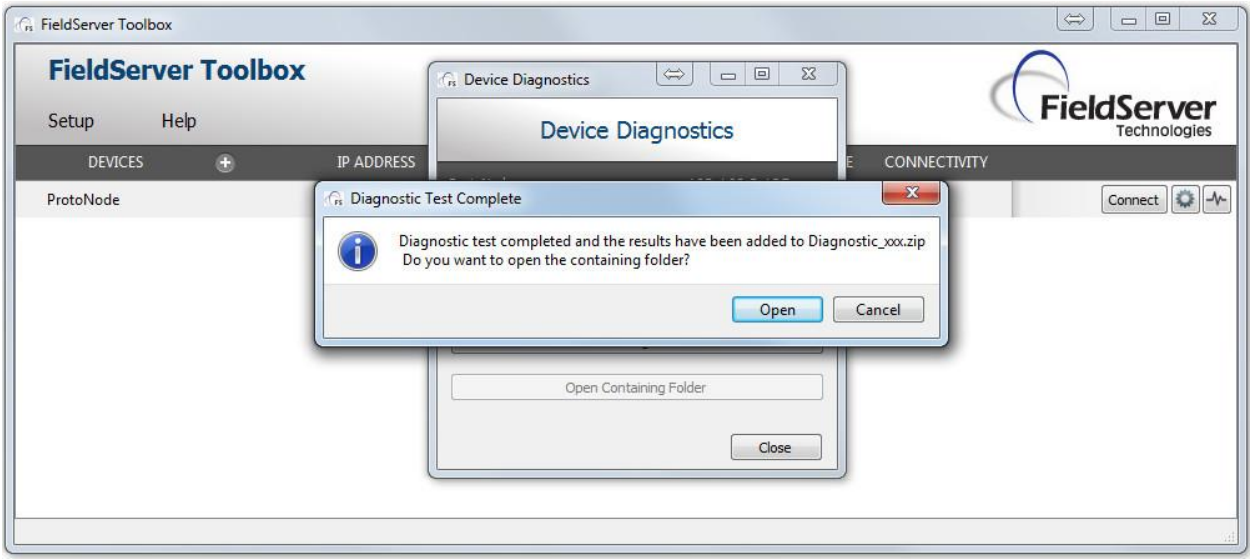


- If desired, the default capture period can be changed.
- Click on Start Diagnostic



- Wait for Capture period to finish. Diagnostic Test Complete window will appear.

- **Step 2**: Send Log
  - Once the Diagnostic test is complete, a .zip file will be saved on the PC.



  - Choose open to launch explorer and have it point directly at the correct folder. Send the Diagnostic zip file to **support@sierramonitor.com**

Appendix A.4. BACnet: Setting Network Number for more than one ProtoNode on Subnet

For both BACnet MS/TP and BACnet/IP, if more than one ProtoNode is connected to the same subnet, they must be assigned unique Network_Number values.

On the main Web Configuration screen, update the Network Number with the "network_nr" field and click submit. The default value is 50.

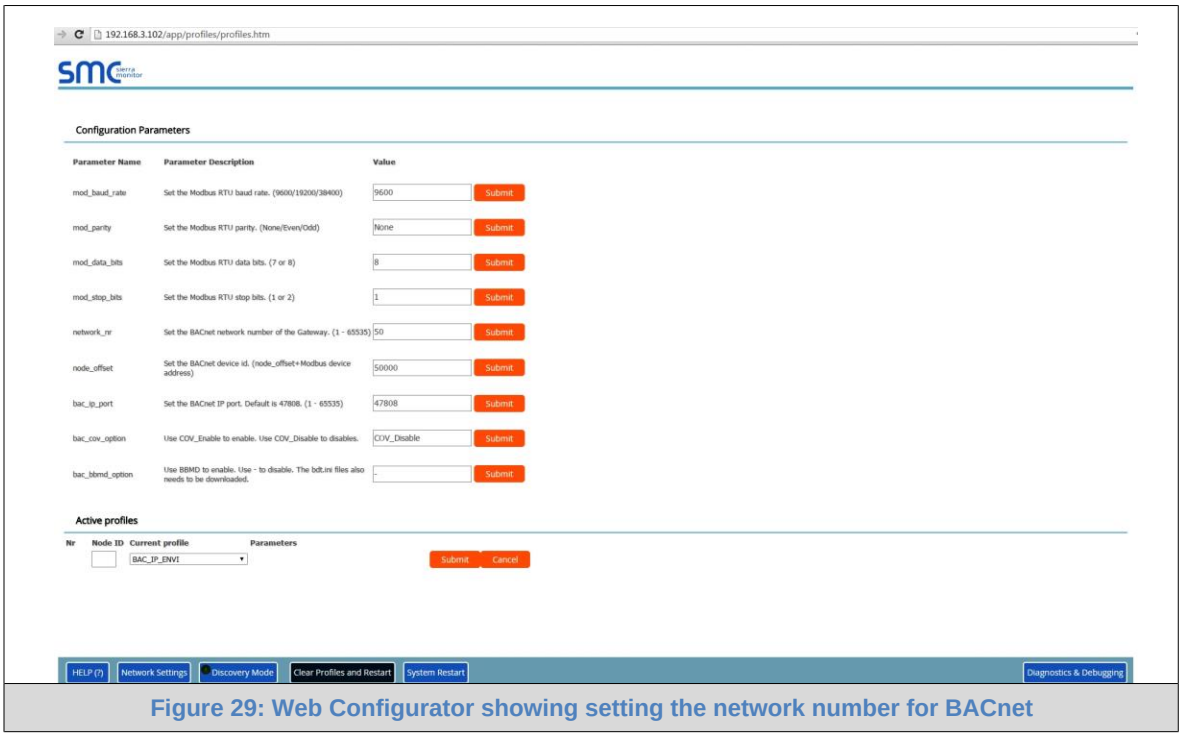
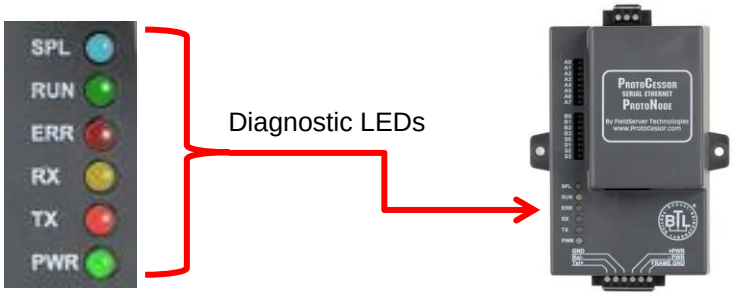


Figure 29: Web Configurator showing setting the network number for BACnet

AppendixA.5.LED Diagnostics for Modbus RTU Communications Between ProtoNode and Devices

Please see the diagram below for ProtoNode FPC-N34 and FPC-N35 LED Locations.



Tag	Description
SPL	The SPL LED will light if the ProtoNode is off line.
RUN	The RUN LED will start flashing 20 seconds after power indicating normal operation.
ERR	The SYS ERR LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. A steady red light will indicate there is a system error on ProtoNode. If this occurs, immediately report the related "system error" shown in the error screen of the GUI interface to FieldServer Technologies for evaluation.
RX	The RX LED will flash when a message is received on the host port.
TX	The TX LED will flash when a message is sent on the host port.
PWR	This is the power light and should show steady green at all times when ProtoNode is powered.

Figure 30: Diagnostic LEDs

Appendix A.6. Passwords

Access to the ProtoNode can be restricted by enabling a password. There are 2 access levels defined by 2 account names: Admin and User.

- The Admin account has unrestricted access to the ProtoNode.
- The User account can view any ProtoNode information, but cannot make any changes or restart the ProtoNode.

The password needs to be a minimum of eight characters and **is case sensitive**.

If you forgot your password, click cancel on the password authentication popup window, and e-mail the Password recovery token to support@sierramonitor.com to receive a temporary password from the Sierra Monitor support team. You can now access the ProtoNode to set a new password.

Appendix B. Vendor Information - Patterson-Kellley, LLC

Appendix B.1. ENVI Modbus RTU Mappings to BACnet MS/TP, BACnet/IP, Metasys N2 and LonWorks

Point Name	BACnet Object Type	BACnet Object ID	N2 Data Type	N2 Point Address	Lon Name	Lon SNVT	Data Array Name	Offset
State **(See Note 1)**	AI	1	AI	1	nvoState_XXX	SNVT_count_inc_f	DA_Byt_XXX	0
Supply Temp	AI	2	AI	2	nvoSupplyTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	1
Return Temp	AI	3	AI	3	nvoReturnTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	2
DHW Temp	AI	4	AI	4	nvoDHWTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	3
Header Temp	AI	5	AI	5	nvoHeaderTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	4
Firing Rate	AI	6	AI	6	nvoFiringRat_XXX	SNVT_lev_percent	DA_Byt_XXX	5
Flue Gas Temp	AI	7	AI	7	nvoFluGasTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	6
HX Temp	AI	8	AI	8	nvoHXTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	7
Outside Temp	AI	9	AI	9	nvoOutsidTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	8
Flame Signal **(See Note 1)**	AI	10	AI	10	nvoFlameSig_XXX	SNVT_count_inc_f	DA_Byt_XXX	9
CH Setpoint (Read/Write)	AV	11	AO	11	nvi/nvoCHSP_XXX	SNVT_count_inc_f	DA_Byt_XXX	10
DHW Setpoint (Read/Write)	AV	12	AO	12	nvi/nvoDHWSP_XXX	SNVT_count_inc_f	DA_Byt_XXX	11
Boiler Operation (Read/Write) **(See Note 3)**	AV	13	AO	13	nvi/nvoBlrOpera_XXX	SNVT_count_inc_f	DA_Byt_XXX	12
High Outdoor Air Temp (Read/Write)	AV	14	AO	14	nvi/nvoHiOATmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	13
Min Outdoor Air Setpoint (Read/Write)	AV	15	AO	15	nvi/nvoMinOASP_XXX	SNVT_count_inc_f	DA_Byt_XXX	14
Low Outdoor Air Temp (Read/Write)	AV	16	AO	16	nvi/nvoLoOATmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	15
Max Outdoor Air Setpoint (Read/Write)	AV	17	AO	17	nvi/nvoMaxOASP_XXX	SNVT_count_inc_f	DA_Byt_XXX	16
Outdoor Air Shutdown Temp (Read/Write)	AV	18	AO	18	nvi/nvoOAShtdnTp_XXX	SNVT_count_inc_f	DA_Byt_XXX	17
Night Setback (Read/Write)	AV	19	AO	19	nvi/nvoNightStbk_XXX	SNVT_count_inc_f	DA_Byt_XXX	18
Error Code **(See Note 4)**	AI	20	AI	20	nvoErrorCode_XXX	SNVT_count_inc_f	DA_Byt_XXX	19
Analog In	AI	21	AI	21	nvoAnalogIn_XXX	SNVT_volt	DA_Byt_XXX	20
Analog Out	AI	22	AI	22	nvoAnalogOut_XXX	SNVT_volt	DA_Byt_XXX	21
Ignitions	AI	23	AI	23	nvoIgnitions_XXX	SNVT_count_inc_f	DA_U16_XXX	11
Burner High Hours	AI	24	AI	24	nvoBrnrHiHrs_XXX	SNVT_time_hour	DA_U16_XXX	12

Burner Medium Hours	AI	25	AI	25	nvoBrnrMdHrs_XXX	SNVT_time_hour	DA_U16_XXX	13
Burner Low Hours	AI	26	AI	26	nvoBrnrLoHrs_XXX	SNVT_time_hour	DA_U16_XXX	14
Water Level	BI	27	DI	27	nvoWaterLvl_XXX	SNVT_switch	DA_Bit_XXX	0
Low Gas Pressure	BI	28	DI	28	nvoLoGasPrs_XXX	SNVT_switch	DA_Bit_XXX	1
Air Pressure	BI	29	DI	29	nvoAirPrs_XXX	SNVT_switch	DA_Bit_XXX	2
Blocked Flue	BI	30	DI	30	nvoBlckdFlue_XXX	SNVT_switch	DA_Bit_XXX	3
CH Pump	BI	31	DI	31	nvoCHPump_XXX	SNVT_switch	DA_Bit_XXX	4
DHW Pump	BI	32	DI	32	nvoDHWPump_XXX	SNVT_switch	DA_Bit_XXX	5
Air Damper	BI	33	DI	33	nvoAirDamper_XXX	SNVT_switch	DA_Bit_XXX	6
High Gas Pressure	BI	34	DI	34	nvoHiGasPrs_XXX	SNVT_switch	DA_Bit_XXX	7
ET Error Number **(See Note 4)**	AI	35	AI	35	nvoETErrNum_XXX	SNVT_count_inc_f	DA_Byt_XXX	23
ET Supply Temp	AI	36	AI	36	nvoETSupTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	24
ET Return Temp	AI	37	AI	37	nvoETRetTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	25
ET DHW Temp	AI	38	AI	38	nvoETDHWTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	26
ET Flue Gas Temp	AI	39	AI	39	nvoETFluGsTp_XXX	SNVT_count_inc_f	DA_Byt_XXX	27
ET HX Temp	AI	40	AI	40	nvoETHXTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	28
ET Outside Temp	AI	41	AI	41	nvoETOtsdTmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	29
Boiler State	AI	42	AI	42	nvoBlrState_XXX	SNVT_count_inc_f	DA_Byt_XXX	38
Frost Protection	BI	43	DI	43	nvoFrstPrtct_XXX	SNVT_switch	DA_Bit_XXX	8
DHW Mode	BI	44	DI	44	nvoDHWMode_XXX	SNVT_switch	DA_Bit_XXX	9
CH Mode	BI	45	DI	45	nvoCHMode_XXX	SNVT_switch	DA_Bit_XXX	10
ET Month	AI	46	AI	46	nvoETMonth_XXX	SNVT_count_inc_f	DA_Byt_XXX	31
ET Day	AI	47	AI	47	nvoETDay_XXX	SNVT_count_inc_f	DA_Byt_XXX	32
ET Year	AI	48	AI	48	nvoETYear_XXX	SNVT_count_inc_f	DA_Byt_XXX	33
ET Hours	AI	49	AI	49	nvoETHrs_XXX	SNVT_count_inc_f	DA_Byt_XXX	34
ET Minutes	AI	50	AI	50	nvoETMinutes_XXX	SNVT_count_inc_f	DA_Byt_XXX	35
ET Day Count High	AI	51	AI	51	nvoETDyCntHi_XXX	SNVT_count_inc_f	DA_Byt_XXX	36
ET Day Count Low	AI	52	AI	52	nvoETDyCntLo_XXX	SNVT_count_inc_f	DA_Byt_XXX	37
ET Run Hours	AI	53	AI	53	nvoETRunHrs_XXX	SNVT_time_hour	DA_U16_XXX	23

NOTES:

1) "State" Codes: 1=resetting; 2=standby, waiting for demand; 3=relay circuit check; 4=relay circuit check; 5=pre-purging; 6=pre-purging; 7=pre-ignition with gas valve closed; 8=ignition with gas valve open; 9=burning; 10=post purging; 11=post purging; 12=post pumping for CH; 13=pumping for CH; 14=post pumping for DHW; 15=pumping for DHW; 16=error handling (locking); 17=error handling (blocking0; 18=restarting burner control; 19=error handling; 20=error handling; 21=error handling

2) "Flame Signal" Codes: 0=no flame; 128=flame
3) "Boiler Operation" Codes: 0=boiler off & pump off; 1=boiler on & pump auto control; 2=boiler off & pump constantly on; 3=boiler on & pump constantly on
4) "Error Code" Codes: 1=ignition failure; 4=max ΔT exceeded; 5=internal error gas valve relay; 6=internal error safety relay; 7=rapid rise outlet temperature; 8=fan wrong speed; 10=internal error E2PROM signal; 11=UV sensor defect; 12=internal error E2PROM error; 15=rapid rise inlet temperature; 16=internal error 16; 17=rapid rise HX temperature; 18=high limit; 20=late flame; 21=early flame; 24=flame failure; 25=air switch not open; 26=air switch not close; 30=low water level (ENVI versions 01BD, BD71, and 49A7) or internal error 30 (ENVI versions 6999 and 79F2); 31=low gas pressure (ENVI versions 01BD, BD71, and 49A7) or internal error 31 (ENVI versions 6999 and 79F2); 32=high gas pressure (ENVI versions 01BD, BD71, and 49A7) or internal error 32 (ENVI versions 6999 and 79F2); 35=internal error 35 (ENVI versions 01BD, BD71, and 49A7) or high flue temperature (ENVI versions 6999 and 79F2); 36=internal error 36 (ENVI versions 01BD, BD71, and 49A7) or false flame (ENVI versions 6999 and 79F2); 37=internal error 37 (ENVI versions 01BD, BD71, and 49A7) or low water level (ENVI versions 6999 and 79F2); 38=high flue temperature (ENVI versions 01BD, BD71, and 49A7) or low gas pressure (ENVI versions 6999 and 79F2); 39=false flame (ENVI versions 01BD, BD71, and 49A7) or blocked flue (ENVI versions 6999 and 79F2); 40=blocked flue (ENVI versions 01BD, BD71, and 49A7) or high inlet temperature (ENVI versions 6999 and 79F2); 41=high inlet temperature (ENVI versions 01BD, BD71, and 49A7) or reverse flow in/out (ENVI versions 6999 and 79F2); 42=reverse flow in/out (ENVI versions 01BD, BD71, and 49A7) or N/A (ENVI versions 6999 and 79F2); 43=N/A (ENVI versions 01BD, BD71, and 49A7) or no ground 60 hertz error (ENVI versions 6999 and 79F2); 44=no ground 60 hertz error (ENVI versions 01BD, BD71, and 49A7) or line neutral reverse (ENVI versions 6999 and 79F2); 45=line neutral reverse (ENVI versions 01BD, BD71, and 49A7) or line frequency error (ENVI versions 6999 and 79F2); 46=line frequency error (ENVI versions 01BD, BD71, and 49A7) or faulty ground (ENVI versions 6999 and 79F2); 47=faulty ground (ENVI versions 01BD, BD71, and 49A7) or internal error 47 (ENVI versions 6999 and 79F2); 48=internal error 47 (ENVI versions 01BD, BD71, and 49A7) or wrong boiler type (ENVI versions 6999 and 79F2); 49=wrong boiler type (ENVI versions 01BD, BD71, and 49A7) or rapid rise HX error (ENVI versions 6999 and 79F2); 50=rapid rise HX error (ENVI versions 01BD, BD71, and 49A7) or N/A (ENVI versions 6999 and 79F2); 51=N/A (ENVI versions 01BD, BD71, and 49A7) or outlet temperature sensor open (ENVI versions 6999 and 79F2); 52=outlet temperature sensor open (ENVI versions 01BD, BD71, and 49A7) or inlet temperature sensor open (ENVI versions 6999 and 79F2); 53=inlet temperature sensor open (ENVI versions 01BD, BD71, and 49A7) or N/A (ENVI versions 6999 and 79F2); 55=N/A (ENVI versions 01BD, BD71, and 49A7) or DHW temperature sensor open (ENVI versions 6999 and 79F2); 56=DHW temperature sensor open (ENVI versions 01BD, BD71, and 49A7) or HX temperature sensor open (ENVI versions 6999 and 79F2); 57=HX temperature sensor open (ENVI versions 01BD, BD71, and 49A7) or flue temperature sensor open (ENVI versions 6999 and 79F2); 58=flue temperature sensor open (ENVI versions 01BD, BD71, and 49A7) or N/A (ENVI versions 6999 and 79F2); 59=N/A (ENVI versions 01BD, BD71, and 49A7) or outlet temperature sensor short (ENVI versions 6999 and 79F2); 60=outlet temperature sensor short (ENVI versions 01BD, BD71, and 49A7) or inlet temperature sensor short (ENVI versions 6999 and 79F2); 61=inlet temperature sensor short (ENVI versions 01BD, BD71, and 49A7) or N/A (ENVI versions 6999 and 79F2); 63=N/A (ENVI versions 01BD, BD71, and 49A7) or DHW temperature sensor short (ENVI versions 6999 and 79F2); 64=DHW temperature sensor short (ENVI versions 01BD, BD71, and 49A7) or HX temperature sensor short (ENVI versions 6999 and 79F2); 65=HX temperature sensor short (ENVI versions 01BD, BD71, and 49A7) or flue temperature sensor short (ENVI versions 6999 and 79F2); 66=flue temperature sensor short (ENVI versions 01BD, BD71, and 49A7) or internal error 66 (ENVI versions 6999 and 79F2); 67=internal error 66 (ENVI versions 01BD, BD71, and 49A7) or high gas pressure (ENVI versions 6999 and 79F2); 68=IF communication failure; 69=header sensor open; 70=header sensor short; 71=rapid rise error

Appendix B.2. Love Modbus RTU Mappings to BACnet MS/TP, BACnet/IP, Metasys N2 and LonWorks

Point Name	BACnet Object Type	BACnet Object ID	N2 Data Type	N2 Point Address	Lon Name	Lon SNVT	Data Array Name	Offset
Process Value **(See Note 1)**	AI	1	AI	1	nvoProcVal_XXX	SNVT_count_inc_f	DA_U16_XXX	0
Setpoint (Read/Write)	AV	2	AO	2	nvi/nvoSetpoint_XXX	SNVT_count_inc_f	DA_U16_XXX	1
Upper-Limit of Temp Range	AI	3	AI	3	nvoUpLmTpRng_XXX	SNVT_count_inc_f	DA_U16_XXX	2
Lower-Limit of Temp Range	AI	4	AI	4	nvoLoLmTpRng_XXX	SNVT_count_inc_f	DA_U16_XXX	3
Control Method (Read/Write) **(See Note 2)**	AV	5	AO	5	nvi/nvoCtrlMethd_XXX	SNVT_count_inc_f	DA_U16_XXX	4
PB Proportional Band (Read/Write)	AV	6	AO	6	nvi/nvoPB_PrpBnd_XXX	SNVT_count_inc_f	DA_U16_XXX	5
Ti Integral Time (Read/Write)	AV	7	AO	7	nvi/nvoTiIntegTm_XXX	SNVT_count_inc_f	DA_U16_XXX	6
Td Derivative Time (Read/Write)	AV	8	AO	8	nvi/nvoTdDerTime_XXX	SNVT_count_inc_f	DA_U16_XXX	7
Output Value (Read/Write)	AV	9	AO	9	nvi/nvoOutputVal_XXX	SNVT_lev_percent	DA_U16_XXX	8
Upper-Limit Regulation (Read/Write)	AV	10	AO	10	nvi/nvoUpLimReg_XXX	SNVT_count_inc_f	DA_U16_XXX	9
Lower-Limit Regulation (Read/Write)	AV	11	AO	11	nvi/nvoLoLimReg_XXX	SNVT_count_inc_f	DA_U16_XXX	10
Analog Decimal Setting (Read/Write)	AV	12	AO	12	nvi/nvoAnaDecSet_XXX	SNVT_count_inc_f	DA_U16_XXX	11
PID Parameter Selection (Read/Write)	AV	13	AO	13	nvi/nvoPIDPrmSel_XXX	SNVT_count_inc_f	DA_U16_XXX	12
SV Value (Read/Write)	AV	14	AO	14	nvi/nvoSVValue_XXX	SNVT_count_inc_f	DA_U16_XXX	13
Alarm 1 Type (Read/Write) **(See Note 3)**	AV	15	AO	15	nvi/nvoAlm1Type_XXX	SNVT_count_inc_f	DA_U16_XXX	14
Alarm 2 Type (Read/Write) **(See Note 3)**	AV	16	AO	16	nvi/nvoAlm2Type_XXX	SNVT_count_inc_f	DA_U16_XXX	15
Alarm 3 Type (Read/Write) **(See Note 3)**	AV	17	AO	17	nvi/nvoAlm3Type_XXX	SNVT_count_inc_f	DA_U16_XXX	16
Upper-Limit Alarm 1 (Read/Write)	AV	18	AO	18	nvi/nvoUpLimAlm1_XXX	SNVT_count_inc_f	DA_U16_XXX	17
Lower-Limit Alarm 1 (Read/Write) Upper-Limit Alarm 2 (Read/ Write)	AV	19	AO	19	nvi/nvoLoLimAlm1_XXX	SNVT_count_inc_f	DA_U16_XXX	18
	AV	20	AO	20	nvi/nvoUpLimAlm2_XXX	SNVT_count_inc_f	DA_U16_XXX	19

Lower-Limit Alarm 2 (Read/Write)	AV	21	AO	21	nvi/nvoLoLimAlm2_XXX	SNVT_count_inc_f	DA_U16_XXX	20
Upper-Limit Alarm 3 (Read/Write)	AV	22	AO	22	nvi/nvoUpLimAlm3_XXX	SNVT_count_inc_f	DA_U16_XXX	21
Lower-Limit Alarm 3 (Read/Write)	AV	23	AO	23	nvi/nvoLoLimAlm3_XXX	SNVT_count_inc_f	DA_U16_XXX	22
Setting Lock Status (Read/Write) **(See Note 4)**	AV	24	AO	24	nvi/nvoSetLkStat_XXX	SNVT_count_inc_f	DA_U16_XXX	23
Communication Write-in Selection **(See Note 5)**	AI	25	AI	25	nvoComWrinSl_XXX	SNVT_count_inc_f	DA_U16_XXX	24
Temp Unit Display Selection (Read/Write) **(See Note 6)**	BV	26	DO	26	nvi/nvoTmpUnit_XXX	SNVT_switch	DA_U16_XXX	25
Control RUN/STOP Setting (Read/Write) **(See Note 7)**	BV	27	DO	27	nvi/nvoCtrRnStSt_XXX	SNVT_switch	DA_U16_XXX	26
STOP Setting for PID (Read/Write) **(See Note 8)**	BV	28	DO	28	nvi/nvoStpSetPID_XXX	SNVT_switch	DA_U16_XXX	27
Temp STOP for PID (Read/ Write) **(See Note 9)**	BV	29	DO	29	nvi/nvoTmpStpPID_XXX	SNVT_switch	DA_U16_XXX	28
PV Unstable	AI	30	AI	30	nvoPV_Unstbl_XXX	SNVT_count_inc_f	DA_U16_XXX	29
Re-initialize	AI	31	AI	31	nvoRe_init_XXX	SNVT_count_inc_f	DA_U16_XXX	30
PV Value for Error 0002H	AI	32	AI	32	nvoPVValEr2H_XXX	SNVT_count_inc_f	DA_U16_XXX	31
Input Sensor Did Not Connect	AI	33	AI	33	nvoInSnNoCnc_XXX	SNVT_count_inc_f	DA_U16_XXX	32
PV Value for error 0003H	AI	34	AI	34	nvoPVValEr3H_XXX	SNVT_count_inc_f	DA_U16_XXX	33
Input Signal Error	AI	35	AI	35	nvoInSigErr_XXX	SNVT_count_inc_f	DA_U16_XXX	34
PV Value for Error 0004H	AI	36	AI	36	nvoPVValEr4H_XXX	SNVT_count_inc_f	DA_U16_XXX	35
Over Input Range	AI	37	AI	37	nvoOvrInRng_XXX	SNVT_count_inc_f	DA_U16_XXX	36
ADC Fail	AI	38	AI	38	nvoADC_Fail_XXX	SNVT_count_inc_f	DA_U16_XXX	37
PV Value for Error 0006H	AI	39	AI	39	nvoPVValEr6H_XXX	SNVT_count_inc_f	DA_U16_XXX	38
EEPROM Read/Write error	AI	40	AI	40	nvoEEPROMErr_XXX	SNVT_count_inc_f	DA_U16_XXX	39

NOTES:

1) "Process Value" Codes: XXX.X=actual value; 8002H=initial process; 8003H=temperature sensor is not connected; 8004H=temperature sensor input error; 8006H=Cannot get temperature value. ADC input error; 8007H=Memory read/write error.
2) "Control Mode" Codes: 0=PID; 1=On/Off; 2=manual tuning; 3=PID program control
3) "Alarm Types" Codes: 0=alarm function disabled; 1=deviation upper- and lower-limit; 2=deviation upper-limit; 3=deviation lower-limit; 4=reverse deviation upper- and lower-limit; 5=absolute value upper- and lower-limit; 6=absolute value upper-limit; 7=absolute value lower-limit; 8=deviation upper- and lower-limit with standby sequence; 9=deviation upper-limit with standby sequence; 10=deviation lower-limit with standby sequence; 11=hysteresis upper-limit alarm output; 12=hysteresis lower-limit alarm output; and 13=CT alarm output

4) "Setting Lock Status" Codes: 0=normal; 1=all setting lock; 11=lock others than SV value
5) "Communication Write In" Codes: 0=disabled; 1=enabled
6) "Temperature Unit Display Selection" Codes: 0=ºF; 1=ºC
7) "Control RUN/STOP Setting" Codes: 0=STOP; 1=RUN
8) "STOP setting for PID program control" Codes: 0=RUN; 1=STOP
9) "Temporary STOP for PID program control" Codes: 0=RUN; 1=temporary STOP

Appendix B.3. Nuro Modbus RTU Mappings to BACnet MS/TP, BACnet/IP, Metasys N2 and LonWorks

Point Name	BACnet Object Type	BACnet Object ID	N2 Data Type	N2 Point Address	Lon Name	Lon SNVT	Data Array Name	Offset
Supply Temperature	AI	1	AI	1	nvoSupplyTmp_XXX	SNVT_temp_p	DA_U16_XXX	0
Return Temperature	AI	2	AI	2	nvoReturnTmp_XXX	SNVT_temp_p	DA_U16_XXX	1
Stack Temperature	AI	3	AI	3	nvoStackTmp_XXX	SNVT_temp_p	DA_U16_XXX	2
DHW Temperature	AI	4	AI	4	nvoDHWTmp_XXX	SNVT_temp_p	DA_U16_XXX	3
Header Temperature	AI	5	AI	5	nvoHeaderTmp_XXX	SNVT_temp_p	DA_U16_XXX	4
HX Temperature	AI	6	AI	6	nvoHXTmp_XXX	SNVT_temp_p	DA_U16_XXX	5
ODA Temperature Filtered	AI	7	AI	7	nvoODATmpFlt_XXX	SNVT_temp_p	DA_U16_XXX	6
Extra Field Temperature	AI	8	AI	8	nvoExtFldTmp_XXX	SNVT_temp_p	DA_U16_XXX	7
Wireless Temperature	AI	9	AI	9	nvoWirlssTmp_XXX	SNVT_temp_p	DA_U16_XXX	8
Analog Input	AI	10	AI	10	nvoAnaInput_XXX	SNVT_count_f	DA_U16_XXX	9
Analog Output	AI	11	AI	11	nvoAnaOutput_XXX	SNVT_count_f	DA_U16_XXX	10
Burner Control Digital I/O **(See Note 1)**	AI	12	AI	12	nvoBrnCtDgIO_XXX	SNVT_count_f	DA_U16_XXX	11
Burner Control Digital I/O 2 **(See Note 2)**	AI	13	AI	13	nvoBrCtDgIO2_XXX	SNVT_count_f	DA_U16_XXX	12
CH Mode Active Setpoint	AI	14	AI	14	nvoCHMdActSP_XXX	SNVT_temp_p	DA_U16_XXX	13
DHW Mode Active Setpoint	AI	15	AI	15	nvoDHWMdAcSP_XXX	SNVT_temp_p	DA_U16_XXX	14
Demand Source **(See Note 3)**	AI	16	AI	16	nvoDmdSrc_XXX	SNVT_count_f	DA_U16_XXX	15
Active Demand Status **(See Note 4)**	AI	17	AI	17	nvoActDmdSt_XXX	SNVT_count_f	DA_U16_XXX	16
Boiler State **(See Note 5)**	AI	18	AI	18	nvoBlrState_XXX	SNVT_count_f	DA_U16_XXX	17
Flame Signal	AI	19	AI	19	nvoFlameSig_XXX	SNVT_count_f	DA_U16_XXX	18
Fan Speed	AI	20	AI	20	nvoFanSpeed_XXX	SNVT_count_f	DA_U16_XXX	19
Firing Rate	AI	21	AI	21	nvoFirRate_XXX	SNVT_lev_percent	DA_U16_XXX	20
Error Code	AI	22	AI	22	nvoErrCode_XXX	SNVT_count_f	DA_U32_XXX	0
Error Type **(See Note 6)**	AI	23	AI	23	nvoErrType_XXX	SNVT_count_f	DA_U16_XXX	23
Burner Control Cycle Count	AI	24	AI	24	nvoBrCtrCyCt_XXX	SNVT_count_f	DA_U32_XXX	1
Burner Control Run Hours	AI	25	AI	25	nvoBrCtrRnHr_XXX	SNVT_time_hour	DA_U32_XXX	2
CH Boiler Control	BV	26	DO	26	nvi/nvoCHBlrCtrl_XXX	SNVT_switch	DA_U16_XXX	28
BMS CH Setpoint	AV	27	AO	27	nvi/nvoBMSCHSP_XXX	SNVT_temp_p	DA_U16_XXX	29
BMS CH Demand	BV	28	DO	28	nvi/nvoBMSCHDmd_XXX	SNVT_switch	DA_U16_XXX	30

DHW Boiler Control	BV	29	DO	29	nvi/nvoDHWBlCtrl_XXX	SNVT_switch	DA_U16_XXX	31
BMS DHW Setpoint	AV	30	AO	30	nvi/nvoBMSDHWSP_XXX	SNVT_temp_p	DA_U16_XXX	32
BMS DHW Tank Setpoint	AV	31	AO	31	nvi/nvoBMDHWTkSP_XXX	SNVT_temp_p	DA_U16_XXX	33

NOTES:

1) "Burner Control Digital I/O" Codes: Bit Map:15=safety relay, 14=night setback input, 13=enable, 12=undefined, 11=undefined, 10=limit control circuit, 9=damper end switch input, 8=interlock control circuit, 7=alarm relay on, 6=undefined, 5=gas valve open, 4=external ignition on, 3=Relay D on, 2=Relay C on, 1=Relay B on, 0=Relay A on
2) "Burner Control Digital I/O 2" Codes: Bit Map: 15-8= undefined, 7=auxiliary input 2, 6=high gas pressure, 5=high temperature limit, 4=low water cut-off, 3=auxiliary input 1, 2=start interlock 2, 1=start interlock 1, 0=air switch
3) "Demand Source" Codes: 0=none; 1=CH; 2=DHW; 3=freeze protection; 4=manual; 5=CH & DHW; 6=DHW & CH
4) "Active Demand Status" Codes: 0=normal; 1=system pump pre-pump; 2=system pump post-pump; 3=CH pump pre-pump; 4=CH pump post-pump; 5=tank pump pre-pump; 6=tank pump post-pump; 7=DHW pump pre-pump; 8=DHW pump post-pump; 9=waiting anti-cycle; 10=mod back max temp; 11=low fire hold; 12=limit time to high fire; 13=limit accelerate; 14=limit decelerate; 15=waiting for mode demand; 16=waiting for boiler to start; 17=CH pump running; 18=system pump running; 19=DHW pump running; 20=tank pump running
5) "Boiler State" Codes: 0=waiting for communication; 1=standby; 2=lockout; 3=hold; 4=waiting for air switch close; 5=waiting for air switch open; 6=opening damper; 7=waiting for damper to open; 8=pre-purge; 9=post purge; 10=run; 11=mod back delta temp; 12=mod back max temp; 13=mod back stack temp; 14=pre-ignition; 15=ignition; 16=mod back delta temp exceeded; 17=mod back max temp exceeded; 18=mod back stack temp exceeded; 19=rate modified by air switch; 20=rate modified by outlet temperature; 21=rate modified by delta limit; 22=rate modified by stack limit; 23=starting; 24=fan only; 25=stopping
6) "Error Type" Codes: 0=no error; 1=lockout; 2=boiler hold; 3=mode hold; 4=alert caused alarm

Appendix C. "A" Bank DIP Switch Settings

Appendix C.1. "A" Bank DIP Switch Settings

Address	A0	A1	A2	A3	A4	A5	A6	A7
1	On	Off	Off	Off	Off	Off	Off	Off
2	Off	On	Off	Off	Off	Off	Off	Off
3	On	On	Off	Off	Off	Off	Off	Off
4	Off	Off	On	Off	Off	Off	Off	Off
5	On	Off	On	Off	Off	Off	Off	Off
6	Off	On	On	Off	Off	Off	Off	Off
7	On	On	On	Off	Off	Off	Off	Off
8	Off	Off	Off	On	Off	Off	Off	Off
9	On	Off	Off	On	Off	Off	Off	Off
10	Off	On	Off	On	Off	Off	Off	Off
11	On	On	Off	On	Off	Off	Off	Off
12	Off	Off	On	On	Off	Off	Off	Off
13	On	Off	On	On	Off	Off	Off	Off
14	Off	On	On	On	Off	Off	Off	Off
15	On	On	On	On	Off	Off	Off	Off
16	Off	Off	Off	Off	On	Off	Off	Off
17	On	Off	Off	Off	On	Off	Off	Off
18	Off	On	Off	Off	On	Off	Off	Off
19	On	On	Off	Off	On	Off	Off	Off
20	Off	Off	On	Off	On	Off	Off	Off
21	On	Off	On	Off	On	Off	Off	Off
22	Off	On	On	Off	On	Off	Off	Off
23	On	On	On	Off	On	Off	Off	Off
24	Off	Off	Off	On	On	Off	Off	Off
25	On	Off	Off	On	On	Off	Off	Off
26	Off	On	Off	On	On	Off	Off	Off
27	On	On	Off	On	On	Off	Off	Off
28	Off	Off	On	On	On	Off	Off	Off
29	On	Off	On	On	On	Off	Off	Off
30	Off	On	On	On	On	Off	Off	Off
31	On	On	On	On	On	Off	Off	Off
32	Off	Off	Off	Off	Off	On	Off	Off
33	On	Off	Off	Off	Off	On	Off	Off
34	Off	On	Off	Off	Off	On	Off	Off
35	On	On	Off	Off	Off	On	Off	Off
36	Off	Off	On	Off	Off	On	Off	Off
37	On	Off	On	Off	Off	On	Off	Off
38	Off	On	On	Off	Off	On	Off	Off
39	On	On	On	Off	Off	On	Off	Off
40	Off	Off	Off	On	Off	On	Off	Off
41	On	Off	Off	On	Off	On	Off	Off
42	Off	On	Off	On	Off	On	Off	Off
43	On	On	Off	On	Off	On	Off	Off
44	Off	Off	On	On	Off	On	Off	Off

Address	A0	A1	A2	A3	A4	A5	A6	A7
45	On	Off	On	On	Off	On	Off	Off
46	Off	On	On	On	Off	On	Off	Off
47	On	On	On	On	Off	On	Off	Off
48	Off	Off	Off	Off	On	On	Off	Off
49	On	Off	Off	Off	On	On	Off	Off
50	Off	On	Off	Off	On	On	Off	Off
51	On	On	Off	Off	On	On	Off	Off
52	Off	Off	On	Off	On	On	Off	Off
53	On	Off	On	Off	On	On	Off	Off
54	Off	On	On	Off	On	On	Off	Off
55	On	On	On	Off	On	On	Off	Off
56	Off	Off	Off	On	On	On	Off	Off
57	On	Off	Off	On	On	On	Off	Off
58	Off	On	Off	On	On	On	Off	Off
59	On	On	Off	On	On	On	Off	Off
60	Off	Off	On	On	On	On	Off	Off
61	On	Off	On	On	On	On	Off	Off
62	Off	On	On	On	On	On	Off	Off
63	On	On	On	On	On	On	Off	Off
64	Off	Off	Off	Off	Off	Off	On	Off
65	On	Off	Off	Off	Off	Off	On	Off
66	Off	On	Off	Off	Off	Off	On	Off
67	On	On	Off	Off	Off	Off	On	Off
68	Off	Off	On	Off	Off	Off	On	Off
69	On	Off	On	Off	Off	Off	On	Off
70	Off	On	On	Off	Off	Off	On	Off
71	On	On	On	Off	Off	Off	On	Off
72	Off	Off	Off	On	Off	Off	On	Off
73	On	Off	Off	On	Off	Off	On	Off
74	Off	On	Off	On	Off	Off	On	Off
75	On	On	Off	On	Off	Off	On	Off
76	Off	Off	On	On	Off	Off	On	Off
77	On	Off	On	On	Off	Off	On	Off
78	Off	On	On	On	Off	Off	On	Off
79	On	On	On	On	Off	Off	On	Off
80	Off	Off	Off	Off	On	Off	On	Off
81	On	Off	Off	Off	On	Off	On	Off
82	Off	On	Off	Off	On	Off	On	Off
83	On	On	Off	Off	On	Off	On	Off
84	Off	Off	On	Off	On	Off	On	Off
85	On	Off	On	Off	On	Off	On	Off
86	Off	On	On	Off	On	Off	On	Off
87	On	On	On	Off	On	Off	On	Off
88	Off	Off	Off	On	On	Off	On	Off

Address	A0	A1	A2	A3	A4	A5	A6	A7
89	On	Off	Off	On	On	Off	On	Off
90	Off	On	Off	On	On	Off	On	Off
91	On	On	Off	On	On	Off	On	Off
92	Off	Off	On	On	On	Off	On	Off
93	On	Off	On	On	On	Off	On	Off
94	Off	On	On	On	On	Off	On	Off
95	On	On	On	On	On	Off	On	Off
96	Off	Off	Off	Off	Off	On	On	Off
97	On	Off	Off	Off	Off	On	On	Off
98	Off	On	Off	Off	Off	On	On	Off
99	On	On	Off	Off	Off	On	On	Off
100	Off	Off	On	Off	Off	On	On	Off
101	On	Off	On	Off	Off	On	On	Off
102	Off	On	On	Off	Off	On	On	Off
103	On	On	On	Off	Off	On	On	Off
104	Off	Off	Off	On	Off	On	On	Off
105	On	Off	Off	On	Off	On	On	Off
106	Off	On	Off	On	Off	On	On	Off
107	On	On	Off	On	Off	On	On	Off
108	Off	Off	On	On	Off	On	On	Off
109	On	Off	On	On	Off	On	On	Off
110	Off	On	On	On	Off	On	On	Off
111	On	On	On	On	Off	On	On	Off
112	Off	Off	Off	Off	On	On	On	Off
113	On	Off	Off	Off	On	On	On	Off
114	Off	On	Off	Off	On	On	On	Off
115	On	On	Off	Off	On	On	On	Off
116	Off	Off	On	Off	On	On	On	Off
117	On	Off	On	Off	On	On	On	Off
118	Off	On	On	Off	On	On	On	Off
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Address	A0	A1	A2	A3	A4	A5	A6	A7
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Address	A0	A1	A2	A3	A4	A5	A6	A7
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255	On	On	On	On	On	On	On	On

Appendix D. Reference

Appendix D.1. Specifications

	ProtoNode FPC-N34	ProtoNode FPC-N35
Electrical Connections	One 6-pin Phoenix connector with: RS-485 port (+ / - / gnd) Power port (+ / - / Frame-gnd) One 3-pin Phoenix connector with: RS-485 port (+ / - / gnd) One Ethernet 10/100 BaseT port	One 6-pin Phoenix connector with: RS-485 port (+ / - / gnd) Power port (+ / - / Frame-gnd) One Ethernet 10/100 BaseT port One FTT-10 LonWorks port
Approvals:	CE Certified; TUV approved to UL 916, EN 60950-1, EN 50491-3 and CSA C22-2 standards; FCC Class A Part 15; DNP3 Conformance Tested; RoHS Compliant; CSA 205 Approved BTL Marked	LonMark Certified
Power Requirements	Multi-mode power adapter: 9-30VDC or 12 - 24VAC	
Physical Dimensions	11.5 cm L x 8.3 cm W x 4.1 cm H (4.5 x 3.2 x 1.6 in.)	
Weight:	0.2 kg (0.4 lbs)	
Operating Temperature:	-40°C to 75°C (-40°F to167°F)	
Surge Suppression	EN61000-4-2 ESD EN61000-4-3 EMC EN61000-4-4 EFT	
Humidity:	5 - 90% RH (non-condensing)	

(Specifications subject to change without notice)

Figure 31: Specifications

Appendix D.1.1. Compliance with UL Regulations

For UL compliance, the following instructions must be met when operating ProtoNode.

- The units shall be powered by listed LPS or Class 2 power supply suited to the expected operating temperature range.
- The interconnecting power connector and power cable shall:
  - Comply with local electrical code.
  - Be suited to the expected operating temperature range.
  - Meet the current and voltage rating for ProtoNode/Net
- Furthermore, the interconnecting power cable shall:
  - Be of length not exceeding 3.05m (118.3")
  - Be constructed of materials rated VW-1 or FT-1 or better
- If the unit is to be installed in an operating environment with a temperature above 65 °C, it should be installed in a Restricted Access Area requiring a key or a special tool to gain access
- This device must not be connected to a LAN segment with outdoor wiring.

Appendix E. Limited 2 Year Warranty

Sierra Monitor Corporation warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. Sierra Monitor Corporation will repair or replace any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by Sierra Monitor Corporation personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without Sierra Monitor Corporation's approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables or to any damage resulting from battery leakage.

In all cases Sierra Monitor Corporation's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above, Sierra Monitor Corporation disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of Sierra Monitor Corporation for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the product.