ProtoNode FPC-N34 and ProtoNode FPC-N35 Startup Guide

For Interfacing Products: ENVI, LOVE, NURO

To Building Automation Systems: BACnet MS/TP, BACnet/IP, Modbus TCP/IP, Metasys N2 and LonWorks

APPLICABILITY & EFFECTIVITY

Explains ProtoNode hardware and installation.

The instructions are effective for the above as of April 2016.

Document Revision: 14.B
Auto Discovery
Template Revision: 57

Technical Support

Thank you for purchasing the ProtoNode.

Please call 570-476-7261, for Technical support of the ProtoNode product.

SMC does not provide direct support. If concerns need to be addressed by SMC, they will contact Sierra Monitor Corporation for assistance.

Technical Support Contact Information:

Technical Service:
570-476-7261

Email: PKCHTsupport@spx.com

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 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. (**Section** 3.4)
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 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. Sierra Monitor 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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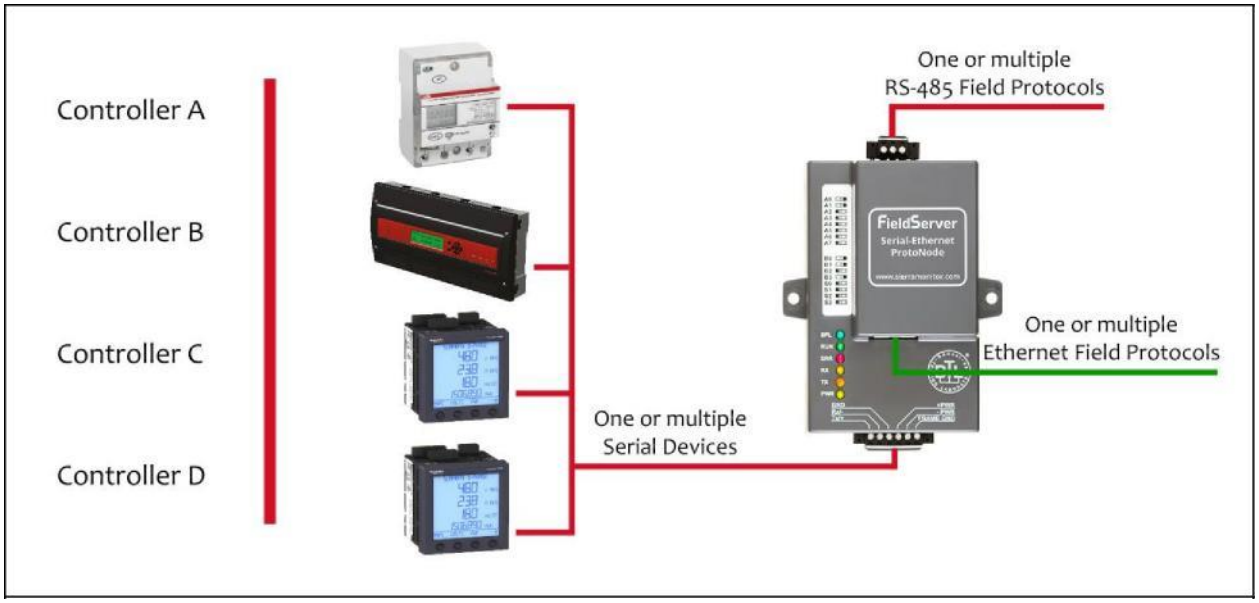
1 INTRODUCTION

1.1 ProtoNode Gateway

ProtoNode is an external, high performance **Building Automation multi-protocol gateway** that is preconfigured to Auto-Discover the 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 SETUP FOR PROTONODE

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	FPC-N34-0710
ProtoNode N35	FPC-N35-0771

Figure 1: ProtoNode 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 Registers presented by all of the devices attached to the ProtoNode cannot exceed:

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

Figure 2: Supported Point Count Capacity

Devices	Registers Per Device
Envi	53
Love	40
Nuro	64

Figure 3: Registers per Device

2.3 Configuring Device Communications

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

- Set up all devices on the same subnet as 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

Figure 4: Modbus RTU COM Settings

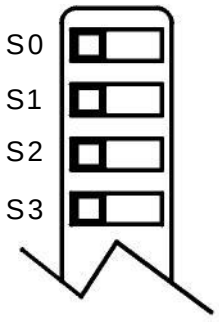
2.3.2 Set Modbus RTU Node-ID for each Device attached to the ProtoNode

- 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-IDs are automatically set to be the same value as the Node-ID of the Modbus RTU device.

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 5** for the switch settings for the ProtoNode.
    - 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

Profile Settings for ProtoNode

Figure 5: S Bank DIP Switches

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

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.
- Refer to **Appendix C.1** for the complete range of MAC Addresses and DIP switch settings.

NOTE: When using Metasys N2 and Modbus TCP/IP, the A Bank of DIP switches are disabled and not used. They should be set to OFF.

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**).
- The BACnet Device Instance can range from 1 to 4,194,303.

  For example:

  If the following is true:
  - 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

  And given that: Device Instance = Node_Offset + Modbus Node_ID

  Then Device Instances are:
  - Device 1 = 50,000 + 1 = 50,001
  - Device 2 = 50,000 + 22 = 50,022
  - 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 5.**
  - 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** will be the Metasy N2 or Modbus TCP/IP Node-ID's to the field protocols.
- Node-ID's range from 1-255. Refer to **Appendix C.1** for the full range of addresses for setting Node-ID.

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 (LonWorks).

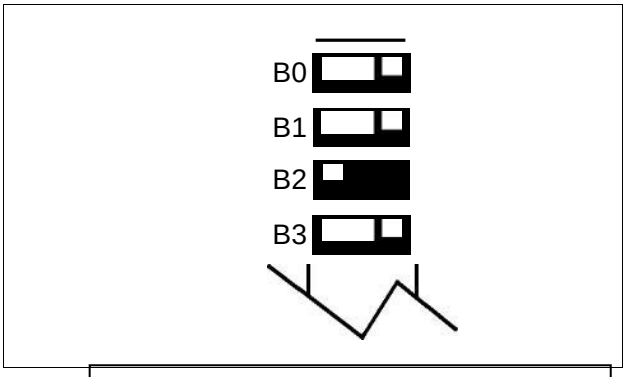


Figure 8: BMS Baud Rate DIP Switches

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 = 38400

3 INTERFACING PROTONODE TO DEVICES

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

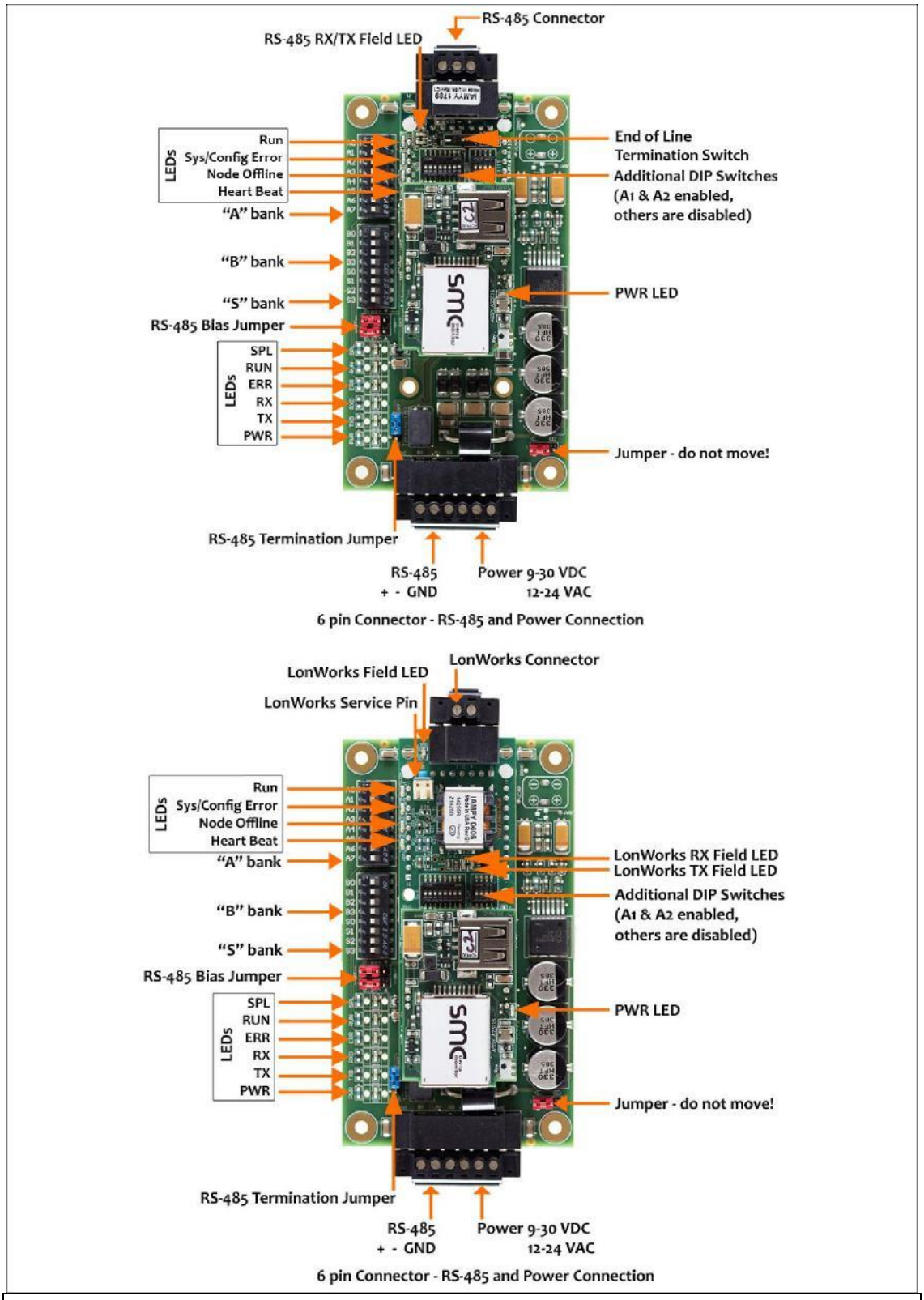


Figure 10: ProtoNode FPC-N34 (upper) and ProtoNode FPC-N35 (lower)

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.

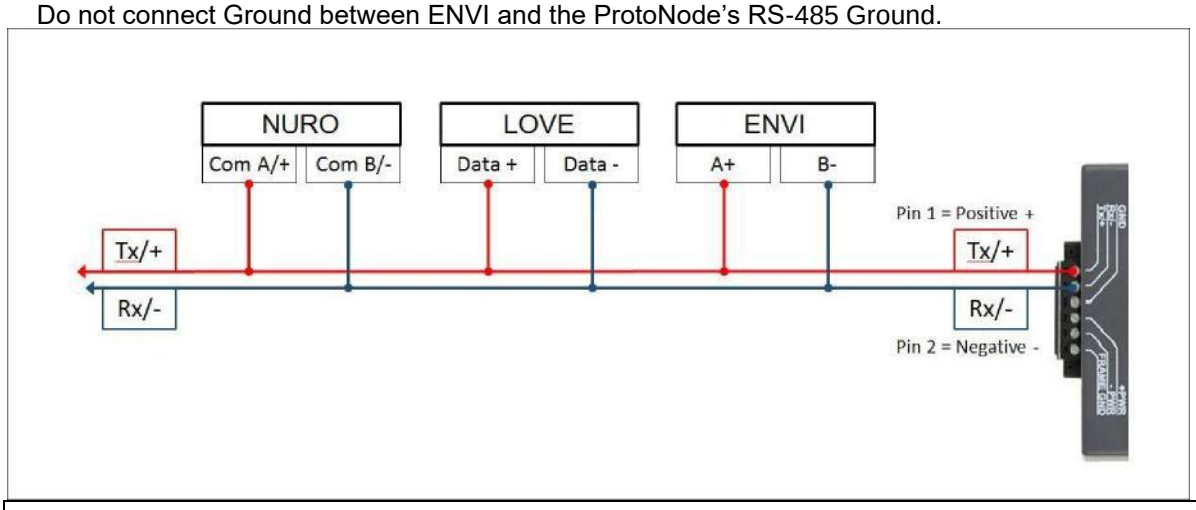


Figure 11: Wiring diagram for Modbus RTU RS-485 connections to the ProtoNode's RS-485 port

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. (**Figure 12**)
- **Only turn biasing ON:**
    - **IF the BMS cannot see more than one device connected to the ProtoNode**
    - **AND all the settings (Modbus COM settings, wiring, and DIP switches) have been checked.**
- 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.

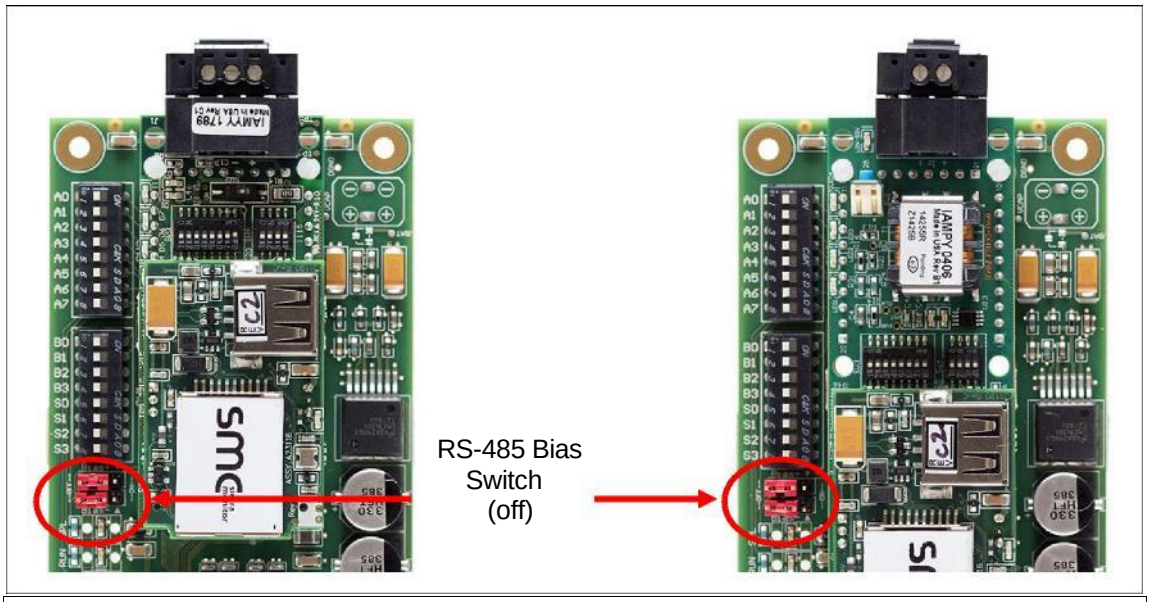


Figure 12: Modbus RS-485 Biasing Switch on the ProtoNode N34 (left) and ProtoNode N35 (right)

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).**

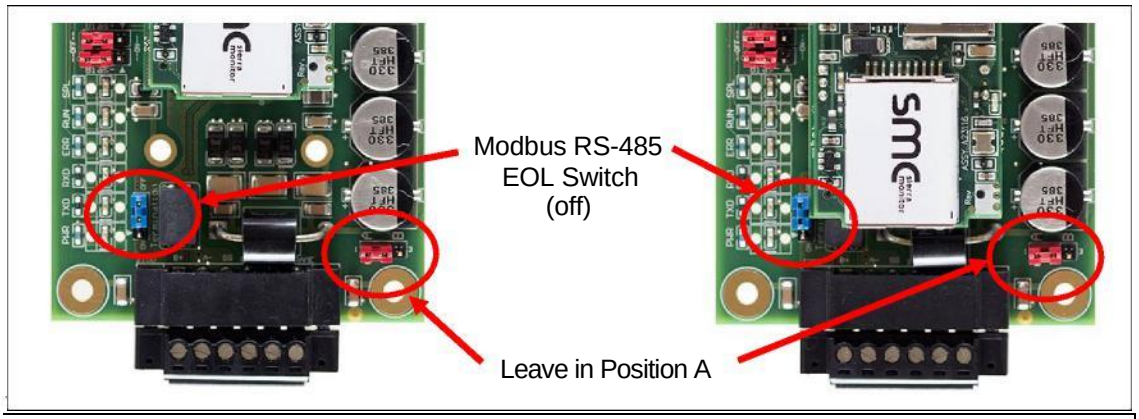


Figure 13: Modbus RS-485 End-Of-Line Termination Switch on the ProtoNode N34 (left) and ProtoNode N35 (right)

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. (**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

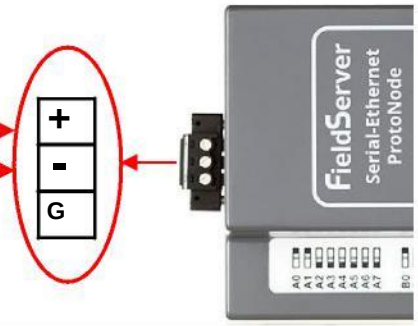


Figure 14: Connection from ProtoNode to RS-485 Field Network

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 approved cable per the FT-10 installation guidelines. 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	ProtoNode Pin #	Pin Assignment
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 2.4.2** 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.
- The "TX" LED will flash during Auto-Discovery. The "TX" LED will stop flashing when completed.
- **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.**
- Then turn the power to the ProtoNode back ON. The stored configuration will be loaded.

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 CAT5 Ethernet cable (Straight through or Cross-Over) between the local 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 

> 

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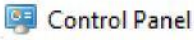
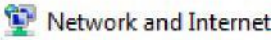
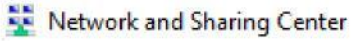
  Right-click on Local Area Connection > Properties

  Highlight 

- For Windows 7 or later:

  Go to 
> 

> 

> 

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  Right-click on Local Area Connection > Properties

  Highlight 

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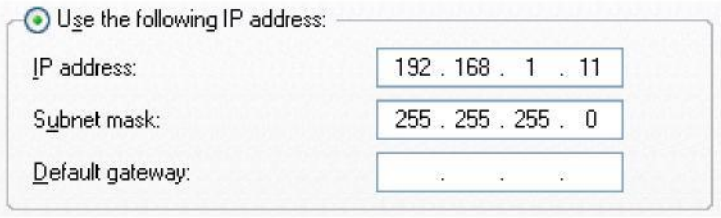
- For Windows XP and Windows 7, use the following IP Address:



- Click 

twice.

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

- After setting a local PC on the same subnet as the ProtoNode (**Section 4.1**), open a web browser on the PC and enter the IP Address of the ProtoNode; the default address is 192.168.1.24.
- The Web Configurator will be displayed as the landing page. (**Figure 20**)

NOTE: Below the "Active profiles" heading are listed the profiles 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.

NOTE: If multiple devices are connected to the ProtoNode, set the BACnet Virtual Server Nodes field to "Yes"; otherwise leave the field on the default "No" setting.

- To access the Web GUI, click on the "Diagnostics & Debugging" button in the bottom right side of the page.

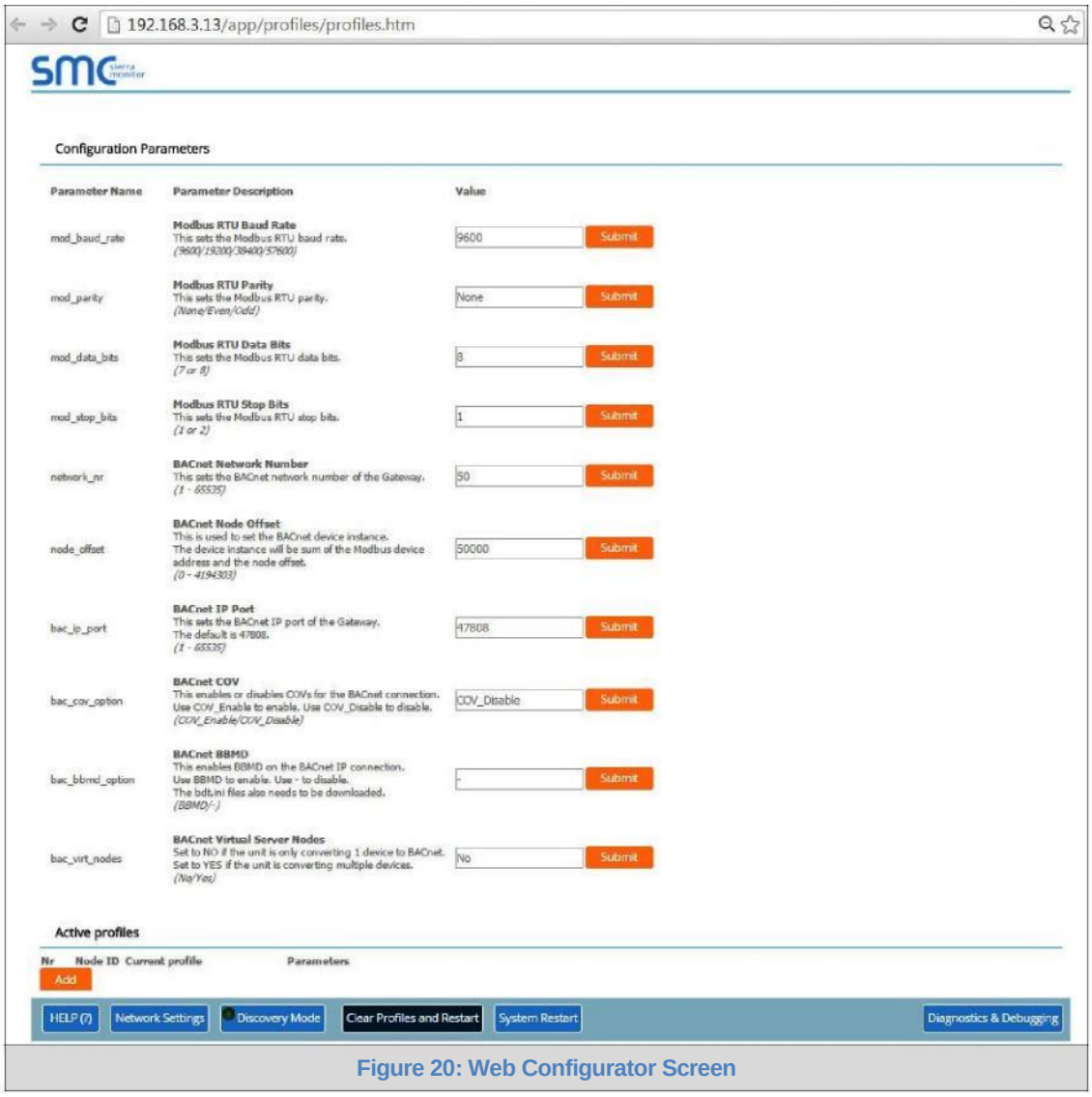


Figure 20: Web Configurator Screen

- From the Web GUI's landing page, click on "Setup" to expand the navigation tree. Then select "Network Settings" to access the IP Settings menu. (Figure 21)

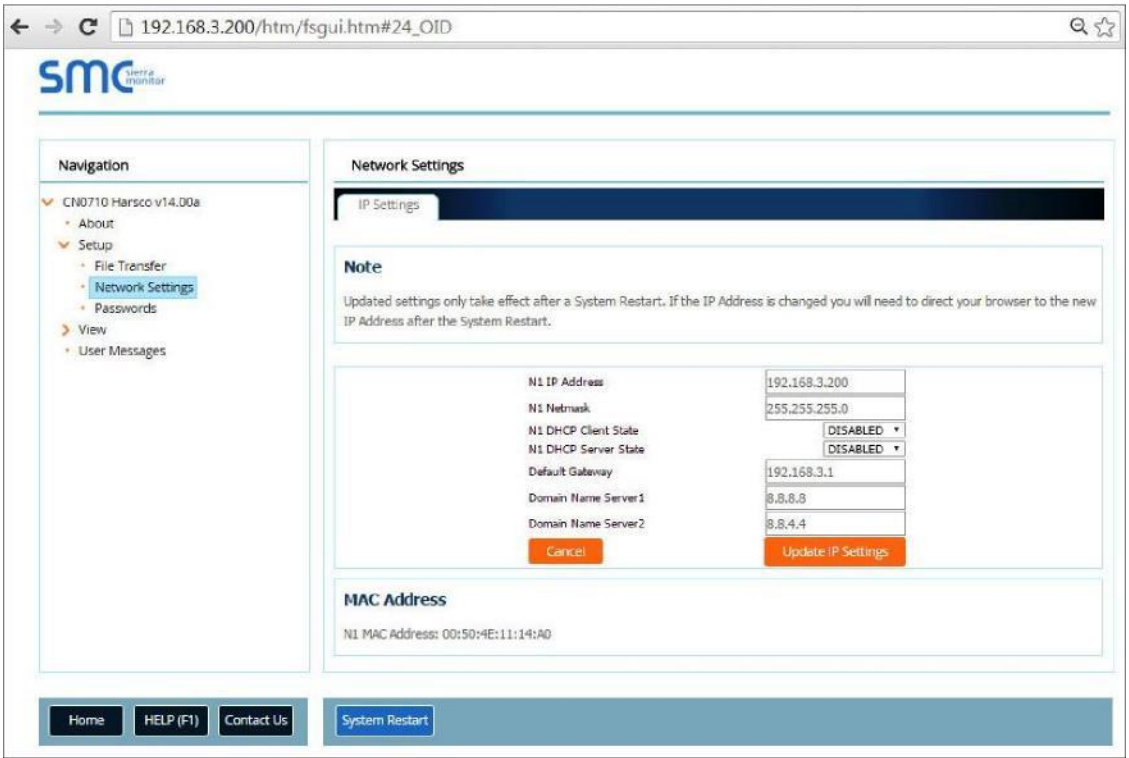


Figure 21: Changing IP Address via Web GUI

- 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 as the router.

- 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 a local PC to the same subnet as the ProtoNode (**Section 4.1**), open a web browser on the 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, the assigned IP Address will need to be obtained from the network administrator.
- The Web Configurator will be displayed as the 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: **Device Instance = Node_Offset + Modbus Node_ID**
    - Then: **Node_Offset (required) = Device Instance (desired) – Modbus Node_ID**

For example, if the desired Device Instance for the 1st device is 1,001:

- 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
- **Node_Offset (required) = 1,001 – (Modbus Node_ID) = 1,001 – 1 =**

1,000 NOTE: 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

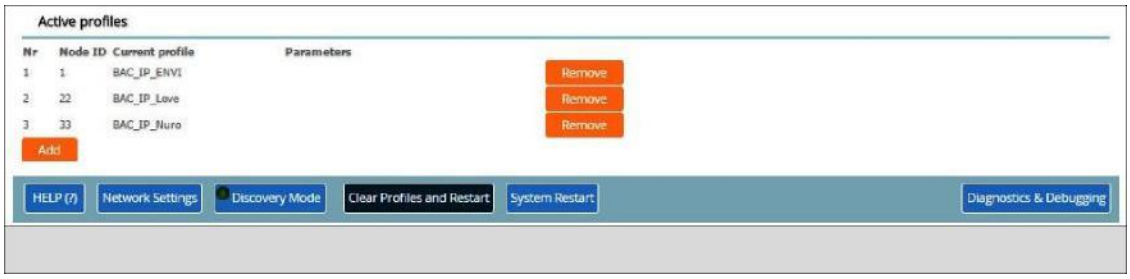


Figure 22: Web Configurator Screen with Active Profiles

6 HOW TO START THE INSTALLATION OVER: CLEARING PROFILES

- After setting a local PC to the same subnet as the ProtoNode (**Section 4.1**), open a web browser on the 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, the assigned IP Address will need to be obtained from the network administrator.
- The Web Configurator will be displayed as the landing page.
- **At the bottom-left of the page, click the "Clear Profiles and Restart" button.**
- Once restart is complete, all past profiles discovered and/or added via Web configurator are deleted. The unit can now 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.

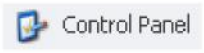
- If an XIF file is required, see steps in **Section** 7.1.1 to generate XIF.

Figure 23: LonWorks Service Pin Location

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

- Connect a CAT5 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 

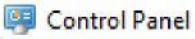
> 

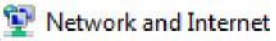
> 

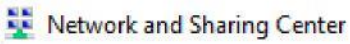
Right-click on Local Area Connection > Properties

Highlight 

- For Windows 7 or later:

Go to  > 

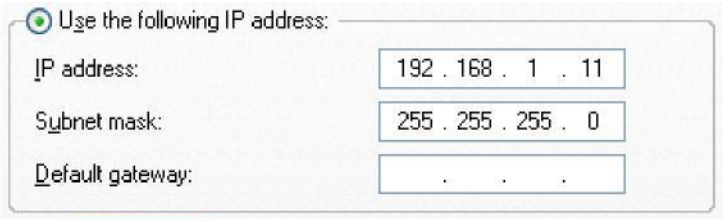
> 

> 

Right-click on Local Area Connection > Properties

Highlight 

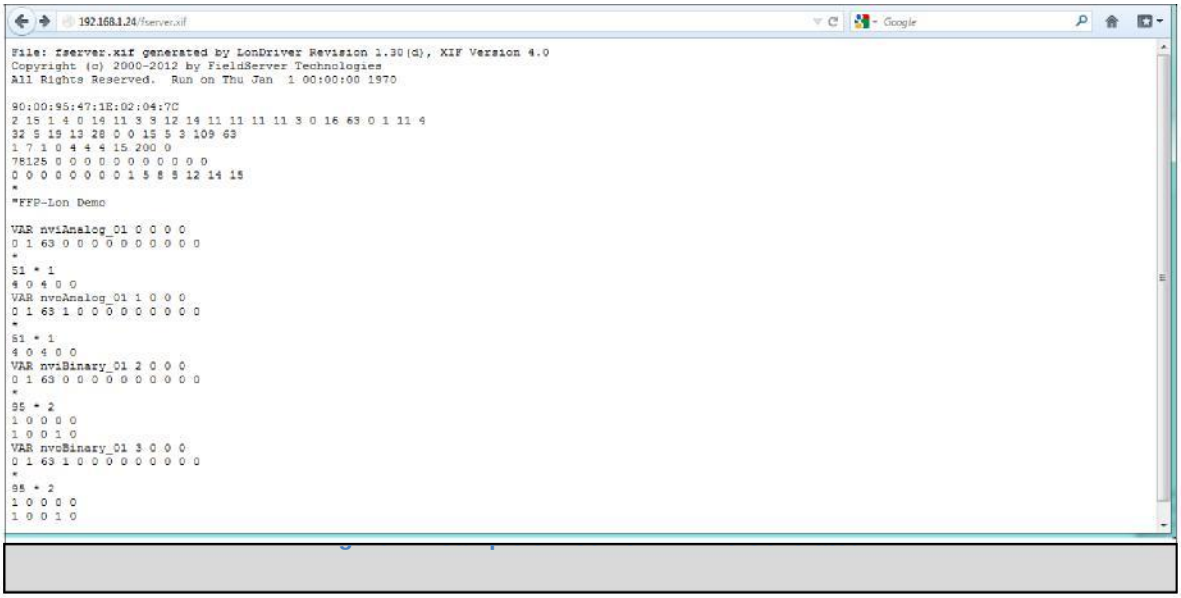
- For Windows XP and Windows 7, select: Use the following IP Address.



- Click OK twice.

- Open a web browser and go to the following address: [IP Address of ProtoNode]/fserver.xif. ○ Example: 192.168.1.24/fserver.xif

- If the web browser prompts to save the file, save the file onto the local PC. If the web browser displays the xif file as a web page, save the file onto the local PC as “fserver.xif”.



8 CAS BACNET EXPLORER FOR VALIDATING PROTONODE IN THE FIELD

Sierra Monitor 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 app.chipkin.com/activation/twoweek and fill in all the information. **Enter Vendor Code "Harsco12".** This will register the email address that was submitted.

Figure 25: Downloading the CAS Explorer

- Go to the following web site, download and install the CAS BACnet Explorer to the local 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".

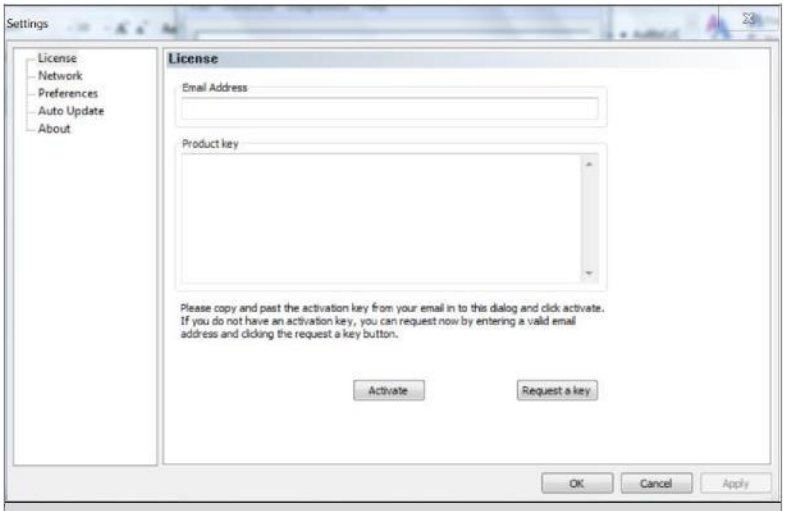


Figure 26: Requesting CAS Activation Key

8.2 CAS BACnet Setup

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

8.2.1 CAS BACnet MS/TP Setup

- Using the serial or USB to RS-485 converter, connect it to the local 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
  - 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. Lost or Incorrect IP Address

- Ensure that FieldServer Toolbox is loaded onto the local PC. If not, download FieldServer-Toolbox.zip on the Sierra Monitor 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.

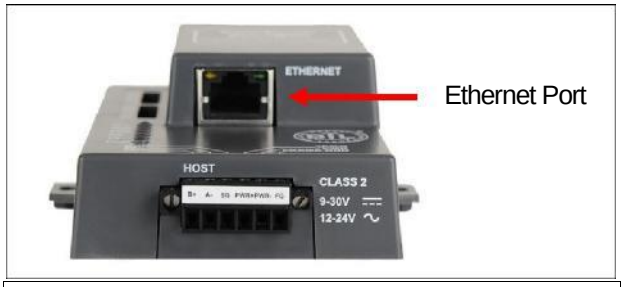
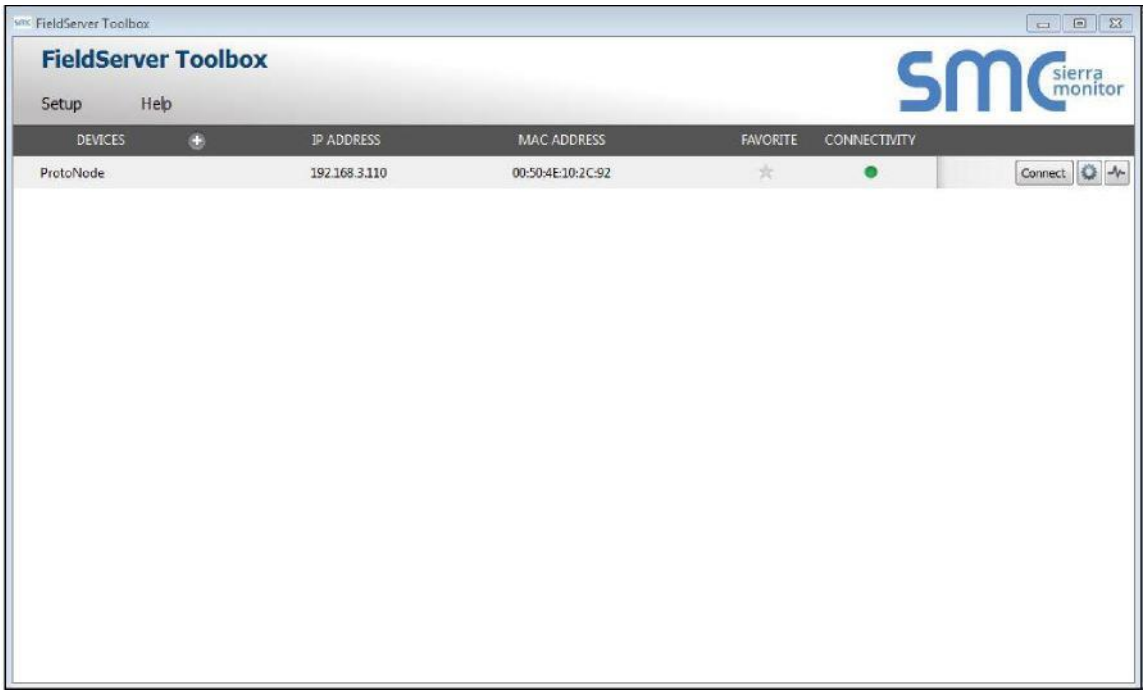


Figure 27: Ethernet Port Location

- 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.
- Check IP Addresses from the Device listings.



- Correct IP Address(es) by right clicking the settings icon and changing the IP Address.

Appendix A.2. Viewing Diagnostic information

- Type the IP Address of the ProtoNode into the 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.
- If there are any errors showing on the Connection page, please refer to **Appendix A.3** for the relevant wiring and settings.

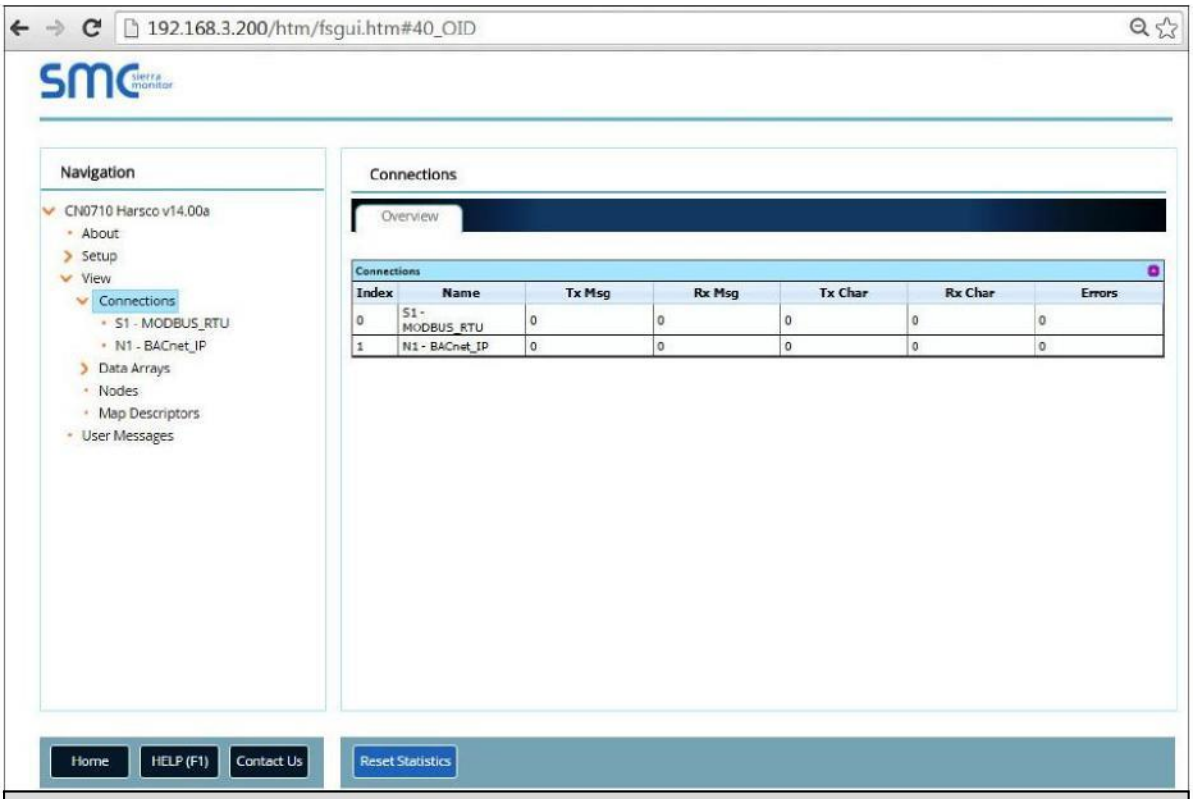


Figure 28: Error messages screen

Appendix A.3. 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. To fix this problem, check the following:
  - Visual observations of LEDs on ProtoNode (**Appendix A.7**)
  - Check baud rate, parity, data bits, stop bits
  - Check Modbus device address
  - Verify wiring
  - Verify Modbus device is connected to the same subnet as the ProtoNode
  - Verify the Modbus device was discovered in Web Configurator (**Section 4.2**)
- Field COM problems:
  - Visual observations of LEDs on ProtoNode (**Appendix A.7**)
  - Check dipswitch settings (using correct baud rate and device instance)
  - Verify IP Address setting
  - Verify wiring

NOTE: If the problem still exists, a Diagnostic Capture needs to be taken and sent to technical support. (Appendix A.4)

Appendix A.4. Take Diagnostic Capture With the FieldServer Utilities

- **Once the Diagnostic Capture is complete, email it to PKCHTsupport@spx.com. The Diagnostic Capture will accelerate diagnosis of 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.

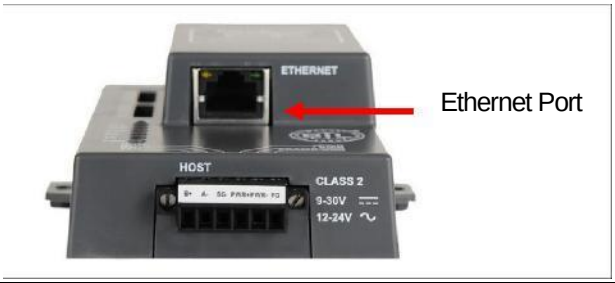
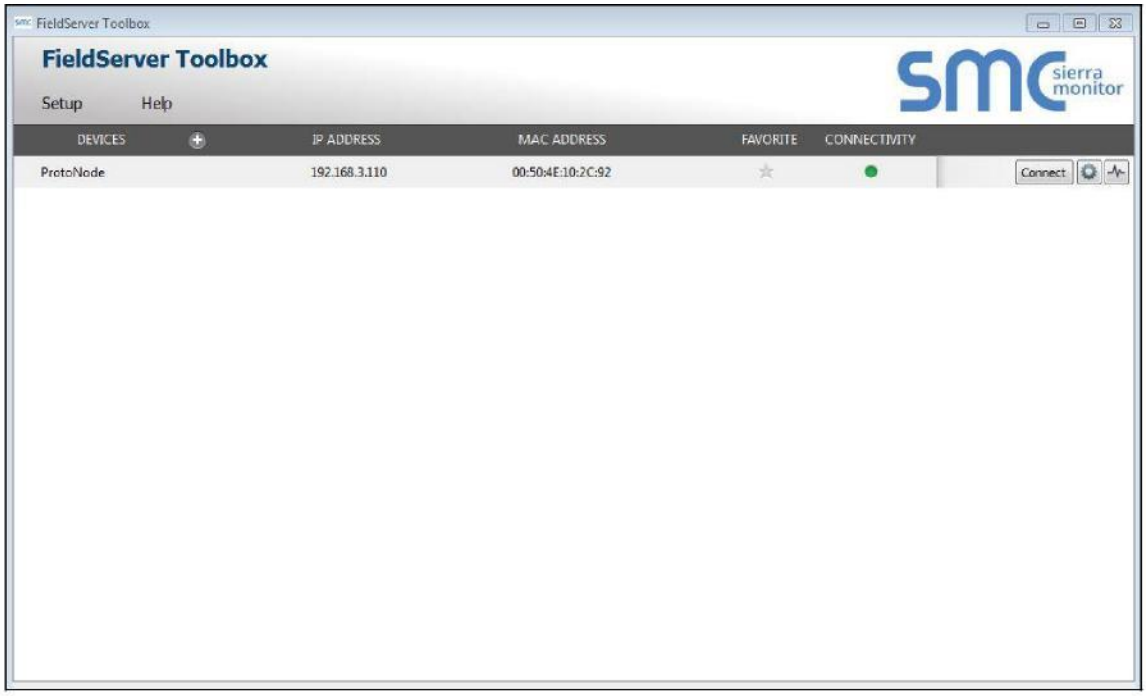


Figure 29: Ethernet Port Location

- 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.

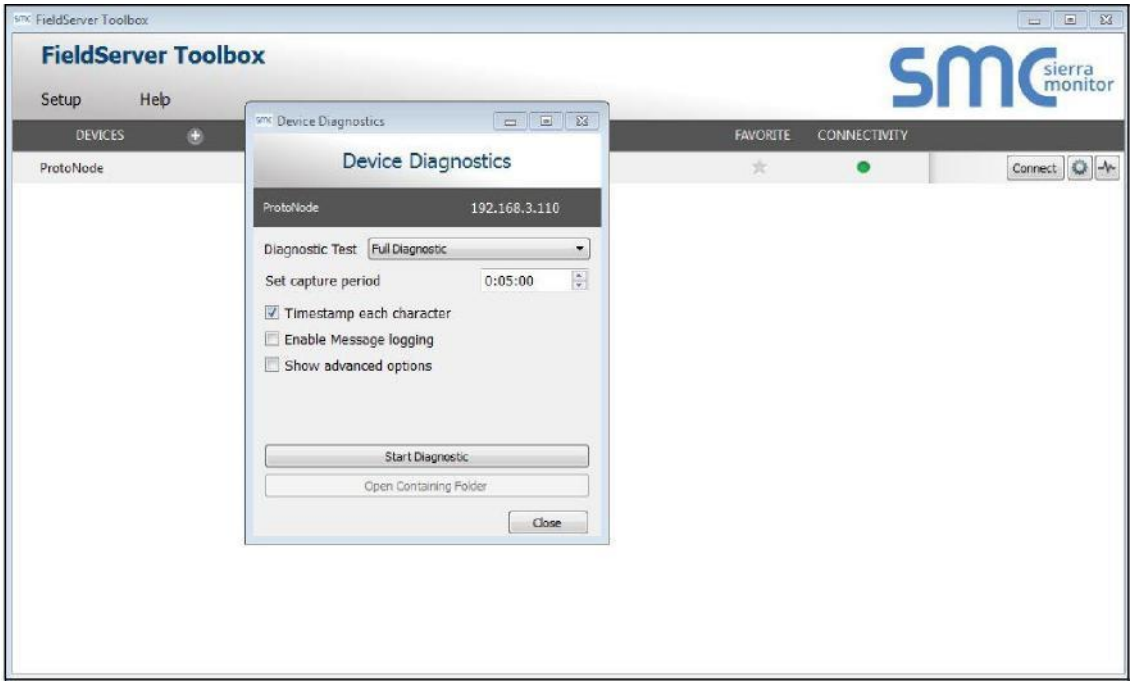
- **Step 1:** Take a Log
  - Click on the diagnose icon of the desired device



  - Select full Diagnostic

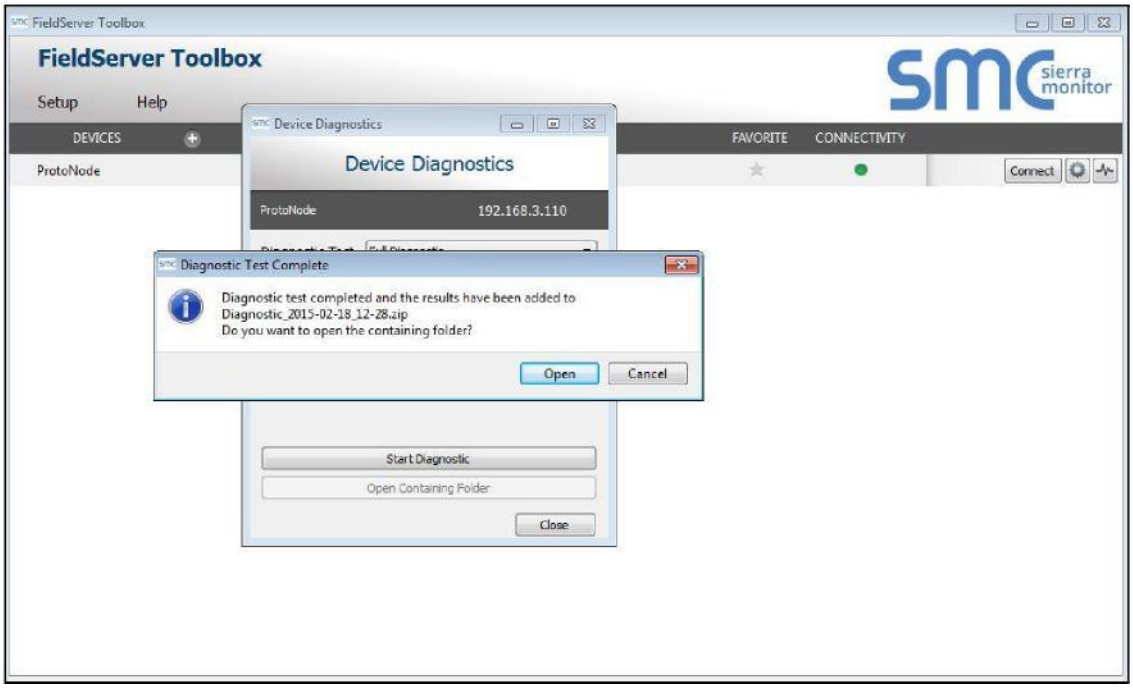
NOTE: If desired, the default capture period can be changed.

- **Click on "Start Diagnostic"**



- Wait for Capture period to finish, then the 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 PKCHTsupport@spx.com

Appendix A.5. Update Firmware

To load a new version of the firmware, follow these instructions:

1. Extract and save the new file onto the local PC.
2. Open a web browser and type the IP Address of the FieldServer in the address bar.
   NOTE: Default IP Address is 192.168.1.24
   NOTE: Use the FS Toolbox utility if you do not know the IP Address (Appendix A.1)
3. Click on the "Diagnostics & Debugging" button.
4. In the Navigation Tree on the left hand side, do the following:
   a. Click on "Setup"
   b. Click on "File Transfer"
   c. Click on the "Firmware" tab
5. In the Firmware tab, click on "Choose Files" and select the firmware file extracted in step 1.
6. Click on the orange "Submit" button.
7. When the download is complete, click on the "System Restart" button.

Appendix A.6. 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.

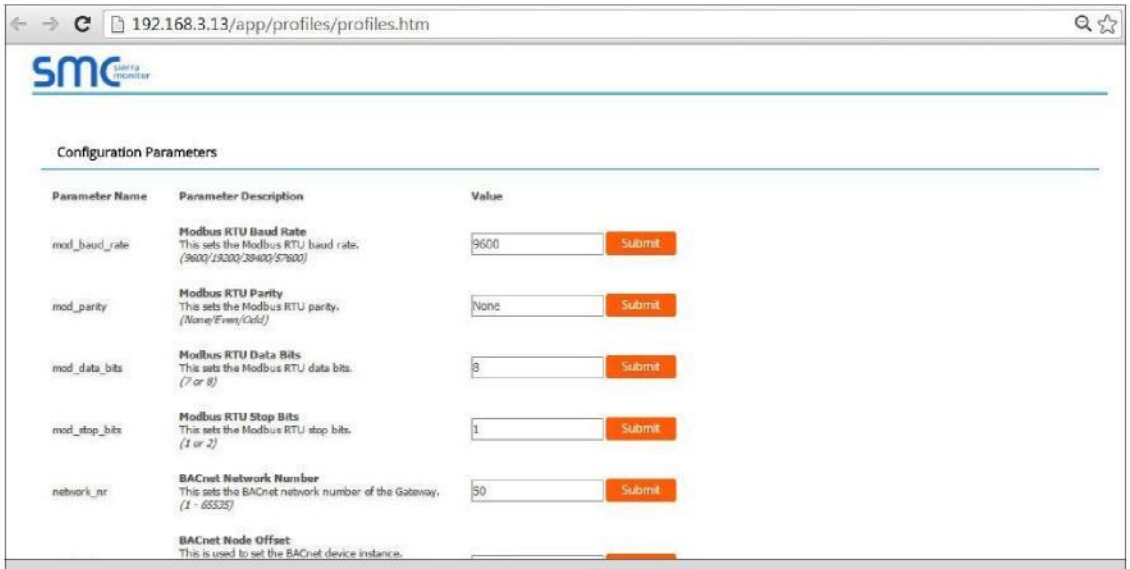
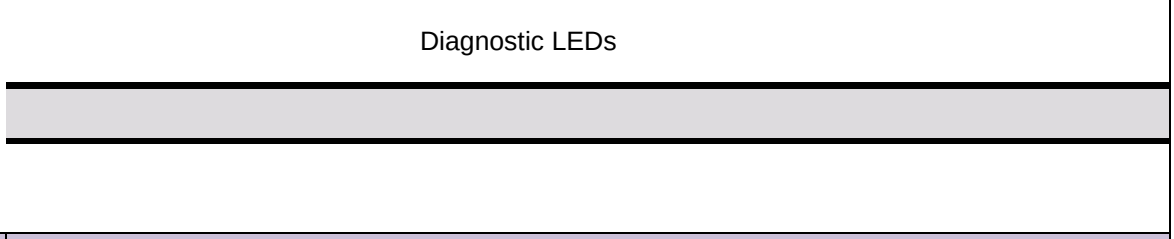


Figure 30: Web Configurator – Setting Network Number for BACnet

Appendix A.7. LED Diagnostics for 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 unit is not getting a response from one or more of the configured devices. **For LonWorks units**, LED will light until the unit is commissioned on the LonWorks network.
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 the unit. If this occurs, immediately report the related "system error" shown in the error screen of the GUI interface to support for evaluation.
RX	**If socket protocol is serial,** the RX LED will flash when a message is received on the host port. **If socket protocol is Ethernet,** this LED is **not used**.
TX	**If socket protocol is serial,** the TX LED will flash when a message is sent on the host port. **If socket protocol is Ethernet,** this LED is **not used**.
PWR	This is the power light and should show steady green at all times when the unit is powered.

Figure 31: Diagnostic LEDs

Appendix A.8. 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 the password is lost, click cancel on the password authentication popup window, and email the password recovery token to PKCHTsupport@spx.com to receive a temporary password from the customer support team. Access the ProtoNode to set a new password.

Appendix B. Vendor Information

NOTE: All Modbus TCP/IP registers are the same as the Modbus RTU registers for the serial device. If this point list is needed, contact the OEM. The Modbus TCP/IP node address of the device is also the same as the Modbus RTU node address.

Appendix B.1. ENVI Modbus RTU Mappings to BACnet, Metasys N2, Modbus TCP/IP 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	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	AI	10	AI	10	nvoFlameSig_XXX	SNVT_count_inc_f	DA_Byt_XXX	9
CH Setpoint	AV	11	AO	11	nvi/nvoCHSP_XXX	SNVT_count_inc_f	DA_Byt_XXX	10
DHW Setpoint	AV	12	AO	12	nvi/nvoDHWSP_XXX	SNVT_count_inc_f	DA_Byt_XXX	11
Boiler Operation	AV	13	AO	13	nvi/nvoBlrOpera_XXX	SNVT_count_inc_f	DA_Byt_XXX	12
High Outdoor Air Temp	AV	14	AO	14	nvi/nvoHiOATmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	13
Min Outdoor Air Setpoint	AV	15	AO	15	nvi/nvoMinOASP_XXX	SNVT_count_inc_f	DA_Byt_XXX	14
Low Outdoor Air Temp	AV	16	AO	16	nvi/nvoLoOATmp_XXX	SNVT_count_inc_f	DA_Byt_XXX	15
Max Outdoor Air Setpoint	AV	17	AO	17	nvi/nvoMaxOASP_XXX	SNVT_count_inc_f	DA_Byt_XXX	16
Outdoor Air Shutdown Temp	AV	18	AO	18	nvi/nvoOAShtdnTp_XXX	SNVT_count_inc_f	DA_Byt_XXX	17
Night Setback	AV	19	AO	19	nvi/nvoNightStbk_XXX	SNVT_count_inc_f	DA_Byt_XXX	18
Error Code	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	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=restartin g burner control; 19=error handling; 20=error handling; 21=error handlin g
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, Metasys N2, Modbus TCP/IP 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	AI	1	AI	1	nvoProcVal_XXX	SNVT_count_inc_f	DA_U16_XXX	0
Setpoint	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	AV	5	AO	5	nvi/nvoCtrlMethd_XXX	SNVT_count_inc_f	DA_U16_XXX	4
PB Proportional Band	AV	6	AO	6	nvi/nvoPB_PrpBnd_XXX	SNVT_count_inc_f	DA_U16_XXX	5
Ti Integral Time	AV	7	AO	7	nvi/nvoTiIntegTm_XXX	SNVT_count_inc_f	DA_U16_XXX	6
Td Derivative Time	AV	8	AO	8	nvi/nvoTdDerTime_XXX	SNVT_count_inc_f	DA_U16_XXX	7
Output Value	AV	9	AO	9	nvi/nvoOutputVal_XXX	SNVT_lev_percent	DA_U16_XXX	8
Upper-Limit Regulation	AV	10	AO	10	nvi/nvoUpLimReg_XXX	SNVT_count_inc_f	DA_U16_XXX	9
Lower-Limit Regulation	AV	11	AO	11	nvi/nvoLoLimReg_XXX	SNVT_count_inc_f	DA_U16_XXX	10
Analog Decimal Setting	AV	12	AO	12	nvi/nvoAnaDecSet_XXX	SNVT_count_inc_f	DA_U16_XXX	11
PID Parameter Selection	AV	13	AO	13	nvi/nvoPIDPrmSel_XXX	SNVT_count_inc_f	DA_U16_XXX	12
SV Value	AV	14	AO	14	nvi/nvoSVValue_XXX	SNVT_count_inc_f	DA_U16_XXX	13
Alarm 1 Type	AV	15	AO	15	nvi/nvoAlm1Type_XXX	SNVT_count_inc_f	DA_U16_XXX	14
Alarm 2 Type	AV	16	AO	16	nvi/nvoAlm2Type_XXX	SNVT_count_inc_f	DA_U16_XXX	15
Alarm 3 Type	AV	17	AO	17	nvi/nvoAlm3Type_XXX	SNVT_count_inc_f	DA_U16_XXX	16
Upper-Limit Alarm 1	AV	18	AO	18	nvi/nvoUpLimAlm1_XXX	SNVT_count_inc_f	DA_U16_XXX	17
Lower-Limit Alarm 1	AV	19	AO	19	nvi/nvoLoLimAlm1_XXX	SNVT_count_inc_f	DA_U16_XXX	18
Upper-Limit Alarm 2	AV	20	AO	20	nvi/nvoUpLimAlm2_XXX	SNVT_count_inc_f	DA_U16_XXX	19
Lower-Limit Alarm 2	AV	21	AO	21	nvi/nvoLoLimAlm2_XXX	SNVT_count_inc_f	DA_U16_XXX	20
Upper-Limit Alarm 3	AV	22	AO	22	nvi/nvoUpLimAlm3_XXX	SNVT_count_inc_f	DA_U16_XXX	21
Lower-Limit Alarm 3	AV	23	AO	23	nvi/nvoLoLimAlm3_XXX	SNVT_count_inc_f	DA_U16_XXX	22
Setting Lock Status	AV	24	AO	24	nvi/nvoSetLkStat_XXX	SNVT_count_inc_f	DA_U16_XXX	23
Communication Write-in Selection	AI	25	AI	25	nvoComWrinSl_XXX	SNVT_count_inc_f	DA_U16_XXX	24
Temp Unit Display Selection	BV	26	DO	26	nvi/nvoTmpUnit_XXX	SNVT_switch	DA_U16_XXX	25
Control RUN/STOP Setting	BV	27	DO	27	nvi/nvoCtrRnStSt_XXX	SNVT_switch	DA_U16_XXX	26
STOP Setting for PID	BV	28	DO	28	nvi/nvoStpSetPID_XXX	SNVT_switch	DA_U16_XXX	27
Temp STOP for PID	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=°F; 1=°C
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, Metasys N2, Modbus TCP/IP 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_Scl_XXX	0
Return Temperature	AI	2	AI	2	nvoReturnTmp_XXX	SNVT_temp_p	DA_Scl_XXX	1
Stack Temperature	AI	3	AI	3	nvoStackTmp_XXX	SNVT_temp_p	DA_Scl_XXX	2
DHW Temperature	AI	4	AI	4	nvoDHWTmp_XXX	SNVT_temp_p	DA_Scl_XXX	3
Header Temperature	AI	5	AI	5	nvoHeaderTmp_XXX	SNVT_temp_p	DA_Scl_XXX	4
HX Temperature	AI	6	AI	6	nvoHXTmp_XXX	SNVT_temp_p	DA_Scl_XXX	5
ODA Temperature Filtered	AI	7	AI	7	nvoODATmpFlt_XXX	SNVT_temp_p	DA_Scl_XXX	6
Extra Field Temperature	AI	8	AI	8	nvoExtFldTmp_XXX	SNVT_temp_p	DA_Scl_XXX	7
Wireless Temperature	AI	9	AI	9	nvoWirlssTmp_XXX	SNVT_temp_p	DA_Scl_XXX	8
Analog Input	AI	10	AI	10	nvoAnaInput_XXX	SNVT_count_f	DA_Scl_XXX	9
Analog Output	AI	11	AI	11	nvoAnaOutput_XXX	SNVT_count_f	DA_U16_XXX	10
Burner Control Digital I/O	AI	12	AI	12	nvoBrnCtDgIO_XXX	SNVT_count_f	DA_U16_XXX	11
Burner Control Digital I/O 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_Scl_XXX	13
DHW Mode Active Setpoint	AI	15	AI	15	nvoDHWMdAcSP_XXX	SNVT_temp_p	DA_Scl_XXX	14
Demand Source	AI	16	AI	16	nvoDmdSrc_XXX	SNVT_count_f	DA_U16_XXX	15
Active Demand Status	AI	17	AI	17	nvoActDmdSt_XXX	SNVT_count_f	DA_U16_XXX	16
Boiler State	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	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

Relay A	BI	32	DI	32	nvoRelayA_XXX	SNVT_switch	DA_Bit_XXX	0
Relay B	BI	33	DI	33	nvoRelayB_XXX	SNVT_switch	DA_Bit_XXX	1
Relay C	BI	34	DI	34	nvoRelayC_XXX	SNVT_switch	DA_Bit_XXX	2
Relay D	BI	35	DI	35	nvoRelayD_XXX	SNVT_switch	DA_Bit_XXX	3
External Ignition	BI	36	DI	36	nvoExtIgn_XXX	SNVT_switch	DA_Bit_XXX	4
Gas Valve	BI	37	DI	37	nvoGasValve_XXX	SNVT_switch	DA_Bit_XXX	5
Alarm Relay	BI	38	DI	38	nvoAlmRelay_XXX	SNVT_switch	DA_Bit_XXX	7
Interlock Control Circuit	BI	39	DI	39	nvoIntCtlCkt_XXX	SNVT_switch	DA_Bit_XXX	8
Damper End Switch	BI	40	DI	40	nvoDmpEndSw_XXX	SNVT_switch	DA_Bit_XXX	9
Limit Control Circuit	BI	41	DI	41	nvoLimCtlCkt_XXX	SNVT_switch	DA_Bit_XXX	10
Enable	BI	42	DI	42	nvoEnable_XXX	SNVT_switch	DA_Bit_XXX	13
Night Setback Input	BI	43	DI	43	nvoNtStbkInp_XXX	SNVT_switch	DA_Bit_XXX	14
Safety Relay	BI	44	DI	44	nvoSafetyRel_XXX	SNVT_switch	DA_Bit_XXX	15
Air Switch	BI	45	DI	45	nvoAirSwitch_XXX	SNVT_switch	DA_Bit_XXX	16
Start Interlock 1	BI	46	DI	46	nvoStIntlk1_XXX	SNVT_switch	DA_Bit_XXX	17
Start Interlock 2	BI	47	DI	47	nvoStIntlk2_XXX	SNVT_switch	DA_Bit_XXX	18
Auxiliary Input 1	BI	48	DI	48	nvoAuxInput1_XXX	SNVT_switch	DA_Bit_XXX	19
High Temperature Limit	BI	49	DI	49	nvoHiTmpLim_XXX	SNVT_switch	DA_Bit_XXX	20
Low Water Cutoff	BI	50	DI	50	nvoLoWtrCtof_XXX	SNVT_switch	DA_Bit_XXX	21
High Gas Pressure	BI	51	DI	51	nvoHiGasPrs_XXX	SNVT_switch	DA_Bit_XXX	22
Aux Input 2 or Flow Switch	BI	52	DI	52	nvoAuxInput2_XXX	SNVT_switch	DA_Bit_XXX	23
BMS Heartbeat	AV	53	AO	53	nvi/nvoBMSHrtbt_XXX	SNVT_count_f	DA_U16_XXX	34
BMS Header Temperature	AI	54	AI	54	nvoBMSHdrTmp_XXX	SNVT_temp_p	DA_Scl_XXX	35
BMS Outdoor Air Temperature	AI	55	AI	55	nvoBMSOATmp_XXX	SNVT_temp_p	DA_Scl_XXX	36
BMS Analog Input	AI	56	AI	56	nvoBMSAI_XXX	SNVT_count_f	DA_Scl_XXX	37
BMS DHW Demand	AV	57	AO	57	nvi/nvoBMSDHWDem_XXX	SNVT_count_f	DA_U16_XXX	38
BMS DHW Temperature	AI	58	AI	58	nvoBMSDHWTmp_XXX	SNVT_temp_p	DA_Scl_XXX	39
Burner Control Dig I/O	AI	59	AI	59	nvoBrnCtDIO_XXX	SNVT_count_f	DA_U16_XXX	11
Burner Control Dig I/O 2	AI	60	AI	60	nvoBrCtDIO2_XXX	SNVT_count_f	DA_U16_XXX	12
BMS Header Temperature	AV	61	AO	61	nviBMSHdrTmp_XXX	SNVT_temp_p	DA_U16_XXX	35
BMS Outdoor Air Temperature	AV	62	AO	62	nviBMSOATmp_XXX	SNVT_temp_p	DA_U16_XXX	36
BMS Analog Input	AV	63	AO	63	nviBMSAI_XXX	SNVT_count_f	DA_U16_XXX	37
BMS DHW Temperature	AV	64	AO	64	nviBMSDHWTmp_XXX	SNVT_temp_p	DA_U16_XXX	39

NOTES:

1) Normal temperatures are °F with 1 decimal of precision. The values listed below indicate there is a problem with the temperature value: 32768 = Sensor Short, 33024 = Sensor Open, 33536 = Sensor Outside High Range, 33792 = Sensor Outside Low Range, 34048 = Sensor Not Reliable
2) Burner Control Digital I/O (AI 12) and Burner Control Digital I/O 2 (AI 13) are legacy points, it is recommended to use points Burner Control Dig I/O (AI 59) and Burner Control Dig I/O 2 (AI 60) for new implementations. The legacy points multiplied by 10. To obtain actual values divide by 10.
3) "Burner Control Dig 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: BI values (BI 32) through (BI 44) may be used alternately.
4) "Burner Control Digital I/O 2" Codes: Bit Map: 15-8= undefined, 7=auxiliary input 2 or Flow Switch, 6=high gas pressure, 5=low water cut-off, 4=high temperature limit, 3=auxiliary input 1, 2=start interlock 2, 1=start interlock 1, 0=air switch: BI values (BI 45) through (BI 52) may be used alternately.
5) "Demand Source" Codes: 0=none; 1=CH; 2=DHW; 3=freeze protection; 4=manual; 5=CH & DHW; 6=DHW & CH
6) "CH Mode Active Setpoint" and "DHW Mode Active Setpoint" temperatures are °F with 1 decimal of precision. A value of 33536 indicates the mode is not currently active.
7) "Active Demand Status" Codes: 0=Normal; 1=System Pump Pre Pumping; 2=System Pump Post Pumping; 3=Boiler Pump Pre Pumping; 4=Boiler Pump Post Pumping; 5=Tank Pump Pre Pumping; 6=Tank Pump Post Pumping; 7=DHW Pump Pre Pumping; 8=DHW Pump Post Pumping; 9=Waiting Anti Cycle; 10=Mod Back Max T; 11=Low Fire Hold; 12=Limiting - Time to High Fire; 13=Limiting - Acceleration Rate; 14=Limiting - Deceleration Rate; 15=Waiting for Mode Demand; 16=Waiting for Boiler to Start; 17=Boiler Pump Running; 18=System Pump Running; 19=DHW Pump Running; 20=Tank Pump Running; 21=Increased - Anti-Condensation
8) "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; 26=Lockout Verification Complete; 27=Reading Modbus Values; 28=Verifying Burner Control Parameters; 29=SOLA Version Incorrect; 30=Checking SOLA Password; 31=Standby Near Max T Limit; 32=Waiting for Flow Switch; 33=Standby Delta T Limit; 34=Standby Near Max Stack Limit; 35=Need to Pair SOLA to NURO; 36=Starting Hold Delay; 37=Starting Communication; 38=Boiler Type Unknown
9) "Error Type" Codes: 0=no error; 1=lockout; 2=boiler hold; 3=mode hold; 4=alert caused alarm
10) "BMS CH Setpoint", "BMS DHW Setpoint", "BMS DHW Tank Setpoint": The NURO control must be programmed to receive its setpoint from the BMS system.
11) "BMS CH Demand" and "BMS DHW Demand": The NURO control must be programmed to receive its demand from the BMS system. You can program the NURO on loss of the BMS Heartbeat to auto disable the demand from the BMS if wanted.
12) "BMS Heartbeat": This function allows for a heartbeat command between the NURO control and the BMS system. In order to establish a successful heartbeat, the BMS system must alternate between 0xABCD (43981) and 0xDCBA (56506) within every "BMSHeartbeatTimeoutPeriod" time period. In the event the BMS no longer alternates the values, the NURO control will assume communication to the BMS is interrupted.
13) "BMS Header Temperature", "BMS Outdoor Air Temperature", "BMS Analog Input", and "BMS DHW Temperature": These points use different points for the Input of the value verses the output. Example AI 54 is for writing the value for "BMS Header Temperature", AV 61 is for reading "BMS Header Temperature". The "BMS Heartbeat" is always active on these points therefore if the "BMS Heartbeat" is lost during operation, the control will automatically change the value to 33024 = "Sensor Open". The NURO control also defaults this value to 33024 = "Sensor Open" on power up until it receives the BMS Heartbeat and the temperature value from the BMS. If the BMS attempts to send a value which is out of range, the control will automatically change the value to 34048 = "Sensor Not Reliable".

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
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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 3-pin Phoenix connector with: 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 32: 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
- Furthermore, the interconnecting power cable shall:
  - Be of length not exceeding 3.05m (118.3")
  - Be constructed of materials rated VW-1, 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.