



ProtoNode FPC-N54 Start-up Guide

For Interfacing Lochinvar Products:

SYNC™, Knight®/Knight XL®/Armor/Wall Mount/Wall Hung, Crest®, Copper-Fin II®, Power Fin, Knight FTXL, Power Fin 2.5-5.0, IPW, Armor_1250_4000

To Building Automation Systems:

BACnet MS/TP, BACnet/IP, Modbus TCP/IP, Metasys N2 and SMC Cloud

APPLICABILITY & EFFECTIVITY

Explains ProtoNode hardware and installation.

The instructions are effective for the above as of June 2020.

Technical Support

Thank you for purchasing the ProtoNode for Lochinvar.

Please call Lochinvar for technical support of the ProtoNode product.

MSA Safety does not provide direct support. If Lochinvar needs to escalate the concern, they will contact MSA Safety for assistance.

Support Contact Information:

Lochinvar, LLC
300 Maddox Simpson Pkwy.
Lebanon, TN 37090

Customer Service:

1-800-722-2101

Email: 2tech@lochinvar.com

Website: www.lochinvar.com

Quick Start Guide

1. Record the information about the unit. ([Section 3.1](#))
2. Check that the ProtoNode and customer device COM settings match. ([Section 3.3](#))
3. Connect the ProtoNode 3 pin RS-485 R1 port to the RS-485 network connected to each of the devices. ([Section 4.1](#))
4. **If using a serial field protocol:**
Connect the ProtoNode 3 pin RS-485 R2 port to the field protocol cabling. ([Section 4.2](#))
5. Connect power to ProtoNode 3 pin power port. ([Section 4.5](#))
6. Connect a PC to the ProtoNode via Ethernet cable. ([Section 5](#))
7. Setup Web Server Security and login via web browser. ([Section 6](#))
8. Use a web browser to access the ProtoNode Web Configurator page to select the profile of the device attached to the ProtoNode and enter any necessary device information. Once the device is selected, the ProtoNode automatically builds and loads the appropriate configuration. ([Section 7](#))
9. Ethernet Network: If using an Ethernet field protocol, use a web browser to access the ProtoNode Web Configurator page to change the IP Address. ([Section 7.4](#))

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1 CERTIFICATION

1.1 BTL Mark – BACnet®¹ Testing Laboratory



BACnet is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Conformance of listed products to requirements of ASHRAE standards is in the responsibility of the manufacturer. ASHRAE is a registered trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

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 www.BACnetInternational.net for more information about the BACnet Testing Laboratory. Click [here](#) for the BACnet PIC Statement.

¹ BACnet is a registered trademark of ASHRAE

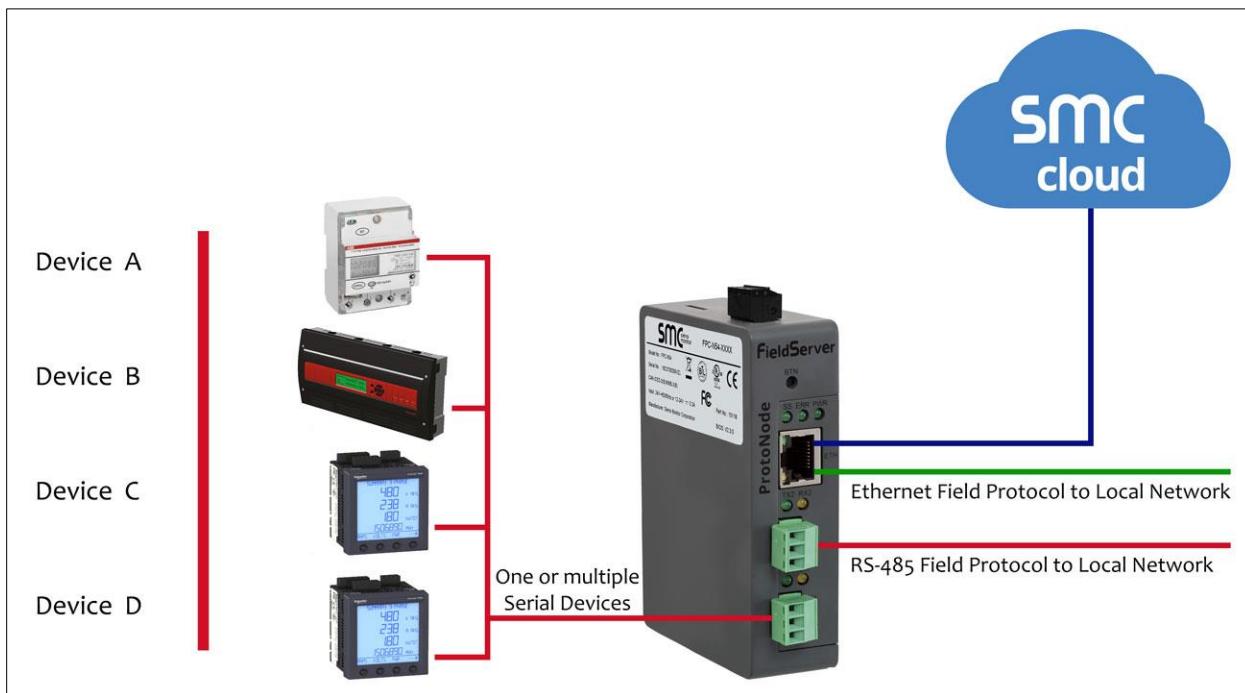
2 INTRODUCTION

2.1 ProtoNode Gateway

The ProtoNode is an external, high performance **building automation multi-protocol gateway** that is preconfigured to automatically communicate between Lochinvar's devices (hereafter simply called "device") connected to the ProtoNode and automatically configures them for BACnet/IP, BACnet MS/TP, Modbus TCP/IP and Metasys[®] N2 by JCI.

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.

FPC-N54 Connectivity Diagram:



The ProtoNode can connect with the SMC Cloud. The SMC Cloud allows technicians, the OEM's support team and MSA Safety's support team to remotely connect to the ProtoNode. The SMC Cloud provides the following capabilities for any registered devices in the field:

- Remotely monitor and control devices.
- Collect device data and view it on the SMC Cloud Dashboard and the SMC Smart Phone App.
- Create user defined device notifications (alarm, trouble and warning) via SMS and/or Email.
- Generate diagnostic captures (as needed for troubleshooting) without going to the site.

For more information about the SMC Cloud, refer to the [SMC Cloud Start-up Guide](#).

² Metasys is a registered trademark of Johnson Controls Inc.

3 PROTONODE SETUP

3.1 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 | FPC-N54-1998 |

Figure 1: ProtoNode Part Numbers

- FPC-N54 units have the following 3 ports: RS-485 + Ethernet + RS-485/RS-232

3.2 Point Count Capacity

The total number of points presented by the device(s) attached to the ProtoNode cannot exceed:

| Part number | Total Points |
|--------------|--------------|
| FPC-N54-1998 | 1,500 |

Figure 2: Supported Point Count Capacity

| Devices | Points Per Device |
|--------------------------------------|-------------------|
| SYNC | 58 |
| Knight_XL_Armor_Wall_Mount_Wall_Hung | 44 |
| Crest | 63 |
| Copper_Fin_II | 52 |
| Power_Fin | 43 |
| Knight_FTXL | 46 |
| Powerfin_2.5_5.0 | 55 |
| IPW | 4 |
| Armor_1250_4000 | 44 |

Figure 3: Points per Device

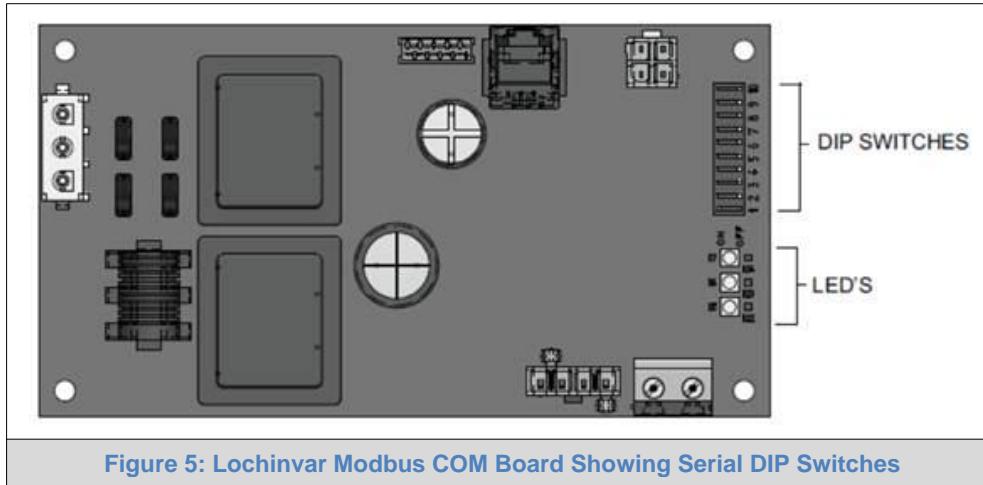
3.3 Configuring Device Communications

3.3.1 Confirm the Device and ProtoNode COM Settings Match

- Any connected serial devices **MUST have the same baud rate, data bits, stop bits, and parity settings as the ProtoNode.**
- [Figure 4](#) specifies the device serial port settings required to communicate with the ProtoNode.

| Port Setting | IPW | Other Devices |
|--------------|------------|---------------|
| Protocol | Modbus RTU | Modbus RTU |
| Baud Rate | 19200 | 9600 |
| Parity | None | None |
| Data Bits | 8 | 8 |
| Stop Bits | 1 | 2 |

[Figure 4: COM Settings](#)



[Figure 5: Lochinvar Modbus COM Board Showing Serial DIP Switches](#)

3.3.2 Set Node-ID for Any Device Attached to the ProtoNode

- Set Node-ID for any device attached to ProtoNode. The Node-ID needs to be uniquely assigned between 1 and 255.
- Document the Node-ID that is assigned. The Node-ID assigned is used for deriving the Device Instance for BACnet/IP and BACnet MS/TP. ([Section 7](#))

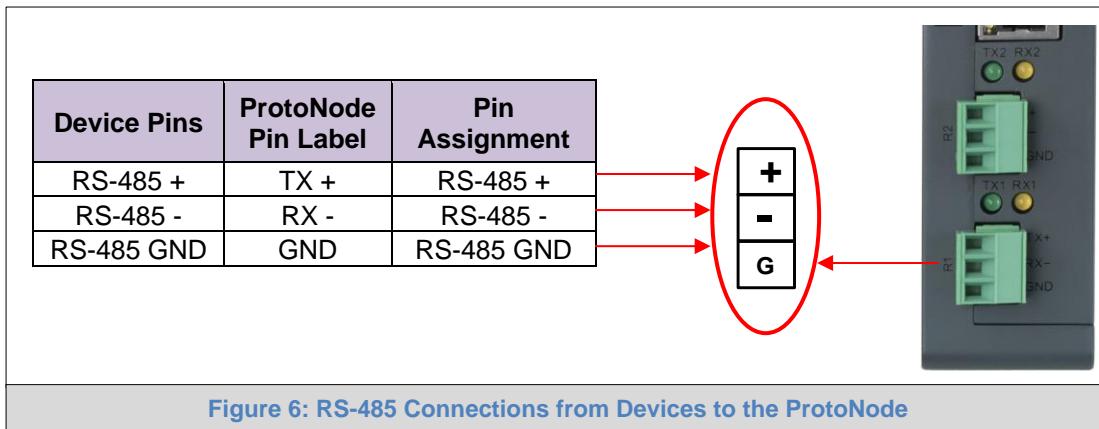
NOTE: The Metasys N2 and Modbus TCP/IP field protocol Node-ID is automatically set to be the same value as the Node-ID of the device.

4 INTERFACING PROTONODE TO DEVICES

4.1 Device Connections to ProtoNode

The ProtoNode has a 3-pin Phoenix connector for connecting RS-485 devices on the R1 port.

NOTE: Use standard grounding principles for RS-485 GND.

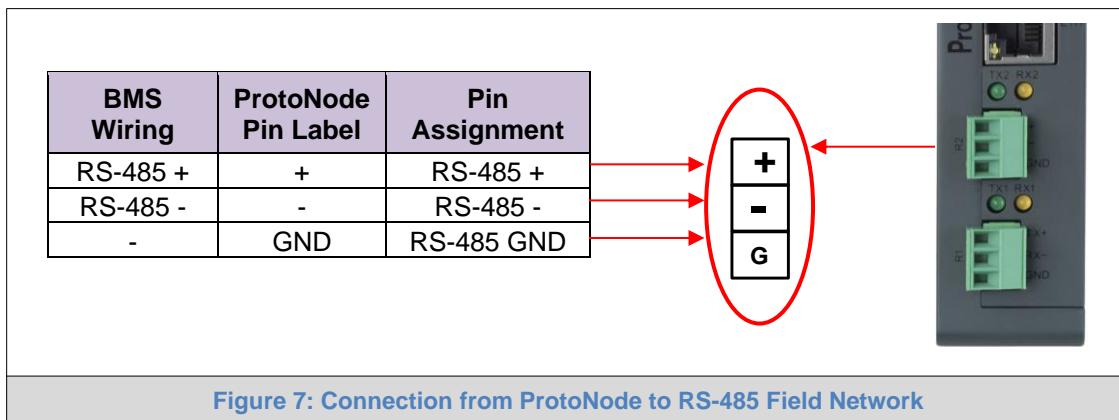


4.1.1 Lochinvar Low Voltage Modbus RTU Wiring to the ProtoNode (Armor, SYNC/Armor X2, Knight/Knight XL, Crest, Copper-Fin II and FTXL)

- On the Lochinvar's Modbus terminal strip, connect Pin A (RS-485+) to B+ (RS-485+) on the ProtoNode's R1 port 3-pin Phoenix connector.
- On the Lochinvar's Modbus terminal strip, connect Pin B (RS-485-) to A- (RS-485-) on the ProtoNode's R1 3-pin Phoenix connector.
- The Shield Pin on the terminal strip (which is Ground) does not need to be grounded to the ProtoNode.

4.2 Wiring Field Port to RS-485 Serial Network

- Connect the RS-485 network wires to the 3-pin RS-485 connector on the R2 port. ([Figure 7](#))
 - Use standard grounding principles for RS-485 GND
- See [Section 5](#) for information on connecting to the Ethernet network.



4.3 Bias Resistors

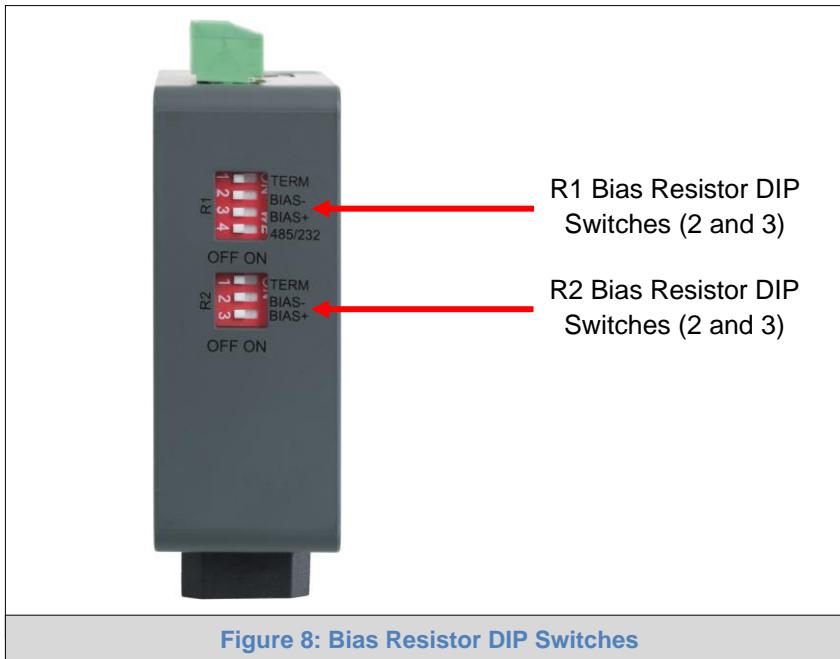


Figure 8: Bias Resistor DIP Switches

To enable Bias Resistors, move both the BIAS- and BIAS+ dip switches to the right as shown in Figure 8.

The ProtoNode bias resistors are used to keep the RS-485 bus to a known state, when there is no transmission on the line (bus is idling), to help prevent false bits of data from being detected. The bias resistors typically pull one line high and the other low - far away from the decision point of the logic.

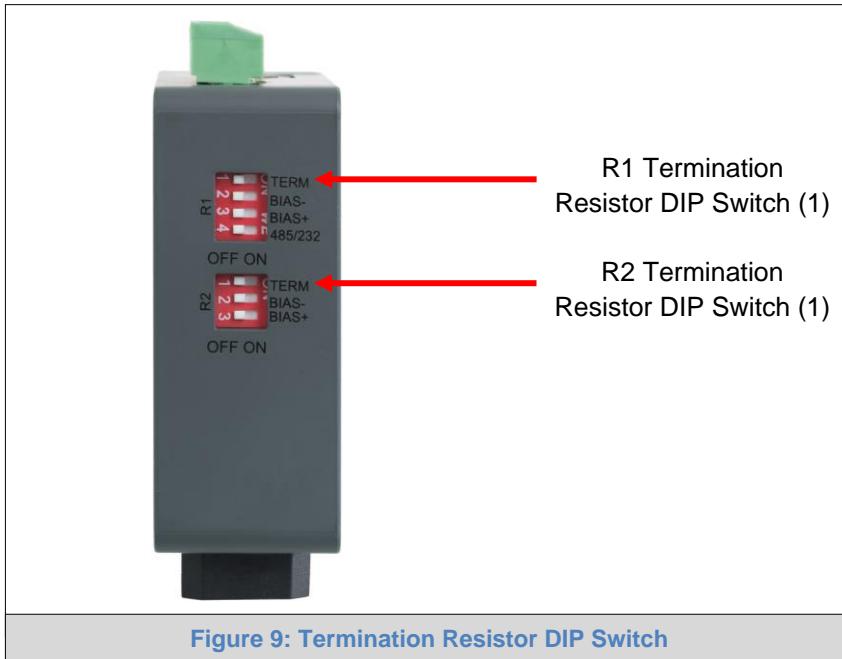
The bias resistor is 510 ohms which is in line with the BACnet spec. It should only be enabled at one point on the bus (for example, on the field port where there are very weak bias resistors of 100k). Since there are no jumpers, many gateways can be put on the network without running into the bias resistor limit which is < 500 ohms.

NOTE: See www.ni.com/support/serial/resinfo.htm for additional pictures and notes.

NOTE: The R1 and R2 DIP Switches apply settings to the respective serial port.

NOTE: If the gateway is already powered on, DIP switch settings will not take effect unless the unit is power cycled.

4.4 Termination Resistor



If the ProtoNode is the last device on the serial trunk, then the End-Of-Line Termination Switch needs to be enabled. **To enable the Termination Resistor, move the TERM dip switch to the right in the orientation shown in Figure 9.**

Termination resistor is also used to reduce noise. It pulls the two lines of an idle bus together. However, the resistor would override the effect of any bias resistors if connected.

NOTE: The R1 and R2 DIP Switches apply settings to the respective serial port.

NOTE: If the gateway is already powered on, DIP switch settings will not take effect unless the unit is power cycled.

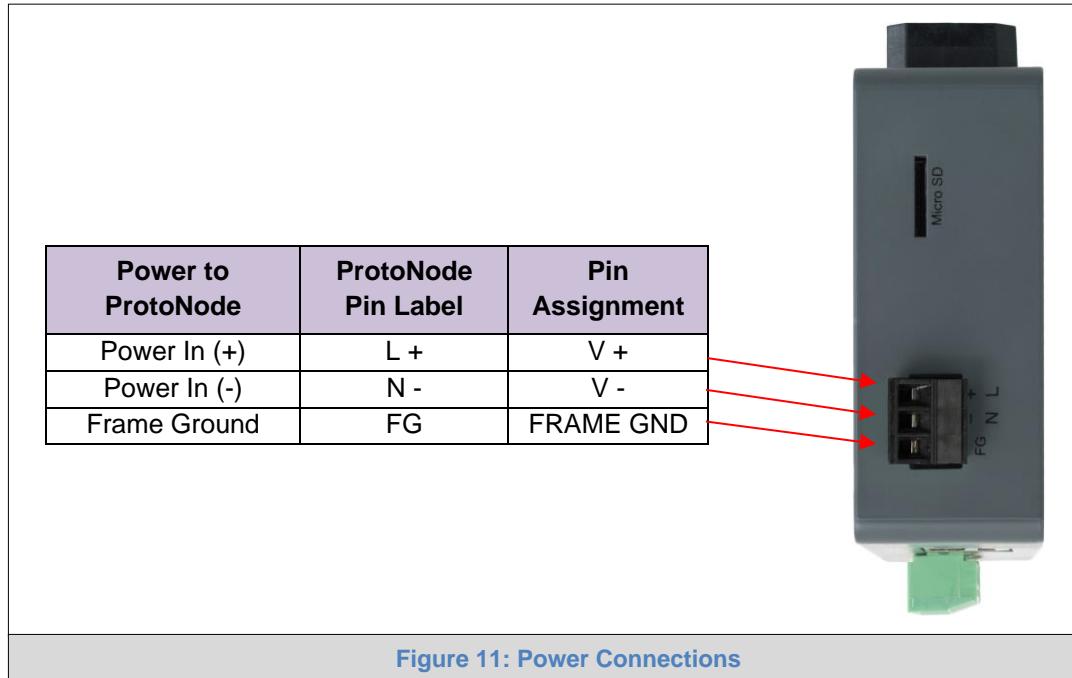
4.5 Power-Up ProtoNode

Check power requirements in the table below:

| Power Requirement for ProtoNode External Gateway | | |
|--|-------------------|----------|
| | Current Draw Type | |
| ProtoNode Family | 12VDC | 24VDC/AC |
| FPC – N54 (Typical) | 250mA | 125mA |
| 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 10: Required Current Draw for the ProtoNode | | |

Apply power to the ProtoNode as shown below in **Figure 11**. Ensure that the power supply used complies with the specifications provided in [Appendix D.1](#).

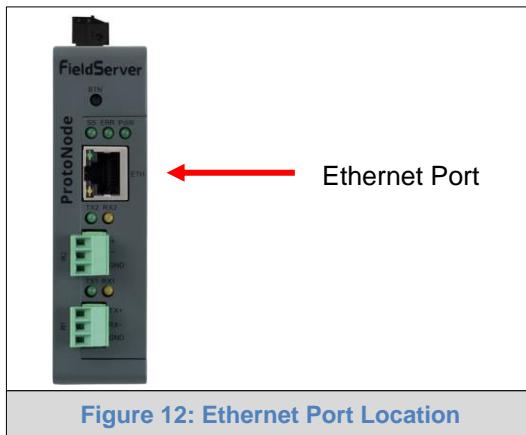
- The ProtoNode accepts 9-30VDC or 24VAC on pins L+ and N-.
- Frame GND should be connected.



5 CONNECT THE PC TO THE PROTONODE

5.1 Connecting to the ProtoNode via Ethernet

Connect a Cat-5 Ethernet cable (straight through or cross-over) between the local PC and ProtoNode.

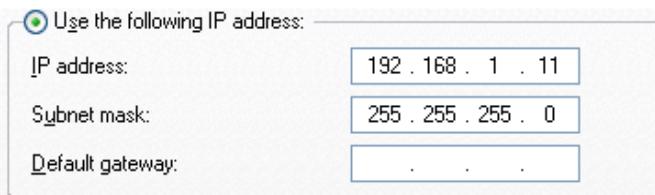


5.1.1 Changing the Subnet of the Connected PC

The default IP Address for the 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 10:

- Find the search field in the local computer's taskbar (usually to the right of the windows icon) and type in "Control Panel".
- Click "Control Panel", click "Network and Internet" and then click "Network and Sharing Center".
- Click "Change adapter settings" on the left side of the window.
- Right-click on "Local Area Connection" and select "Properties" from the dropdown menu.
- Highlight **Internet Protocol Version 4 (TCP/IPv4)** and then click the Properties button.
- Select and enter a static IP Address on the same subnet. For example:



- Click the Okay button to close the Internet Protocol window and the Close button to close the Ethernet Properties window.

6 SETUP WEB SERVER SECURITY

Navigate to the IP Address of the ProtoNode on the local PC by opening a web browser and entering the IP Address of the ProtoNode; the default Ethernet address is 192.168.1.24.

NOTE: If the IP Address of the ProtoNode has been changed, the IP Address can be discovered using the FS Toolbox utility. See [Appendix A.1](#) for instructions.

6.1 Login to the FieldServer

The first time the FieldServer GUI is opened in a browser, the IP Address for the gateway will appear as untrusted. This will cause the following pop-up windows to appear.

- When the Web Server Security Unconfigured window appears, read the text and choose whether to move forward with HTTPS or HTTP.

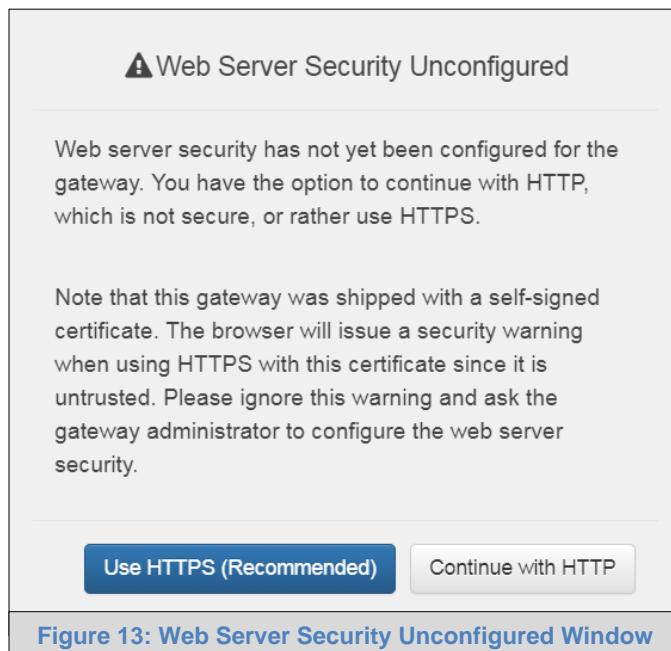


Figure 13: Web Server Security Unconfigured Window

- When the warning that "Your connection is not private" appears, click the advanced button on the bottom left corner of the screen.

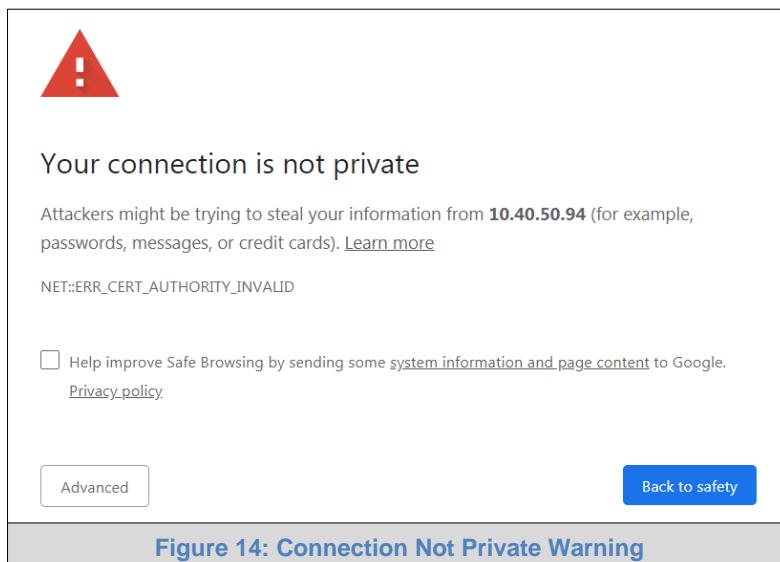
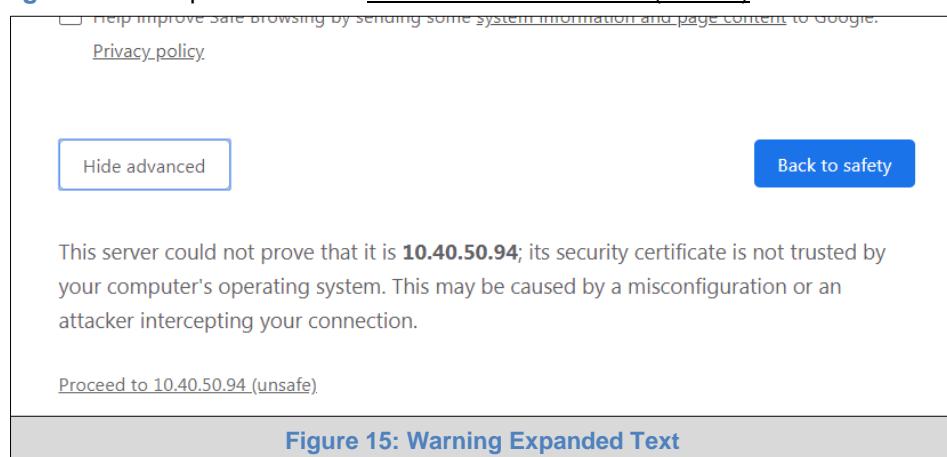
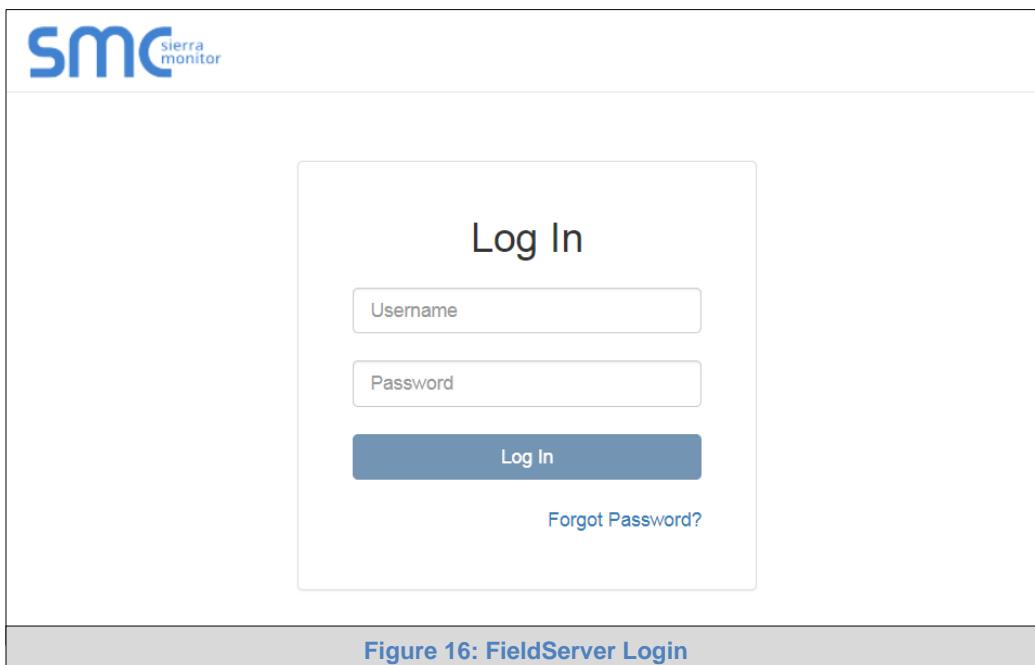


Figure 14: Connection Not Private Warning

- Additional text will expand below the warning, click the underlined text to go to the IP Address. In the **Figure 15** example this text is “[Proceed to 10.40.50.94 \(unsafe\)](#)”.



- When the login screen appears, put in the Username (default is “admin”) and the Password (found on the label of the FieldServer).



NOTE: A user has 5 attempts to login then there will be a 10-minute lockout. There is no timeout on the FieldServer to enter a password.

NOTE: To create individual user logins, go to [Appendix B.9](#).

6.2 Select the Security Mode

- On the first login to the FieldServer, the following screen will appear that allows the user to select which mode the FieldServer should use.

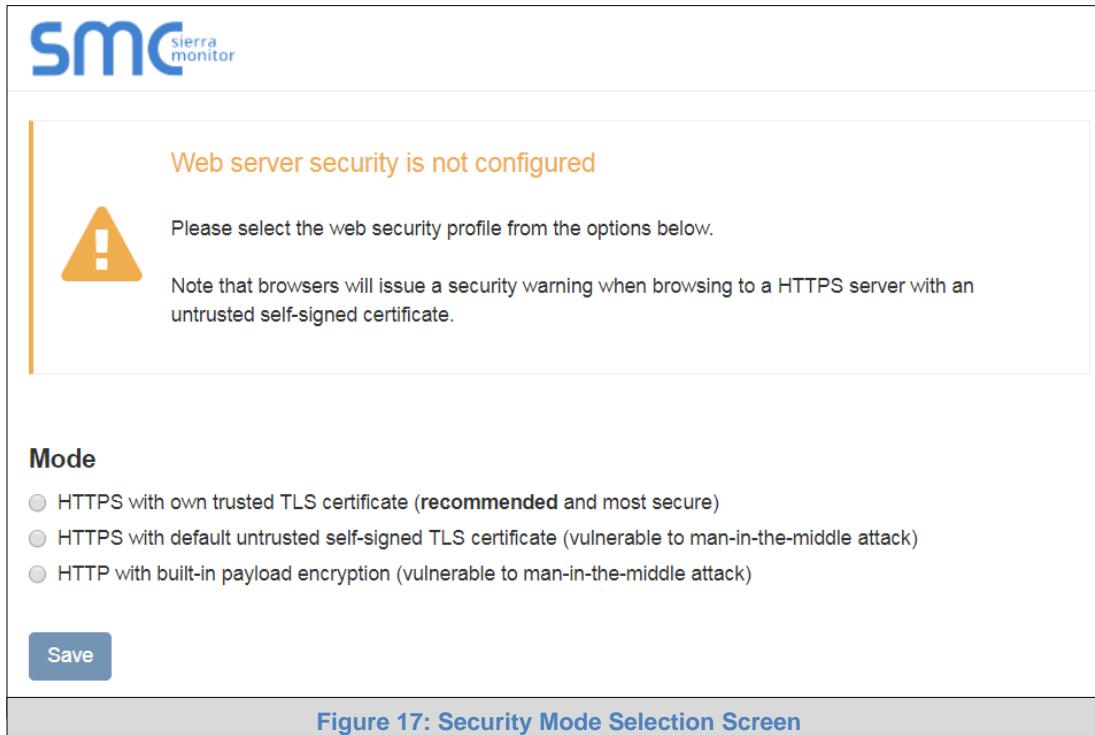


Figure 17: Security Mode Selection Screen

NOTE: Cookies are used for authentication.

NOTE: To change the web server security mode after initial setup, go to [Appendix B.8](#).

The sections that follow include instructions for assigning the different security modes.

6.2.1 HTTPS with Own Trusted TLS Certificate

This is the recommended selection and the most secure.

- Once this option is selected, the Certificate, Private Key and Private Key Passphrase fields will appear under the mode selection.

| |
|--|
| Mode |
| <input checked="" type="radio"/> HTTPS with own trusted TLS certificate (recommended and most secure) |
| <input type="radio"/> HTTPS with default untrusted self-signed TLS certificate (vulnerable to man-in-the-middle attack) |
| <input type="radio"/> HTTP with built-in payload encryption (vulnerable to man-in-the-middle attack) |
| Certificate |
| XzyMbQZFiRuJZJPe7CTHLcHOrHLowoUFoVTaBMYd4d6VGdNklKazByWKcNOL7mrXA4IBAQBFM+IPvOx3T/47VEmalXqE3bx3zEuBFJ6pWPlw7LHf2r2ZoHw+9xb+aNMUdVyAelhBMTMsni2ERyQVp0xj3psSv2EJyKXS1bQYNRLsq7UzpwuAdT/Wy3o6vUM5K+Cwf9qEoQ0LuxDZTIECt67MkcHMiuFi5pk7TRicHnQF/sfOAYOuluHQy9exlk9FmHFVDlZt/cJUaF+e74EuSph+gEr0lQo2wvmhyC7L22UXse1NoOfU2Zq0Eu1V/tuJRryaMWiRFEWuuzMGZtKFWC+8q2JQsVcgiRWM7naobllEhOCMH+sKHJMCxDoxGtvTzjZUoAL51YXxWSVcyZdGiAP5e-----END CERTIFICATE----- |
| Private Key |
| sHB0zZoHr4YQSDK2BbYVzzbl0LDuKtc8+JiO3ooGjoTuHngkeAj/fKfbTAsKeAzwgKQe+H5UQNk0bdvZfOJrm6daDK2vVDmR5k+iUUhEi5N49uplroB97MQqYotzqfT+THlbpq5t1SIK617k04ObKrmHF5l8fck+ru545sVmpeezh0m5j5SURYZMvbq5daCuJ4f5NlihbEvxRF4UK41ZDMCvujopcBKUWrba/3XXnDnM2K9xyZ2wze998D6Wk46+7aOFY9F+7j5ljmnkoS3GYtwCyH5iP+mPP1K6RnuiD019wvvGPb4dtN/RTnfd0eFGYeVSkl9fxkkxDOftdWRZbM/rPin4tmO1Xf8HqONVN1x/iaMynOXG4cukoi4+VOu0rZaUEsII2zNkfrn7FAASm5NBWg202C9lAYnuujs3aALI5uGBeeKA62oTMxlzx-----END RSA PRIVATE KEY----- |
| Private Key Passphrase |
| Specify if encrypted |
| Save |

Figure 18: Security Mode Selection Screen

- Copy and paste the Certificate and Private Key text into their respective fields. If the Private Key is encrypted type in the associated Passphrase.
- Click Save.
- A “Redirecting” message will appear and after a short period of time the FieldServer GUI will open.

6.2.2 HTTPS with Default Untrusted Self-Signed TLS Certificate or HTTP with Built-in Payload Encryption

- Simply select one of these options and click the Save button.
- A “Redirecting” message will appear and after a short period of time the FieldServer GUI will open.

7 CONFIGURE THE PROTONODE

7.1 Select Field Protocol and Set Configuration Parameters

- On the Web Configurator page, the first configuration parameter is the Protocol Selector.

The screenshot shows the 'Configuration Parameters' section of the Web Configurator. It lists several parameters with their descriptions and current values:

| Parameter Name | Parameter Description | Value |
|-----------------|---|-------|
| protocol_select | Protocol Selector Set to 1 for BACnet IP/Modbus TCP Set to 2 for BACnet MSTP Set to 3 for Metasys N2 | 2 |
| temp_units | Temperature Units This sets the units for the temperature. (Deg_F/Deg_C) | Deg_F |
| mod_baud_rate | Modbus RTU Baud Rate This sets the Modbus RTU baud rate. (9600/19200/38400/57600/115200) | 9600 |
| mod_parity | Modbus RTU Parity This sets the Modbus RTU parity. | None |

At the bottom of the page, there are several buttons: HELP (?), Network Settings, Clear Profiles and Restart, System Restart, Diagnostics & Debugging, and a 'Powered by FieldServer' logo.

Figure 19: Web Configurator Showing Protocol Selector Parameter

- Select the field protocol by entering the appropriate number into the Protocol Selector Value. Click the Submit button. Click the System Restart button to save the updated configuration.

NOTE: Protocol specific parameters are only visible when the associated protocol is selected.

NOTE: If Modbus TCP/IP was selected and is used for the field protocol, skip Section 7.2. Device profiles are NOT used for Modbus TCP/IP.

- Ensure that all parameters are entered for successful operation of the gateway. Find the legal value options for each parameter under the Parameter Description in parentheses.

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.

7.2 Setting ProtoNode Active Profiles

- In the Web Configurator, the Active Profiles are shown below the configuration parameters. The Active Profiles section lists the currently active device profiles, including previous Web Configurator additions. This list is empty for new installations, or after clearing all configurations. (**Figure 20**)

The screenshot shows the Lochinvar Web Configurator interface. At the top, there's a logo for 'Lochinvar HIGH EFFICIENCY BOILERS & WATER HEATERS'. Below it, the title 'Configuration Parameters' is displayed.

| Parameter Name | Parameter Description | Value | Action |
|-----------------|---|-------------|--------|
| protocol_select | Protocol Selector Set to 1 for BACnet IP/Modbus TCP Set to 2 for BACnet MSTP Set to 3 for Metasys N2 | 2 | Submit |
| temp_units | Temperature Units This sets the units for the temperature. (<i>Deg_F/Deg_C</i>) | Deg_F | Submit |
| mod_baud_rate | Modbus RTU Baud Rate This sets the Modbus RTU baud rate. (9600/19200/38400/57600/115200) | 9600 | Submit |
| mod_parity | Modbus RTU Parity This sets the Modbus RTU parity. (None/Even/Odd) | None | Submit |
| mod_data_bits | Modbus RTU Data Bits This sets the Modbus RTU data bits. (7 or 8) | 8 | Submit |
| mod_stop_bits | Modbus RTU Stop Bits This sets the Modbus RTU stop bits. (1 or 2) | 2 | Submit |
| network_nr | BACnet Network Number This sets the BACnet network number of the Gateway. (1 - 65535) | 50 | Submit |
| node_offset | BACnet Node Offset This is used to set the BACnet device instance. The device instance will be sum of the Modbus device address and the node offset. (0 - 4194303) | 50000 | Submit |
| bac_mac_addr | BACnet MSTP Mac Address This sets the BACnet MSTP MAC address. (1 - 127) | 127 | Submit |
| bac_baud_rate | BACnet MSTP Baud Rate This sets the BACnet MSTP baud rate. (9600/19200/38400/76800) | 38400 | Submit |
| bac_max_master | BACnet MSTP Max Master This sets the BACnet MSTP max master. (1 - 127) | 127 | Submit |
| bac_cov_option | BACnet COV This enables or disables COVs for the BACnet connection. Use COV_Enable to enable. Use COV_Disable to disable. (COV_Enable/COV_Disable) | COV_Disable | Submit |
| bac_virt_nodes | BACnet Virtual Server Nodes Set to NO if the unit is only converting 1 device to BACnet. Set to YES if the unit is converting multiple devices. (No/Yes) | No | Submit |

Active profiles

| Nr | Node ID | Current profile | Parameters |
|---|---------|-----------------|------------|
| | | Add | |
| HELP (?) Network Settings Clear Profiles and Restart System Restart Diagnostics & Debugging | | | |

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Figure 20: Web Configurator Showing no Active Profiles

- To add an active profile to support a device, click the Add button under the Active Profiles heading. This will present a profile drop-down menu underneath the Current profile column. ([Figure 21](#))



Figure 21: Web Configurator Active Profile Selection

- Once the Profile for the device has been selected from the drop-down list, enter the value of the device's Node-ID which was assigned in [Section 3.3.2](#).
- Then press the "Submit" button to add the Profile to the list of devices to be configured.
- Repeat this process until all the devices have been added.
- Completed additions are listed under "Active profiles" as shown in [Figure 22](#).

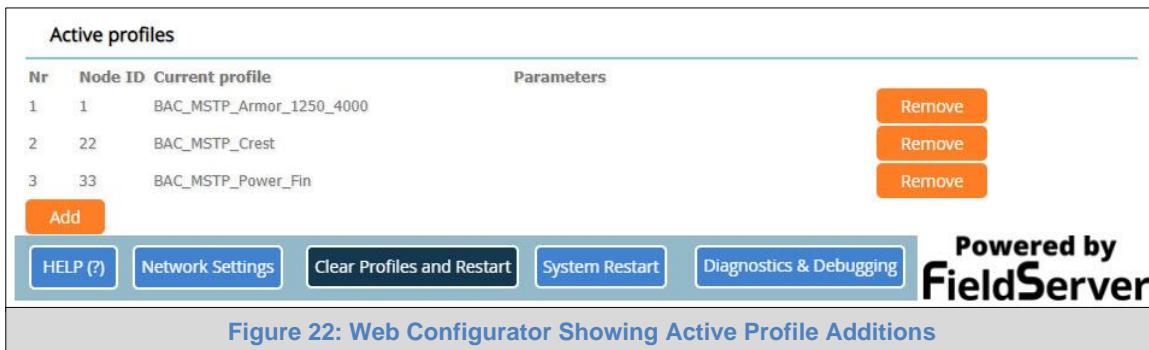


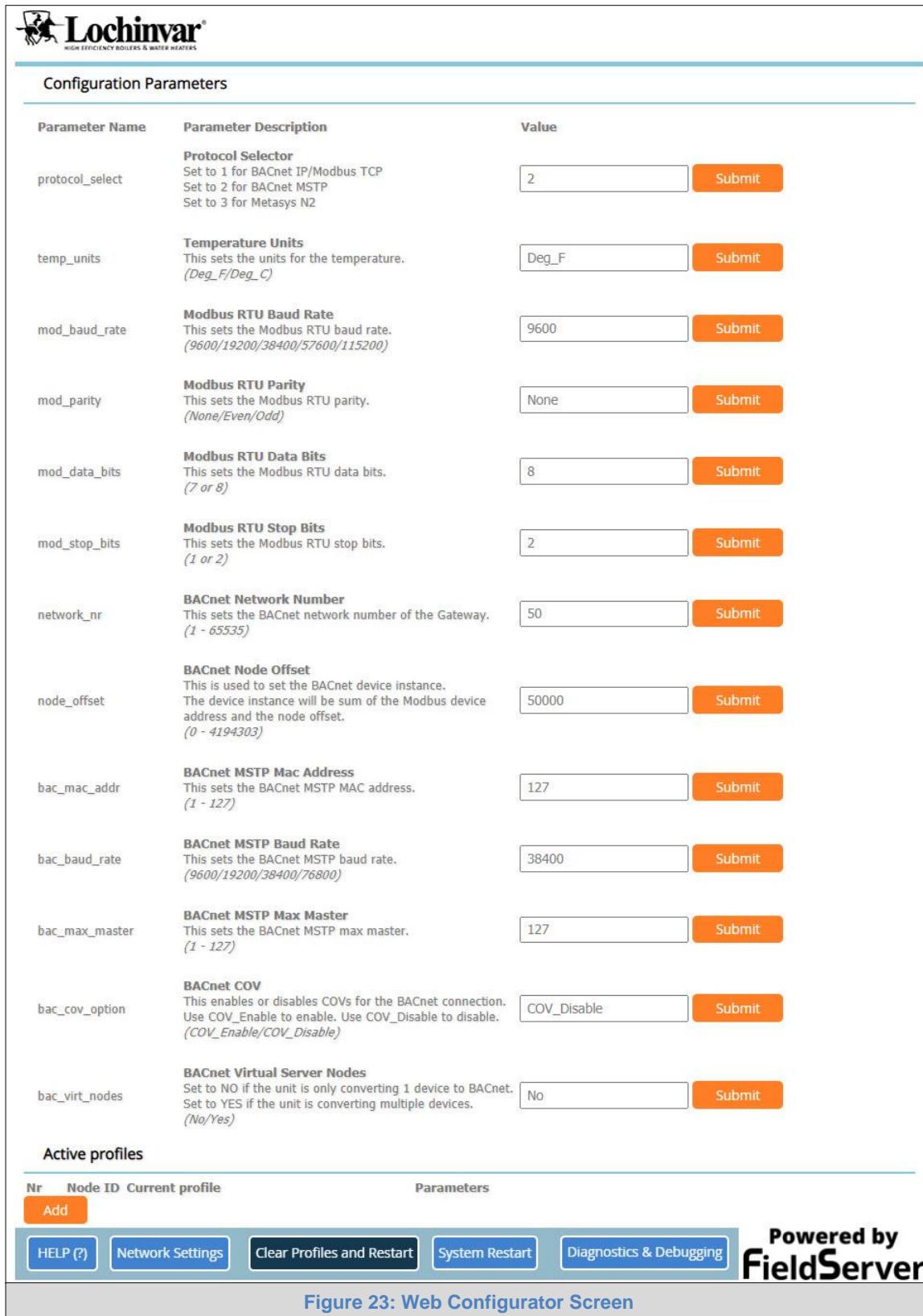
Figure 22: Web Configurator Showing Active Profile Additions

7.3 Verify Device Communications

- Check that the port R1 TX1 and RX1 LEDs are rapidly flashing.** See [Appendix A.4](#) for additional LED information and images.
- Confirm the software shows good communications without errors ([Appendix A.2](#)).

7.4 Ethernet Network: Setting IP Address for the Field Network

- Follow the steps outlined in **Section 6** to access the ProtoNode Web Configurator.
- To access the FS-GUI, click on the “Diagnostics & Debugging” button.



The screenshot shows the configuration parameters for the Lochinvar ProtoNode. The interface includes a header with the Lochinvar logo and navigation links for Configuration Parameters, Active profiles, Help, Network Settings, Clear Profiles and Restart, System Restart, and Diagnostics & Debugging. The main area displays a table of configuration parameters with their descriptions and current values.

| Parameter Name | Parameter Description | Value | Action | | | | | | | | | | |
|---|---|----------------------------|----------------|-------------------------|------------|--|--|--|----------|------------------|----------------------------|----------------|-------------------------|
| protocol_select | Protocol Selector Set to 1 for BACnet IP/Modbus TCP Set to 2 for BACnet MSTP Set to 3 for Metasys N2 | 2 | Submit | | | | | | | | | | |
| temp_units | Temperature Units This sets the units for the temperature. (<i>Deg_F/Deg_C</i>) | Deg_F | Submit | | | | | | | | | | |
| mod_baud_rate | Modbus RTU Baud Rate This sets the Modbus RTU baud rate. (9600/19200/38400/57600/115200) | 9600 | Submit | | | | | | | | | | |
| mod_parity | Modbus RTU Parity This sets the Modbus RTU parity. (<i>None/Even/Odd</i>) | None | Submit | | | | | | | | | | |
| mod_data_bits | Modbus RTU Data Bits This sets the Modbus RTU data bits. (<i>7 or 8</i>) | 8 | Submit | | | | | | | | | | |
| mod_stop_bits | Modbus RTU Stop Bits This sets the Modbus RTU stop bits. (<i>1 or 2</i>) | 2 | Submit | | | | | | | | | | |
| network_nr | BACnet Network Number This sets the BACnet network number of the Gateway. (<i>1 - 65535</i>) | 50 | Submit | | | | | | | | | | |
| node_offset | BACnet Node Offset This is used to set the BACnet device instance. The device instance will be sum of the Modbus device address and the node offset. (<i>0 - 4194303</i>) | 50000 | Submit | | | | | | | | | | |
| bac_mac_addr | BACnet MSTP Mac Address This sets the BACnet MSTP MAC address. (<i>1 - 127</i>) | 127 | Submit | | | | | | | | | | |
| bac_baud_rate | BACnet MSTP Baud Rate This sets the BACnet MSTP baud rate. (9600/19200/38400/76800) | 38400 | Submit | | | | | | | | | | |
| bac_max_master | BACnet MSTP Max Master This sets the BACnet MSTP max master. (<i>1 - 127</i>) | 127 | Submit | | | | | | | | | | |
| bac_cov_option | BACnet COV This enables or disables COVs for the BACnet connection. Use COV_Enable to enable. Use COV_Disable to disable. (<i>COV_Enable/COV_Disable</i>) | COV_Disable | Submit | | | | | | | | | | |
| bac_virt_nodes | BACnet Virtual Server Nodes Set to NO if the unit is only converting 1 device to BACnet. Set to YES if the unit is converting multiple devices. (<i>No/Yes</i>) | No | Submit | | | | | | | | | | |
| Active profiles | | | | | | | | | | | | | |
| Nr | Node ID | Current profile | Parameters | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Add</th> <th colspan="4">Parameters</th> </tr> </thead> <tbody> <tr> <td>HELP (?)</td> <td>Network Settings</td> <td>Clear Profiles and Restart</td> <td>System Restart</td> <td>Diagnostics & Debugging</td> </tr> </tbody> </table> | | | | Add | Parameters | | | | HELP (?) | Network Settings | Clear Profiles and Restart | System Restart | Diagnostics & Debugging |
| Add | Parameters | | | | | | | | | | | | |
| HELP (?) | Network Settings | Clear Profiles and Restart | System Restart | Diagnostics & Debugging | | | | | | | | | |

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Figure 23: Web Configurator Screen

- From the FS-GUI landing page, click on “Setup” to expand the navigation tree and then select “Network Settings” to access the IP Settings menu. ([Figure 24](#))

The screenshot shows the FS-GUI interface for the Lochinvar ProtoNode. The left sidebar has a navigation tree with sections like CN1998 Lochinvar v5.00a, Setup, View, User Messages, and Diagnostics. The 'Network Settings' option under Setup is highlighted. The main content area is titled 'Network Settings' and has a sub-tab 'IP Settings' selected. A note at the top states: 'Updated settings will take effect immediately. If the IP Address is changed you will need to direct your browser to the new IP Address.' Below this are two tables. The first table contains IP configuration fields:

| | |
|----------------------|---------------|
| N1 IP Address | 10.40.50.90 |
| N1 Netmask | 255.255.255.0 |
| N1 DHCP Client State | [DISABLED ▾] |
| Default Gateway | 10.40.50.1 |
| Domain Name Server1 | 10.5.4.226 |
| Domain Name Server2 | 10.5.4.227 |

Buttons for 'Cancel' and 'Update IP Settings' are at the bottom of this section.

The second table shows connection status metrics:

| | |
|--------------------------|-------------------|
| Connection Status | Connected |
| Ethernet MAC Address | 00:50:4E:60:06:3C |
| Ethernet Tx Msgs | 5527201 |
| Ethernet Rx Msgs | 33007046 |
| Ethernet Tx Msgs Dropped | 0 |
| Ethernet Rx Msgs Dropped | 0 |

At the bottom of the page are buttons for 'Home', 'HELP (F1)', 'Contact Us', 'System Restart', 'Logout', and 'Powered by FieldServer'.

[Figure 24: Changing IP Address via FS-GUI](#)

- Modify the IP Address (N1 IP Address field) of the ProtoNode Ethernet port.
- If necessary, change the Netmask (N1 Netmask field).
- If necessary, change the IP Gateway (Default Gateway field).

NOTE: If the ProtoNode is connected to a managed switch/router, the IP Gateway of the ProtoNode should be set to the IP Address of that managed switch/router.

- Click the “System Restart” button at the bottom of the page to apply changes and restart the ProtoNode.
- Unplug Ethernet cable from PC and connect it to the network switch or router.
- Record the IP Address assigned to the ProtoNode for future reference.

NOTE: The SMC Cloud button  (see [Figure 24](#)) allows users to connect to the SMC Cloud, MSA Safety's device cloud solution for IIoT. The SMC Cloud enables secure remote connection to field devices through a FieldServer and its local applications for configuration, management, maintenance. For more information about the SMC Cloud, refer to the [SMC Cloud Start-up Guide](#).

7.5 BACnet: Setting Node_Offset to Assign Specific Device Instances

- Follow the steps outlined in [Section 6](#) to access the ProtoNode Web Configurator.
- Node_Offset field shows the current value (default = 50,000).
 - 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 as needed using the calculation below:

$$\text{Device Instance (desired)} = \text{Node_Offset} + \text{Node_ID}$$

For example, if the desired Device Instance for the device 1 is 50,001 and the following is true:

- Device 1 has a Node-ID of 1
- Device 2 has a Node-ID of 22
- Device 3 has a Node-ID of 33

Then plug the device 1's information into the formula to find the desired Node_Offset:

$$50,001 = \text{Node_Offset} + 1$$

➤ **50,000 = Node_Offset**

Once the Node_Offset value is input, it will be applied as shown below:

- Device 1 Instance = 50,000 + Node_ID = 50,000 + 1 = 50,001
- Device 2 Instance = 50,000 + Node_ID = 50,000 + 22 = 50,022
- Device 3 Instance = 50,000 + Node_ID = 50,000 + 33 = 50,033

- Click "Submit" once the desired value is entered.

| | |
|---|--|
| BACnet Node Offset This is used to set the BACnet device instance. The device instance will be sum of the node id and the node offset. (0 - 4194303) | |
| node_offset | <input type="text" value="50000"/> Submit |

Figure 25: Web Configurator Node Offset Field

| Active profiles | | | Parameters |
|-----------------|---------|--------------------------|---------------|
| Nr | Node ID | Current profile | |
| 1 | 1 | BAC_MSTP_Armor_1250_4000 | Remove |
| 2 | 22 | BAC_MSTP_Crest | Remove |
| 3 | 33 | BAC_MSTP_Power_Fin | Remove |

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Figure 26: Active Profiles

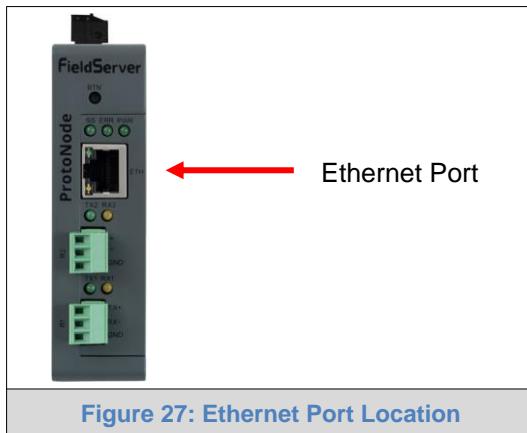
7.6 How to Start the Installation Over: Clearing Profiles

- Follow the steps outlined in **Section 6** to access the ProtoNode Web Configurator.
- 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.

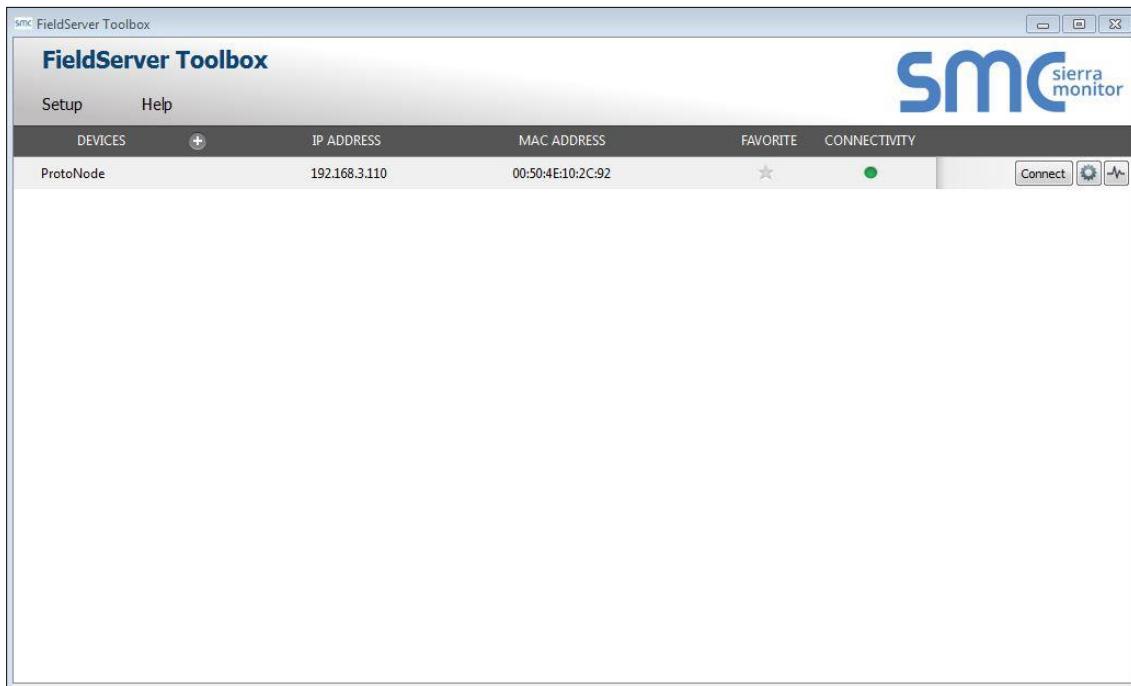
Appendix A Troubleshooting

Appendix A.1 Lost or Incorrect IP Address

- Ensure that FieldServer Toolbox is loaded onto the local PC. Otherwise, download the FieldServer-Toolbox.zip via the Sierra Monitor website's [Software Downloads](#).
- Extract the executable file and complete the installation.



- Connect a standard Cat-5 Ethernet cable between the user's PC and ProtoNode.
- Double click on the FS Toolbox Utility and click Discover Now on the splash page.
- Check for the IP Address of the desired gateway.



- If correcting the IP Address of the gateway: click the settings icon on the same row as the gateway, then click Network Settings, change the IP Address and click Update IP Settings to save.

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 Button, then click on view, and then on connections.
- If there are any errors showing on the Connections page, refer to [Appendix A.3](#) to check the wiring and settings.

The screenshot shows the 'Connections' page of the Lochinvar ProtoNode web interface. The left sidebar has a 'Navigation' section with links for CN1998 Lochinvar v5.00a (About, Setup, View), View (Connections, Data Arrays, Nodes, Map Descriptors, User Messages, Diagnostics), and Diagnostics. The main area is titled 'Connections' and contains a table with two rows of connection statistics. The table columns are Index, Name, Tx Msg, Rx Msg, Tx Char, Rx Char, and Errors. The data is as follows:

| Index | Name | Tx Msg | Rx Msg | Tx Char | Rx Char | Errors |
|-------|------------------|--------|--------|---------|---------|--------|
| 0 | R1 - MODBUS_RTU | 0 | 0 | 0 | 0 | 0 |
| 1 | R2 - BACnet_MSTP | 0 | 0 | 0 | 0 | 0 |

At the bottom, there are links for Home, HELP (F1), Contact Us, Reset Statistics, Logout, and a 'Powered by FieldServer' logo.

Figure 28: Error Messages Screen

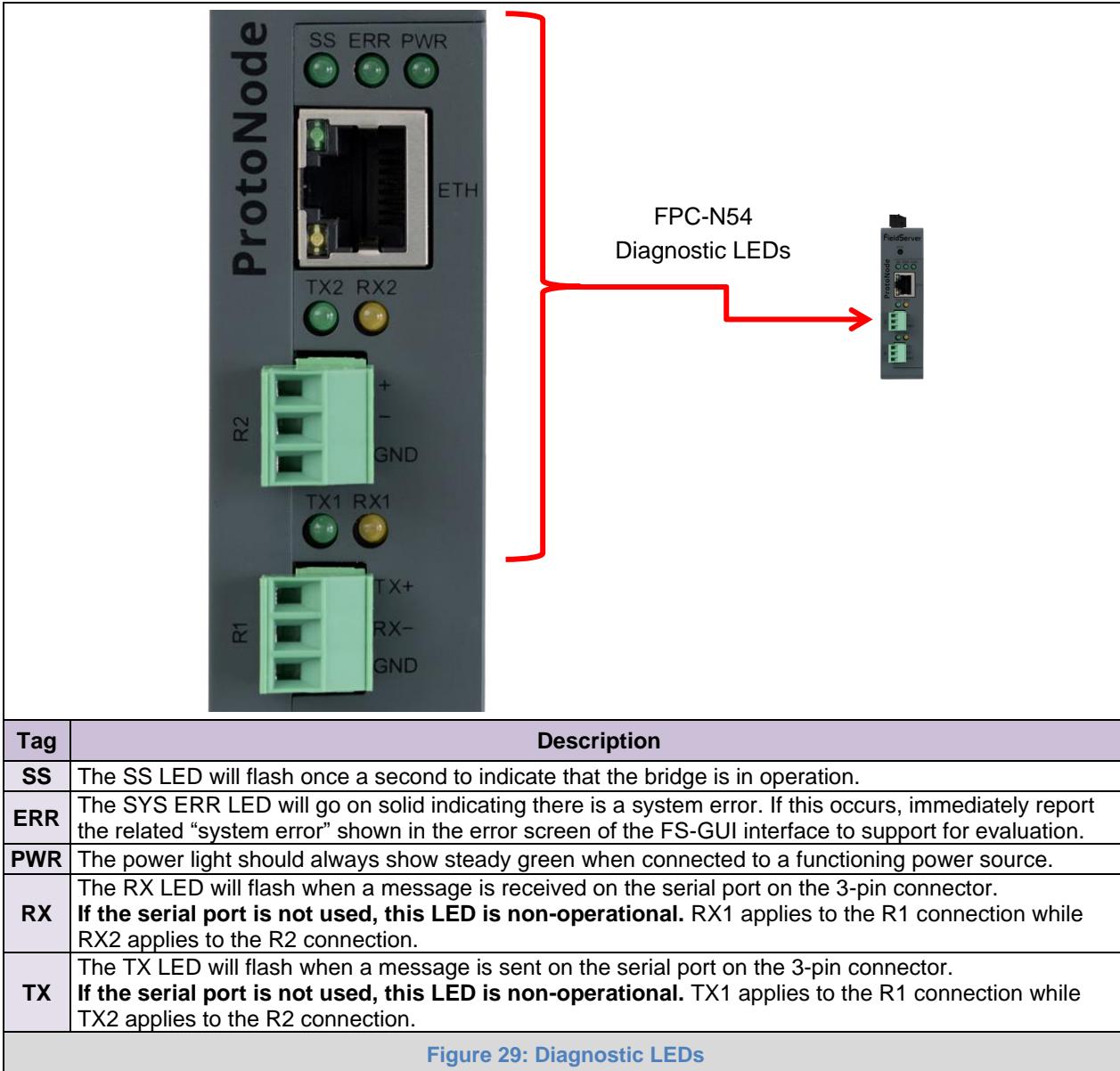
Appendix A.3 Checking Wiring and Settings

- No COMS on Modbus RTU side. If the Tx/Rx LEDs are not flashing rapidly then there is a COM issue. To fix this, check the following:
 - Visual observations of LEDs on ProtoNode ([Appendix A.4](#))
 - Check baud rate, parity, data bits, stop bits
 - Check Detector ID matches the correct device
 - Verify wiring
 - Verify the device was listed under the Web Configurator Active Profiles ([Section 7.2](#))
- Field COM problems:
 - Visual observations of LEDs on the ProtoNode ([Appendix A.4](#))
 - 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.5](#))

Appendix A.4 LED Diagnostics for Communications Between ProtoNode and Devices

See the diagram below for ProtoNode FPC-N54 LED Locations.



Appendix A.5 Take a FieldServer Diagnostic Capture

When there is a problem on-site that cannot easily be resolved, perform a diagnostic capture before contacting support so that support can quickly solve the problem. There are two methods for taking diagnostic captures:

- **FieldServer Toolbox:**

This method requires installation of the FS Toolbox program. A FS Toolbox diagnostic capture takes a snapshot of the loaded configuration files and a log of all the communications on the serial ports over a specified period of time. If the problem occurs over an Ethernet connection, then take a Wire Shark capture.

- **Gateway's FS-GUI Page:**

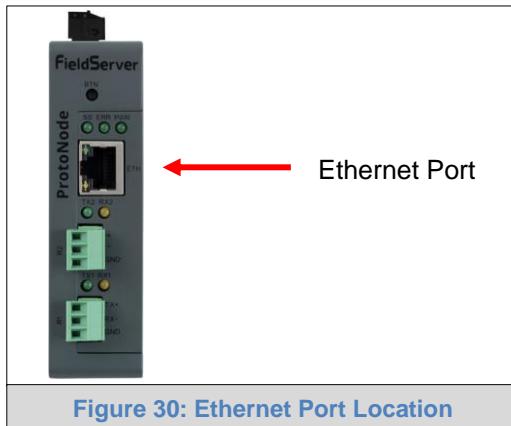
This method doesn't require downloading software. The diagnostic capture utilities are embedded in the FS-GUI web interface. Starting a diagnostic capture takes a snapshot of the loaded configuration files and a log of all the communications over a specified period of time. This works for both serial and Ethernet connections.

NOTE: The information in the zipped files contains everything support needs to quickly resolve problems that occur on-site.

Appendix A.5.1 Using the FieldServer Toolbox

Once the Diagnostic Capture is complete, email it to technical support. The Diagnostic Capture will accelerate diagnosis of the problem.

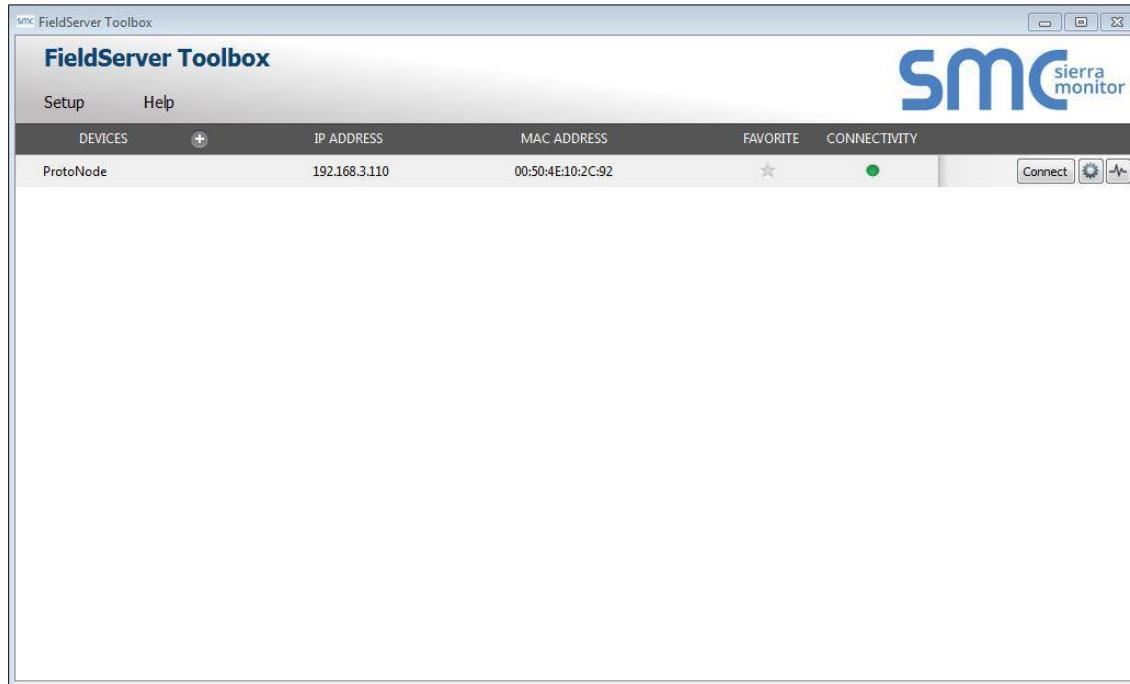
- Ensure that FieldServer Toolbox is loaded onto the local PC. Otherwise, download the FieldServer-Toolbox.zip via the Sierra Monitor website's [Software Downloads](#).
- Extract the executable file and complete the installation.



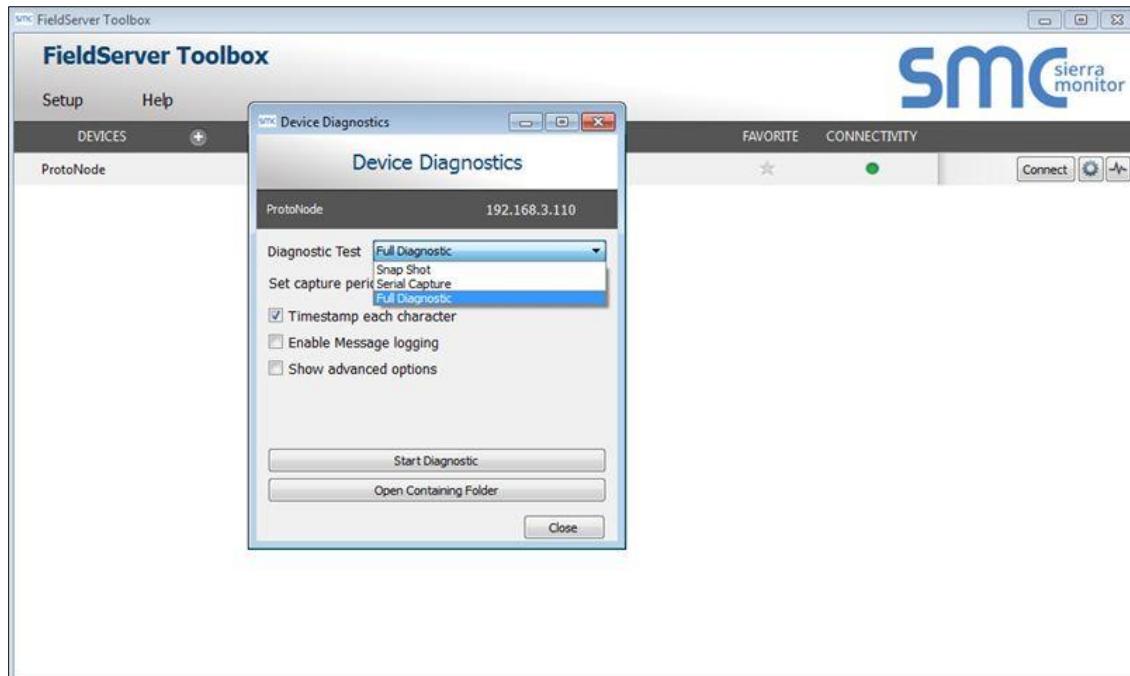
- Connect a standard Cat-5 Ethernet cable between the PC and ProtoNode.
- Double click on the FS Toolbox Utility.

- **Step 1:** Take a Log

- Click on the diagnose icon  of the desired device

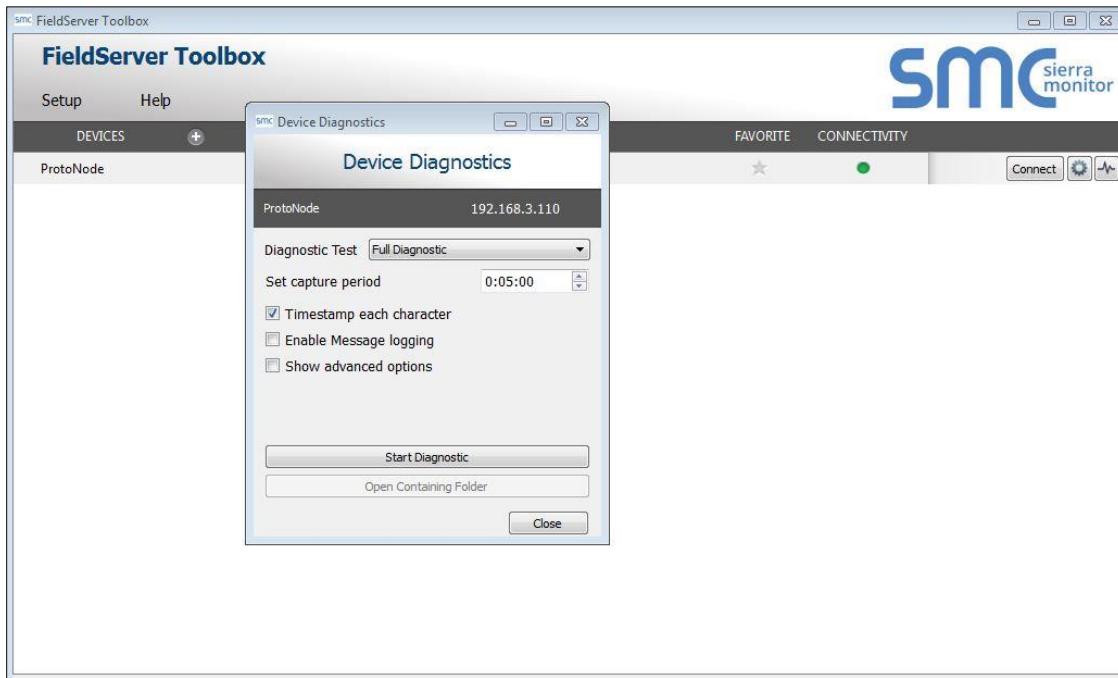


- Ensure “Full Diagnostic” is selected (this is the default)

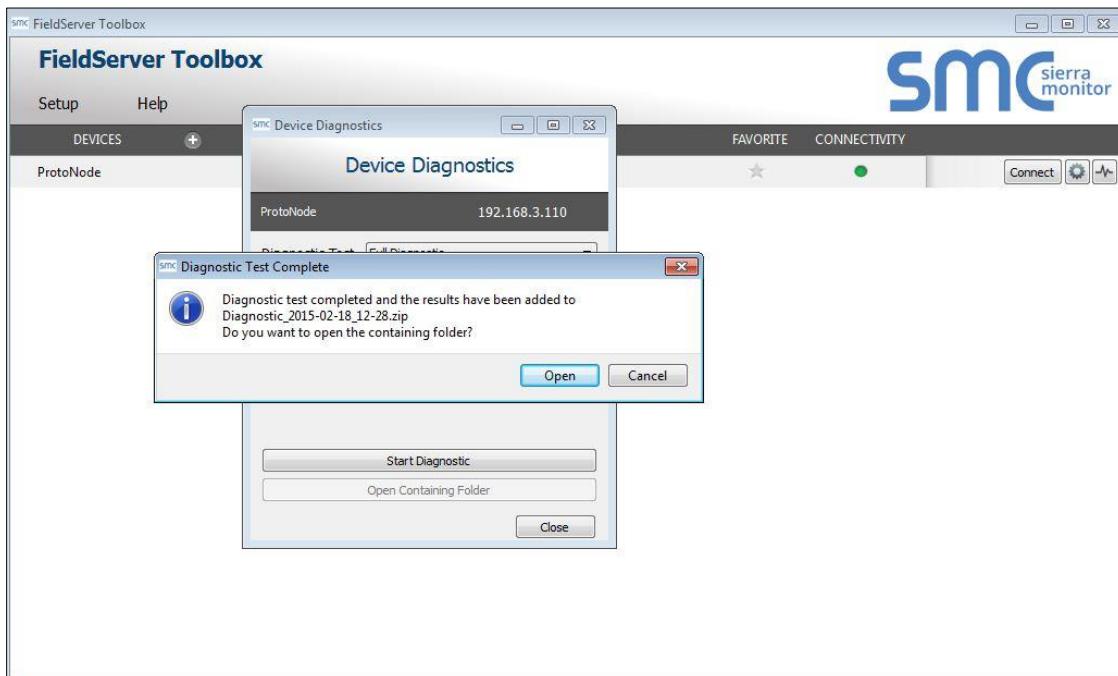


NOTE: If desired, the default capture period can be changed.

- 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 is saved on the PC



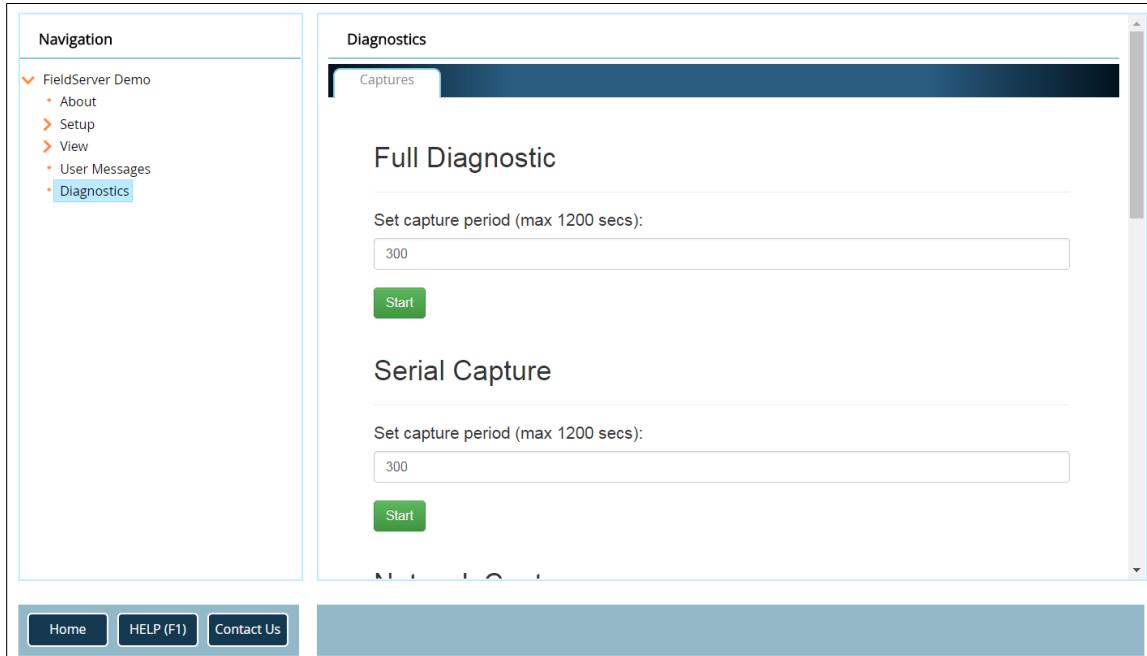
- Choose “Open” to launch explorer and have it point directly at the correct folder
- Email the diagnostic zip file to technical support.

| | | | |
|---------------------------------|------------------|-------------|--------|
| Diagnostic_2014-07-17_20-15.zip | 2014/07/17 20:16 | zip Archive | 676 KB |
|---------------------------------|------------------|-------------|--------|

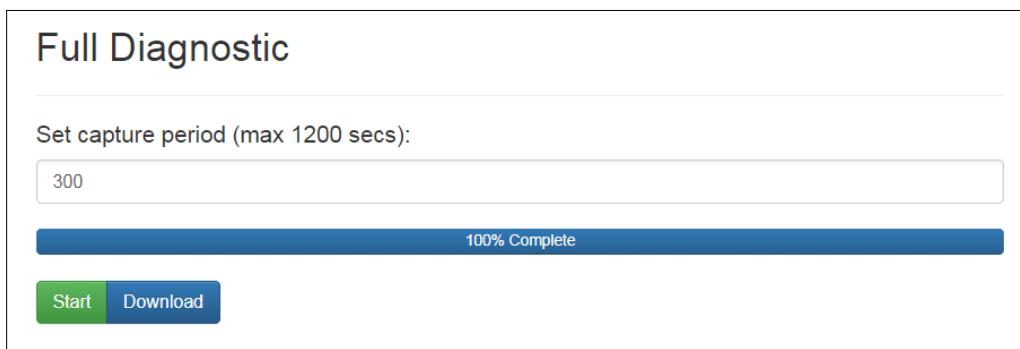
Appendix A.5.2 Using FS-GUI

Completing a Diagnostic Capture through the FieldServer allows network connections (such as Ethernet and Wi-Fi) to be captured. **Once the Diagnostic Capture is complete, email it to technical support. The Diagnostic Capture will accelerate diagnosis of the problem.**

- Open the FieldServer FS-GUI page.
- Click on Diagnostics in the Navigation panel.



- Go to Full Diagnostic and select the capture period.
- Click the Start button under the Full Diagnostic heading to start the capture.
 - When the capture period is finished, a Download button will appear next to the Start button



- Click Download for the capture to be downloaded to the local PC.
- Email the diagnostic zip file to technical support.

NOTE: Diagnostic captures of BACnet MS/TP communication are output in a “.PCAP” file extension which is compatible with Wireshark.

Appendix B Additional Information

Appendix B.1 Updating 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.
 - o Default IP Address is 192.168.1.24
 - o Use the FS Toolbox utility if the IP Address is unknown ([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 “General” tab
5. In the General tab, click on “Choose Files” and select the web.img 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 B.2 BACnet: Setting Network_Number for More Than One ProtoNode on the 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 BACnet Network Number field and click submit. The default value is 50.

| | | | |
|---|--|---------------------------------|---------------|
| network_nr | BACnet Network Number This sets the BACnet network number of the Gateway. (1 - 65535) | <input type="text" value="50"/> | Submit |
| Figure 31: Web Configurator – Network Number Field | | | |

Appendix B.3 Securing ProtoNode with Passwords

Access to the ProtoNode can be restricted by enabling a password on the FS-GUI Passwords page – click Setup and then Passwords in the navigation panel. 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 technical support to receive a temporary password from the customer support team. Access the ProtoNode to set a new password.

The screenshot shows the FS-GUI interface. On the left, there is a navigation sidebar with sections like 'ProtoNode Demo', 'Setup' (which is expanded to show 'File Transfer', 'Network Settings', 'Passwords', and 'Time Settings'), 'View', and 'User Messages'. The main content area is titled 'Passwords' and contains a 'Note' section which states: 'The current Admin password (if set) is required to change all passwords. To disable password protection, set an empty Admin password. IMPORTANT: You may be required to log in again after changing a password.' Below the note is a form with fields for 'Account Name' (set to 'Admin'), 'Current Admin Password', 'New Password', and 'Confirm New Password'. At the bottom of the form are 'Cancel' and 'Update Password' buttons. At the very bottom of the page are links for 'Home', 'HELP (F1)', and 'Contact Us'.

Figure 32: FS-GUI Passwords Page

The screenshot shows a 'Unauthorized' page. It features the SMC logo at the top. The main heading is 'Unauthorized'. Below it, text reads: 'If you are the authorized administrator of this device and need to recover password access, you may contact support@sierramonitor.com and send them the Password Recovery Token shown below.' Further down, it says: 'You will be given a recovery password to enable you to log in as Admin and create a new password.' A bolded 'Password Recovery Token: zMtvwSDf4A==' is displayed. At the bottom, there are two links: 'LOGIN' and 'www.sierramonitor.com'.

Figure 33: Password Recovery Page

Appendix B.4 Factory Reset Instructions

For instructions on how to reset a FieldServer back to its factory released state, see [ENOTE - FieldServer Next Gen Recovery](#).

Appendix B.5 Internet Browser Software Support

The following web browsers are supported:

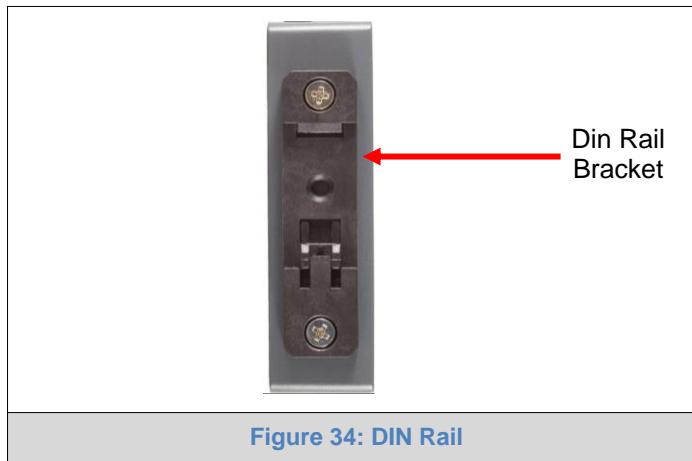
- Chrome Rev. 57 and higher
- Firefox Rev. 35 and higher
- Microsoft Edge Rev. 41 and higher
- Safari Rev. 3 and higher

NOTE: Internet Explorer is no longer supported as recommended by Microsoft.

NOTE: Computer and network firewalls must be opened for Port 80 to allow FieldServer GUI to function.

Appendix B.6 Mounting

The ProtoNode can be mounted using the DIN rail mounting bracket on the back of the unit.



Appendix B.7 Physical Dimension Drawing

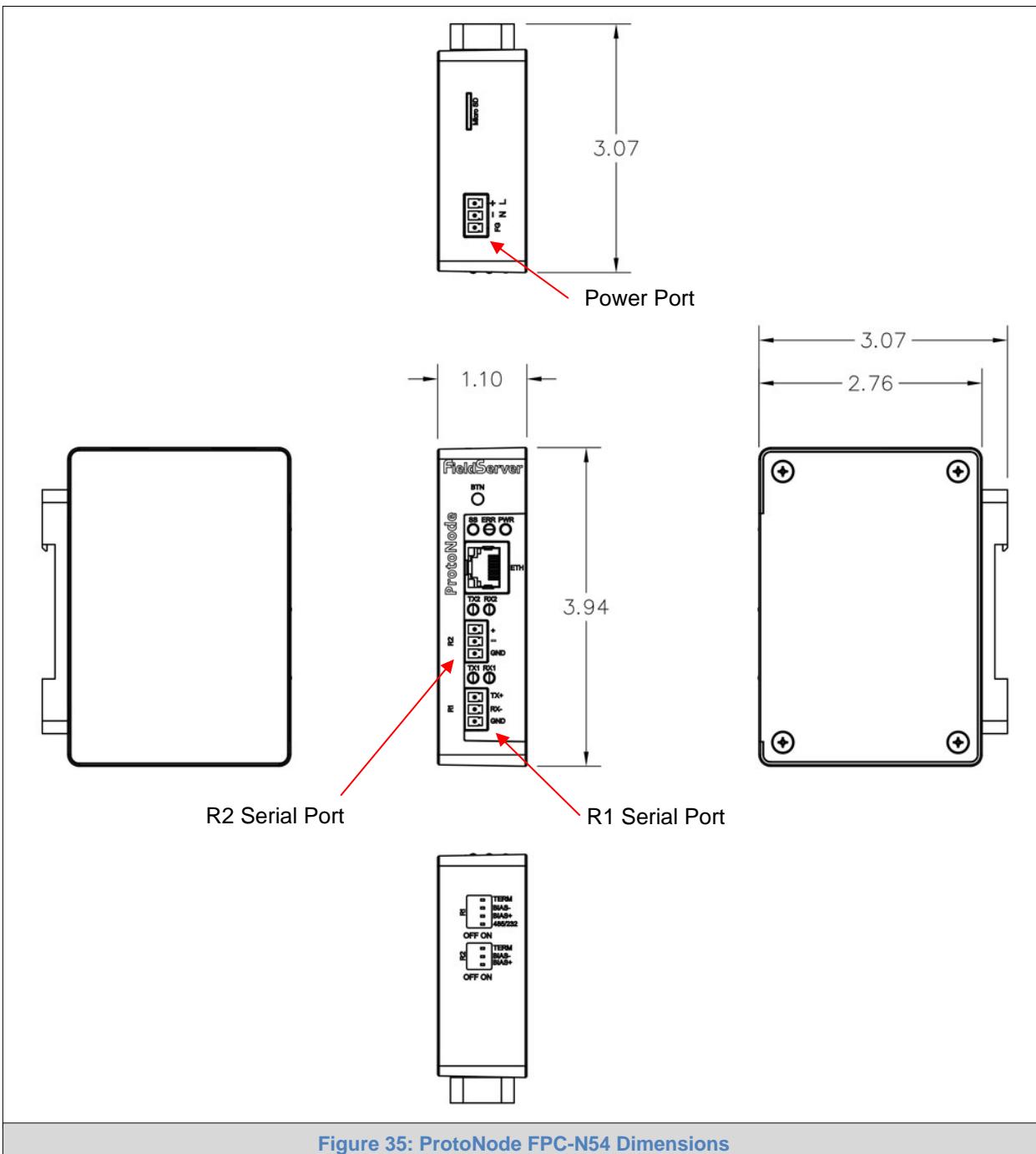


Figure 35: ProtoNode FPC-N54 Dimensions

Appendix B.8 Change Web Server Security Settings After Initial Setup

- Type the IP Address of the ProtoCessor into the web browser or use the FieldServer Toolbox to connect to the ProtoCessor, then login to the FieldServer.
- Click on the Diagnostics tab at the top of the screen, then click on View in the navigation panel, and then on Connections.
- Click Setup in the Navigation panel.

The screenshot shows the FS-GUI landing screen. At the top left is the SMC logo. At the top right is a blue button labeled "SMC cloud". The main area has a title "Test Bridge 1" above a table. The table has three columns: "Name" and "Value". Below the table are several buttons: "Home", "HELP (F1)", "Contact Us", "System Restart", "System Reboot", "System Time Synch", "Reset Cycle Times", and "Logout".

| Name | Value |
|-----------------------------|---------------------------|
| Driver_Configuration | DCC000 |
| DCC_Version | V6.05p (A) |
| Kernel_Version | V6.51c (B) |
| Release_Status | Normal |
| Build_Revision | 4.43.6-45-gcd82a452bb |
| Build_Date | 2019-11-28 14:05:21 +0200 |
| Platform_Name | ProtoAir_2RS485_ARMv7 |
| BIOS_Version | 4.1.2 |
| FieldServer_Model | FS-QS-2010-F |
| Serial_Number | 1902300071VZL |
| Carrier Type | - |
| Data_Points_Used | 0 |
| Data_Points_Max | 250 |
| Application Memory: | |
| Protocol_Engine_Memory_Used | 0.31% |
| Memory_Used | 440 kB |
| Memory_Available | 141,433 kB |
| Memory_Free_Bytes | 141,433 kB |
| Memory_Min_Free_Bytes | 140,526 kB |

Figure 36: FS-GUI Landing Screen

Appendix B.8.1 Change Security Mode

- Click Security in the Navigation panel.

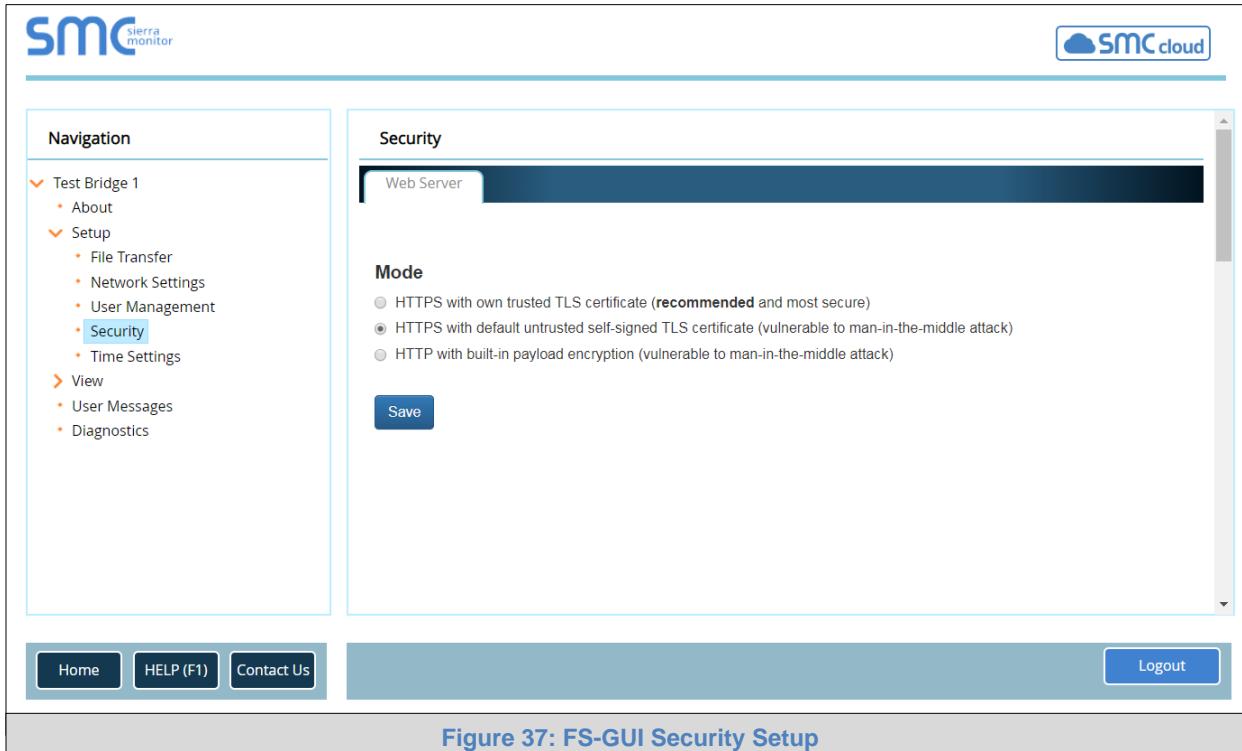


Figure 37: FS-GUI Security Setup

- Click the Mode desired.
 - If changing the security mode to HTTPS with own trusted TLS certificate, follow instructions in **Section 6.2.1**.
- Click the Save button.

Appendix B.8.2 Edit the Certificate Loaded onto the FieldServer

NOTE: A loaded certificate will only be available if the security mode was previously setup as HTTPS with own trusted TLS certificate.

- Click Security in the Navigation panel.

The screenshot shows the SMC FS-GUI interface. In the top right corner, there is a 'SMC cloud' logo. On the left, a navigation sidebar titled 'Navigation' contains items like 'Test Bridge 1', 'Setup' (which is expanded to show 'File Transfer', 'Network Settings', 'User Management', 'Security' which is selected and highlighted in blue, and 'Time Settings'), 'View', 'User Messages', and 'Diagnostics'. The main content area is titled 'Security' and has a sub-section 'Web Server'. Below this, under 'Mode', there are three radio button options: 'HTTPS with own trusted TLS certificate (recommended and most secure)' (selected), 'HTTPS with default untrusted self-signed TLS certificate (vulnerable to man-in-the-middle attack)', and 'HTTP with built-in payload encryption (vulnerable to man-in-the-middle attack)'. Under 'Certificate Loaded', it shows certificate details: Issuer: Internet Widgits Pty Ltd, Subject: Internet Widgits Pty Ltd, Valid From: 2019-11-25T13:52:29.000Z, and Valid To: 2019-12-25T13:52:29.000Z. There are 'Edit Certificate' and 'Save' buttons. At the bottom of the page, there are links for 'Home', 'HELP (F1)', 'Contact Us', and 'Logout'.

Figure 38: FS-GUI Security Setup – Certificate Loaded

- Click the Edit Certificate button to open the certificate and key fields.
- Edit the loaded certificate or key text as needed.
- Click Save.

Appendix B.9 Create and Manage Individual Users

- Type the IP Address of the ProtoCessor into the web browser or use the FieldServer Toolbox to connect to the ProtoCessor, then login to the FieldServer.
- Click on the Diagnostics tab at the top of the screen, then click on View in the navigation panel, and then on Connections.
- Click Setup in the Navigation panel.
- Click User Management in the navigation panel.
- Check that the Users tab is selected.

The screenshot shows the FS-GUI User Management interface. At the top left is the SMC logo. At the top right is a 'SMC cloud' icon. The main area has a 'User Management' title. Below it is a navigation bar with 'Users' and 'Password' tabs, where 'Users' is selected. A table header row contains 'Username', 'Groups', and 'Actions'. At the bottom of the table area is a 'Create User' button. On the left, a 'Navigation' sidebar lists 'Test Bridge 1' (with 'About'), 'Setup' (with 'File Transfer', 'Network Settings', 'User Management' which is selected and highlighted in blue), 'View' (with 'User Messages', 'Diagnostics'). The bottom of the page features a footer with 'Home', 'HELP (F1)', 'Contact Us', and 'Logout' buttons.

Figure 39: FS-GUI User Management

User Types:

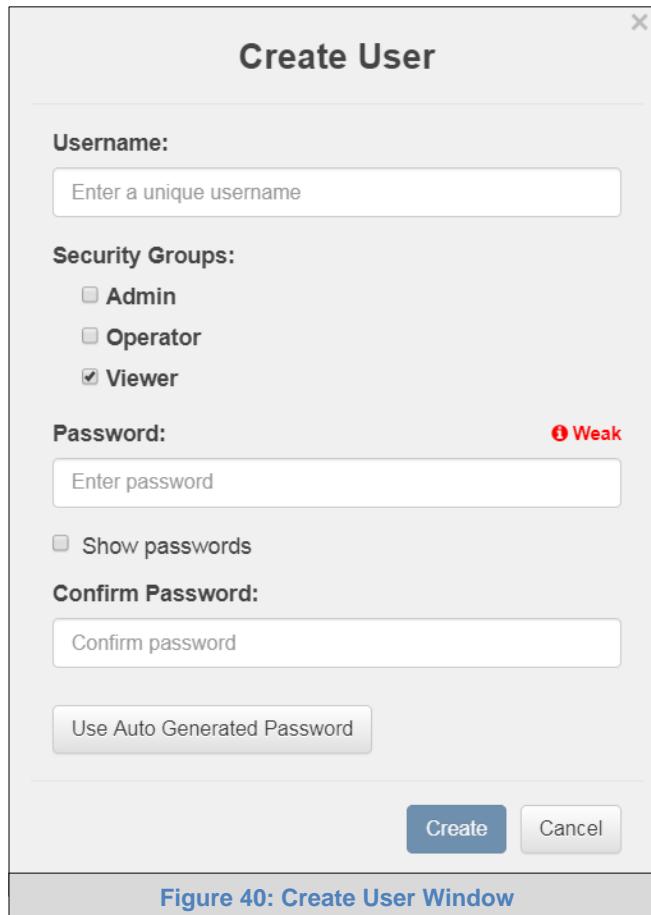
Admin – Can modify and view any settings on the FieldServer.

Operator – Can only make changes to the writable device points on the FieldServer.

Viewer – Can only view settings/readings on the FieldServer.

Appendix B.9.1 Create Users

- Click the Create User button.



- Enter the new User fields: Name, Security Group and Password.
 - User details are hashed and salted.

NOTE: Passwords must be at least 10 characters long. An algorithm automatically checks the password entered and notes the level of strength on the top right of the Password text field.

- Click the Create button.
- Once the Success message appears, click OK.

Appendix B.9.2 Edit Users

- Click the pencil icon next to the desired user to open the User Edit window.

The screenshot shows a 'User Management' interface with a 'Users' tab selected. There are two entries in the table:

| Username | Groups | Actions |
|----------|-------------------------|---------|
| User A | Viewer | |
| User B | Admin, Operator, Viewer | |

A 'Create User' button is located at the bottom left of the table area.

Figure 41: Setup Users

- Once the User Edit window opens, change the User Security Group and Password as needed.

The screenshot shows the 'Edit User' dialog for 'User A'. The fields are as follows:

- Username:** User A
- Security Groups:**
 - Admin
 - Operator
 - Viewer
- Password:** Optional
- Confirm Password:** Optional
- Buttons:** Confirm, Cancel, Use Auto Generated Password

Figure 42: Edit User Window

- Click Confirm.
- Once the Success message appears, click OK.

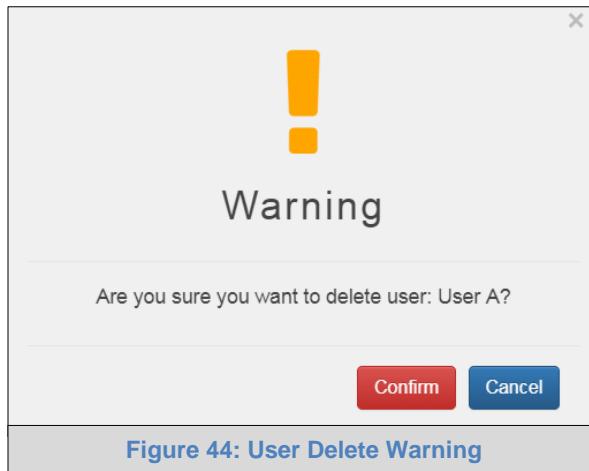
Appendix B.9.3 Delete Users

- Click the trash can icon next to the desired user to delete the entry.

The screenshot shows a 'User Management' interface with a 'Users' tab selected. There is a table with columns for Username, Groups, and Actions. User A is listed with 'Viewer' in the Groups column and edit/delete icons in the Actions column. User B is listed with 'Admin, Operator, Viewer' in the Groups column and edit/delete icons in the Actions column. A 'Create User' button is at the bottom left.

Figure 43: Setup Users

- When the warning message appears, click Confirm.



Appendix B.10 Change General Password

- Type the IP Address of the ProtoCessor into the web browser or use the FieldServer Toolbox to connect to the ProtoCessor, then login to the FieldServer.
- Click on the Diagnostics tab at the top of the screen, then click on View in the navigation panel, and then on Connections.
- Click Setup in the Navigation panel.
- Click User Management in the navigation panel.
- Click the Password tab.

The screenshot shows the FS-GUI User Management interface. The left sidebar has a 'Navigation' section with 'Test Bridge 1' expanded, showing 'About', 'Setup' (with 'User Management' selected), 'View', 'User Messages', and 'Diagnostics'. The main area is titled 'User Management' and contains tabs for 'Users' and 'Password'. The 'Password' tab is active, showing fields for 'Password' (containing 'Enter password' and a red 'Weak' strength indicator) and 'Confirm Password' (containing 'Confirm password'). A 'Use Auto Generated Password' button is below these fields. At the bottom right is a 'Confirm' button. The footer includes links for 'Home', 'HELP (F1)', 'Contact Us', and 'Logout'.

Figure 45: FS-GUI General Password Update

- Change the general login password for the FieldServer as needed.

NOTE: Passwords must be at least 10 characters long. An algorithm automatically checks the password entered and notes the level of strength on the top right of the Password text field.

Appendix C Vendor Information – Lochinvar

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 technical support. The Modbus TCP/IP node address of the device is also the same as the Modbus RTU node address.

Appendix C.1 SYNC Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|---------------------------------------|--------------------|------------------|--------------|------------|
| Boiler Enable/Room Thermostat 1/Stg 1 | BV | 1 | DO | 1 |
| Tank Thermostat | BV | 2 | DO | 2 |
| Manual Reset High Limit 1 | BI | 3 | DI | 3 |
| Flow Switch 1 | BI | 4 | DI | 4 |
| Gas Pressure Switch 1 | BI | 5 | DI | 5 |
| Louver Proving Switch 1 | BI | 6 | DI | 6 |
| Air Pressure Switch/Flap Vlv 1 | BI | 7 | DI | 7 |
| Blocked Drain Switch 1 | BI | 8 | DI | 8 |
| Auto Reset High Limit 1 | BI | 9 | DI | 9 |
| Flame 1 | BI | 10 | DI | 10 |
| Enable/Room Thermostat 1/Stg 1 | BI | 11 | DI | 11 |
| Tank Thermostat | BI | 12 | DI | 12 |
| Manual Reset High Limit 2 | BI | 13 | DI | 13 |
| Flow Switch 2 | BI | 14 | DI | 14 |
| Gas Pressure Switch 2 | BI | 15 | DI | 15 |
| Louver Proving Switch 2 | BI | 16 | DI | 16 |
| Air Pressure Switch/Flap Vlv 2 | BI | 17 | DI | 17 |
| Blocked Drain Switch 2 | BI | 18 | DI | 18 |
| Flame 2 | BI | 19 | DI | 19 |
| Run-time Contacts | BI | 20 | DI | 20 |
| Alarm Contacts 1 | BI | 21 | DI | 21 |
| CH Pump 1 | BI | 22 | DI | 22 |
| DHW Pump 1 | BI | 23 | DI | 23 |
| Gas Vlv 1 | BI | 24 | DI | 24 |
| System Pump | BI | 25 | DI | 25 |
| Run-time Contacts 2 | BI | 26 | DI | 26 |
| Alarm Contacts 2 | BI | 27 | DI | 27 |
| CH Pump 2 | BI | 28 | DI | 28 |
| Gas Vlv 2 | BI | 29 | DI | 29 |
| Discrete Inputs 1 - 16 | AI | 30 | AI | 30 |
| Discrete Inputs 17 - 32 | AI | 31 | AI | 31 |
| Discrete Inputs 33 - 48 | AI | 32 | AI | 32 |
| System/Cascade Setpoint | AI | 33 | AI | 33 |
| Cascade Total Power | AI | 34 | AI | 34 |
| Cascade Current Power | AI | 35 | AI | 35 |
| Outlet Setpoint 1 | AI | 36 | AI | 36 |
| Outlet Temperature 1 | AI | 37 | AI | 37 |
| Inlet Temperature 1 | AI | 38 | AI | 38 |
| Flue Temperature 1 | AI | 39 | AI | 39 |
| Firing Rate 1 | AI | 40 | AI | 40 |
| Boiler 1 Status Code | AI | 41 | AI | 41 |
| Boiler 1 Blocking Code | AI | 42 | AI | 42 |
| Boiler 1 Lockout Code | AI | 43 | AI | 43 |
| Outlet Setpoint 2 | AI | 44 | AI | 44 |
| Outlet Temperature 2 | AI | 45 | AI | 45 |
| Inlet Temperature 2 | AI | 46 | AI | 46 |
| Flue Temperature 2 | AI | 47 | AI | 47 |
| Firing Rate 2 | AI | 48 | AI | 48 |
| Boiler 2 Status Code | AI | 49 | AI | 49 |
| Boiler 2 Blocking Code | AI | 50 | AI | 50 |
| Boiler 2 Lockout Code | AI | 51 | AI | 51 |
| Configuration | AV | 52 | AO | 52 |
| Coils | AV | 53 | AO | 53 |

| | | | | |
|---------------------------------|----|----|----|----|
| 0-10 Volt Input/Rate Cmd/SP Cmd | AV | 54 | AO | 54 |
| Tank Setpoint | AV | 55 | AO | 55 |
| Tank Temperature | AV | 56 | AO | 56 |
| Outdoor Temperature | AV | 57 | AO | 57 |
| System Supply Temperature | AV | 58 | AO | 58 |

Appendix C.2 Knight/Knight XL/Armor/Wall Mount/Wall Hung Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|---------------------------------|--------------------|------------------|--------------|------------|
| Room Thermostat 1 | BV | 1 | DO | 1 |
| Room Thermostat 2 | BV | 2 | DO | 2 |
| Room Thermostat 3 | BV | 3 | DO | 3 |
| Tank Thermostat | BV | 4 | DO | 4 |
| Flow Switch | BI | 5 | DI | 5 |
| Gas Pressure Switch | BI | 6 | DI | 6 |
| Louver Proving Switch | BI | 7 | DI | 7 |
| Air Pressure Switch | BI | 8 | DI | 8 |
| Blocked Drain Switch | BI | 9 | DI | 9 |
| Auto Reset High Limit | BI | 10 | DI | 10 |
| Flame | BI | 11 | DI | 11 |
| Room Thermostat 1 | BI | 12 | DI | 12 |
| Tank Thermostat | BI | 13 | DI | 13 |
| Room Thermostat 2 | BI | 14 | DI | 14 |
| Run-time Contacts | BI | 15 | DI | 15 |
| Alarm Contacts | BI | 16 | DI | 16 |
| CH Pump | BI | 17 | DI | 17 |
| DHW Pump | BI | 18 | DI | 18 |
| Gas Valve | BI | 19 | DI | 19 |
| System Pump | BI | 20 | DI | 20 |
| Discrete Inputs 1 - 16 | AI | 21 | AI | 21 |
| Discrete Inputs 17 - 32 | AI | 22 | AI | 22 |
| Discrete Inputs 33 - 48 | AI | 23 | AI | 23 |
| System Cascade Setpoint | AI | 24 | AI | 24 |
| System Pump Speed | AI | 25 | AI | 25 |
| Cascade Total Power | AI | 26 | AI | 26 |
| Cascade Current Power | AI | 27 | AI | 27 |
| Outlet Setpoint | AI | 28 | AI | 28 |
| Outlet Temperature | AI | 29 | AI | 29 |
| Inlet Temperature | AI | 30 | AI | 30 |
| Flue Temperature | AI | 31 | AI | 31 |
| Firing Rate | AI | 32 | AI | 32 |
| Boiler Pump Speed | AI | 33 | AI | 33 |
| Boiler Status Code | AI | 34 | AI | 34 |
| Boiler Blocking Code | AI | 35 | AI | 35 |
| Boiler Lockout Code | AI | 36 | AI | 36 |
| Configuration | AV | 37 | AO | 37 |
| Coils | AV | 38 | AO | 38 |
| 0-10 Volt Input/Rate Cmd/SP Cmd | AV | 39 | AO | 39 |
| Tank Setpoint | AV | 40 | AO | 40 |
| Tank Temperature | AV | 41 | AO | 41 |
| Outdoor Temperature | AV | 42 | AO | 42 |
| System Supply Temperature | AV | 43 | AO | 43 |
| System Return Temperature | AV | 44 | AO | 44 |

Appendix C.3 Crest Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|-----------------|--------------------|------------------|--------------|------------|
| Boiler Enable | BV | 1 | DO | 1 |
| Tank Thermostat | BV | 2 | DO | 2 |

| | | | | |
|----------------------------|----|----|----|----|
| Manual Reset High Limit | BI | 3 | DI | 3 |
| Flow Switch | BI | 4 | DI | 4 |
| Gas Pressure Switch | BI | 5 | DI | 5 |
| Louvers Proving Switch | BI | 6 | DI | 6 |
| Blower Proving Switch 1 | BI | 7 | DI | 7 |
| Blocked Drain Switch | BI | 8 | DI | 8 |
| Flame 1 | BI | 9 | DI | 9 |
| Enable | BI | 10 | DI | 10 |
| Tank Thermostat | BI | 11 | DI | 11 |
| Blocked Flue | BI | 12 | DI | 12 |
| Blower Proving Switch 2 | BI | 13 | DI | 13 |
| Flue Damper Proving Switch | BI | 14 | DI | 14 |
| Flame 2 | BI | 15 | DI | 15 |
| Run Time Contacts | BI | 16 | DI | 16 |
| Alarm Contacts | BI | 17 | DI | 17 |
| SH Pump | BI | 18 | DI | 18 |
| HWG Pump | BI | 19 | DI | 19 |
| Louver Relay | BI | 20 | DI | 20 |
| Gas Valve 1 | BI | 21 | DI | 21 |
| System Pump | BI | 22 | DI | 22 |
| Vent Damper Relay | BI | 23 | DI | 23 |
| Gas Valve 2 | BI | 24 | DI | 24 |
| Blower #1 Power | BI | 25 | DI | 25 |
| Blower #2 Power | BI | 26 | DI | 26 |
| Spark Igniter | BI | 27 | DI | 27 |
| Transition Gas Valve | BI | 28 | DI | 28 |
| Air Valve Trigger | BI | 29 | DI | 29 |
| Air Valve Proving | BI | 30 | DI | 30 |
| Discrete Inputs 01-16 | AI | 31 | AI | 31 |
| Discrete Inputs 17-32 | AI | 32 | AI | 32 |
| Discrete Inputs 33-48 | AI | 33 | AI | 33 |
| System Cascade Setpoint | AI | 34 | AI | 34 |
| System Pump Speed In | AI | 35 | AI | 35 |
| Cascade Total Power | AI | 36 | AI | 36 |
| Cascade Current Power | AI | 37 | AI | 37 |
| Outlet Setpoint | AI | 38 | AI | 38 |
| Outlet Temperature | AI | 39 | AI | 39 |
| Inlet Temperature | AI | 40 | AI | 40 |
| Flue Temperature | AI | 41 | AI | 41 |
| Firing Rate | AI | 42 | AI | 42 |
| Boiler Pump Speed Out | AI | 43 | AI | 43 |
| Boiler Status Code | AI | 44 | AI | 44 |
| Boiler Blocking Code | AI | 45 | AI | 45 |
| Boiler Lock Out Code | AI | 46 | AI | 46 |
| Discrete Inputs 49-64 | AI | 47 | AI | 47 |
| Lockout Error Leader | AI | 48 | AI | 48 |
| Lockout Error Member 1 | AI | 49 | AI | 49 |
| Lockout Error Member 2 | AI | 50 | AI | 50 |
| Lockout Error Member 3 | AI | 51 | AI | 51 |
| Lockout Error Member 4 | AI | 52 | AI | 52 |
| Lockout Error Member 5 | AI | 53 | AI | 53 |
| Lockout Error Member 6 | AI | 54 | AI | 54 |
| Lockout Error Member 7 | AI | 55 | AI | 55 |
| Configuration | AV | 56 | AO | 56 |
| Coils | AV | 57 | AO | 57 |
| 0-10 Volt Input | AV | 58 | AO | 58 |
| Tank Setpoint | AV | 59 | AO | 59 |
| Tank Temperature | AV | 60 | AO | 60 |
| Outdoor Temperature | AV | 61 | AO | 61 |
| System Supply Temperature | AV | 62 | AO | 62 |
| System Return Temperature | AV | 63 | AO | 63 |

Appendix C.4 Copper-Fin II Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|---------------------------|--------------------|------------------|--------------|------------|
| Stage 1 Enable | BV | 1 | DO | 1 |
| Stage 2 Enable | BV | 2 | DO | 2 |
| Stage 3 Enable | BV | 3 | DO | 3 |
| Stage 4 Enable | BV | 4 | DO | 4 |
| Tank Thermostat | BV | 5 | DO | 5 |
| High Limits | BI | 6 | DI | 6 |
| Flow Switch | BI | 7 | DI | 7 |
| Gas Pressure Switch | BI | 8 | DI | 8 |
| Louver Proving Switch | BI | 9 | DI | 9 |
| Air Pressure Switch | BI | 10 | DI | 10 |
| Flame 1 | BI | 11 | DI | 11 |
| Stage 1 On | BI | 12 | DI | 12 |
| Tank Thermostat | BI | 13 | DI | 13 |
| Stage 2 On | BI | 14 | DI | 14 |
| Stage 3 On | BI | 15 | DI | 15 |
| Stage 4 On | BI | 16 | DI | 16 |
| Flame 2 | BI | 17 | DI | 17 |
| Enable 2 | BI | 18 | DI | 18 |
| Run Time Contacts | BI | 19 | DI | 19 |
| Alarm Contacts | BI | 20 | DI | 20 |
| HTR Pump | BI | 21 | DI | 21 |
| DHW Pump | BI | 22 | DI | 22 |
| Louver Relay | BI | 23 | DI | 23 |
| Gas Valve 1 | BI | 24 | DI | 24 |
| System Pump | BI | 25 | DI | 25 |
| Gas Valve 2 | BI | 26 | DI | 26 |
| Gas Valve 3 | BI | 27 | DI | 27 |
| Gas Valve 4 | BI | 28 | DI | 28 |
| Discrete Inputs 01-16 | AI | 29 | AI | 29 |
| Discrete Inputs 17-32 | AI | 30 | AI | 30 |
| Discrete Inputs 33-48 | AI | 31 | AI | 31 |
| System Cascade Setpoint | AI | 32 | AI | 32 |
| System Pump Speed | AI | 33 | AI | 33 |
| Cascade Total Power | AI | 34 | AI | 34 |
| Cascade Current Power | AI | 35 | AI | 35 |
| Outlet Setpoint | AI | 36 | AI | 36 |
| Outlet Temperature | AI | 37 | AI | 37 |
| Inlet Temperature | AI | 38 | AI | 38 |
| Pool Temperature | AI | 39 | AI | 39 |
| Firing Rate | AI | 40 | AI | 40 |
| Boiler Status Code | AI | 41 | AI | 41 |
| Boiler Blocking Code | AI | 42 | AI | 42 |
| Boiler Lockout Code | AI | 43 | AI | 43 |
| Configuration | AV | 45 | AO | 45 |
| Coils | AV | 46 | AO | 46 |
| 0-10 Volt Input | AV | 47 | AO | 47 |
| Pool Setpoint | AV | 48 | AO | 48 |
| Tank Temperature | AV | 49 | AO | 49 |
| Outdoor Temperature | AV | 50 | AO | 50 |
| System Supply Temperature | AV | 51 | AO | 51 |
| System Return Temperature | AV | 52 | AO | 52 |

Appendix C.5 Power Fin Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|---------------------------------------|--------------------|------------------|--------------|------------|
| Boiler Enable/Room Thermostat 1/Stg 1 | BV | 1 | DO | 1 |
| Tank Thermostat | BV | 2 | DO | 2 |
| Manual Reset High Limit 1 | BI | 3 | DI | 3 |
| Flow Switch 1 | BI | 4 | DI | 4 |

| | | | | |
|---------------------------------|----|----|----|----|
| Gas Pressure Switch 1 | BI | 5 | DI | 5 |
| Louver Proving Switch 1 | BI | 6 | DI | 6 |
| Air Pressure Switch/Flap Vlv 1 | BI | 7 | DI | 7 |
| Blocked Drain Switch 1 | BI | 8 | DI | 8 |
| Auto Reset High Limit 1 | BI | 9 | DI | 9 |
| Flame 1 | BI | 10 | DI | 10 |
| Enable/Room Thermostat 1/Stg 1 | BI | 11 | DI | 11 |
| Tank Thermostat | BI | 12 | DI | 12 |
| Run-time Contacts | BI | 13 | DI | 13 |
| Alarm Contacts 1 | BI | 14 | DI | 14 |
| CH Pump 1 | BI | 15 | DI | 15 |
| DHW Pump 1 | BI | 16 | DI | 16 |
| Gas Vlv 1 | BI | 17 | DI | 17 |
| System Pump | BI | 18 | DI | 18 |
| Mains Fan 1 | BI | 19 | DI | 19 |
| External Spark | BI | 20 | DI | 20 |
| Discrete Inputs 1 - 16 | AI | 21 | AI | 21 |
| Discrete Inputs 17 - 32 | AI | 22 | AI | 22 |
| Discrete Inputs 33 - 48 | AI | 23 | AI | 23 |
| System/Cascade Setpoint | AI | 24 | AI | 24 |
| Cascade Total Power | AI | 25 | AI | 25 |
| Cascade Current Power | AI | 26 | AI | 26 |
| Outlet Setpoint 1 | AI | 27 | AI | 27 |
| Outlet Temperature 1 | AI | 28 | AI | 28 |
| Inlet Temperature 1 | AI | 29 | AI | 29 |
| Flue Temperature 1 | AI | 30 | AI | 30 |
| Firing Rate 1 | AI | 31 | AI | 31 |
| Boiler 1 Status Code | AI | 32 | AI | 32 |
| Boiler 1 Blocking Code | AI | 33 | AI | 33 |
| Boiler 1 Lockout Code | AI | 34 | AI | 34 |
| Discrete Inputs 49-64 | AI | 35 | AI | 35 |
| Configuration | AV | 36 | AO | 36 |
| Coils | AV | 37 | AO | 37 |
| 0-10 Volt Input/Rate Cmd/SP Cmd | AV | 38 | AO | 38 |
| Tank Setpoint | AV | 39 | AO | 39 |
| Tank Temperature | AV | 40 | AO | 40 |
| Outdoor Temperature | AV | 41 | AO | 41 |
| System Supply Temperature | AV | 42 | AO | 42 |
| System Return Temperature | AV | 43 | AO | 43 |

Appendix C.6 Knight FTXL Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|-----------------------|--------------------|------------------|--------------|------------|
| Room Thermostat 1 | BV | 1 | DO | 1 |
| Room Thermostat 2 | BV | 2 | DO | 2 |
| Room Thermostat 3 | BV | 3 | DO | 3 |
| Tank Thermostat | BV | 4 | DO | 4 |
| Flow Switch | BI | 5 | DI | 5 |
| Gas Pressure Switch | BI | 6 | DI | 6 |
| Louver Proving Switch | BI | 7 | DI | 7 |
| Air Pressure Switch | BI | 8 | DI | 8 |
| Blocked Drain Switch | BI | 9 | DI | 9 |
| Auto Reset High Limit | BI | 10 | DI | 10 |
| Flame | BI | 11 | DI | 11 |
| Room Thermostat 1 | BI | 12 | DI | 12 |
| Tank Thermostat | BI | 13 | DI | 13 |
| Room Thermostat 2 | BI | 14 | DI | 14 |
| Run-time Contacts | BI | 15 | DI | 15 |
| Alarm Contacts | BI | 16 | DI | 16 |
| CH Pump | BI | 17 | DI | 17 |
| DHW Pump 1 | BI | 18 | DI | 18 |
| Louver Relay | BI | 19 | DI | 19 |
| Gas Valve | BI | 20 | DI | 20 |

| | | | | |
|---------------------------------|----|----|----|----|
| System Pump | BI | 21 | DI | 21 |
| DHW Pump 2 | BI | 22 | DI | 22 |
| Discrete Inputs 1 - 16 | AI | 23 | AI | 23 |
| Discrete Inputs 17 - 32 | AI | 24 | AI | 24 |
| Discrete Inputs 33 - 48 | AI | 25 | AI | 25 |
| System Cascade Setpoint | AI | 26 | AI | 26 |
| System Pump Speed | AI | 27 | AI | 27 |
| Cascade Total Power | AI | 28 | AI | 28 |
| Cascade Current Power | AI | 29 | AI | 29 |
| Outlet Setpoint | AI | 30 | AI | 30 |
| Outlet Temperature | AI | 31 | AI | 31 |
| Inlet Temperature | AI | 32 | AI | 32 |
| Flue Temperature | AI | 33 | AI | 33 |
| Firing Rate | AI | 34 | AI | 34 |
| Boiler Pump Speed | AI | 35 | AI | 35 |
| Boiler Status Code | AI | 36 | AI | 36 |
| Boiler Blocking Code | AI | 37 | AI | 37 |
| Boiler Lockout Code | AI | 38 | AI | 38 |
| Configuration | AV | 39 | AO | 39 |
| Coils | AV | 40 | AO | 40 |
| 0-10 Volt Input/Rate Cmd/SP Cmd | AV | 41 | AO | 41 |
| Tank Setpoint | AV | 42 | AO | 42 |
| Tank Temperature | AV | 43 | AO | 43 |
| Outdoor Temperature | AV | 44 | AO | 44 |
| System Supply Temperature | AV | 45 | AO | 45 |
| System Return Temperature | AV | 46 | AO | 46 |

Appendix C.7 Power Fin 2.5-5.0 Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|---------------------------------------|--------------------|------------------|--------------|------------|
| Boiler Enable/Room Thermostat 1/Stg 1 | BV | 1 | DO | 1 |
| Tank Thermostat Cmd | BV | 2 | DO | 2 |
| Manual Reset High Limit 1 | BI | 3 | DI | 3 |
| Flow Switch 1 | BI | 4 | DI | 4 |
| Gas Pressure Switch 1 | BI | 5 | DI | 5 |
| Louver Proving Switch 1 | BI | 6 | DI | 6 |
| Blocked Drain Switch 1 | BI | 7 | DI | 7 |
| Flame 1 | BI | 8 | DI | 8 |
| Enable/Room Thermostat 1/Stg 1 | BI | 9 | DI | 9 |
| Tank Thermostat | BI | 10 | DI | 10 |
| Stage 2/Air Pressure Switch | BI | 11 | DI | 11 |
| Air Pres Switch 2/Flap Vlv 2/Flue Vlv | BI | 12 | DI | 12 |
| Run-time Contacts | BI | 13 | DI | 13 |
| Alarm Contacts 1 | BI | 14 | DI | 14 |
| CH Pump 1 | BI | 15 | DI | 15 |
| DHW Pump 1 | BI | 16 | DI | 16 |
| Louver Relay 1 | BI | 17 | DI | 17 |
| Gas Vlv 1 | BI | 18 | DI | 18 |
| System Pump | BI | 19 | DI | 19 |
| DHW Pump 2/Flue Valve | BI | 20 | DI | 20 |
| Mains Fan 1 | BI | 21 | DI | 21 |
| External Spark | BI | 22 | DI | 22 |
| Discrete Inputs 1 - 16 | AI | 23 | AI | 23 |
| Discrete Inputs 17 - 32 | AI | 24 | AI | 24 |
| Discrete Inputs 33 - 48 | AI | 25 | AI | 25 |
| System/Cascade Setpoint | AI | 26 | AI | 26 |
| System Pump Speed | AI | 27 | AI | 27 |
| Cascade Total Power | AI | 28 | AI | 28 |
| Cascade Current Power | AI | 29 | AI | 29 |
| Outlet Setpoint 1 | AI | 30 | AI | 30 |
| Outlet Temperature 1 | AI | 31 | AI | 31 |
| Inlet Temperature 1 | AI | 32 | AI | 32 |
| Flue Temperature 1 | AI | 33 | AI | 33 |

| | | | | |
|---------------------------------|----|----|----|----|
| Firing Rate 1 | AI | 34 | AI | 34 |
| Boiler 1 Pump Speed | AI | 35 | AI | 35 |
| Boiler 1 Status Code | AI | 36 | AI | 36 |
| Boiler 1 Blocking Code | AI | 37 | AI | 37 |
| Boiler 1 Lockout Code | AI | 38 | AI | 38 |
| Discrete Inputs 49-64 | AI | 39 | AI | 39 |
| Lockout Error Leader | AI | 40 | AI | 40 |
| Lockout Error Member 1 | AI | 41 | AI | 41 |
| Lockout Error Member 2 | AI | 42 | AI | 42 |
| Lockout Error Member 3 | AI | 43 | AI | 43 |
| Lockout Error Member 4 | AI | 44 | AI | 44 |
| Lockout Error Member 5 | AI | 45 | AI | 45 |
| Lockout Error Member 6 | AI | 46 | AI | 46 |
| Lockout Error Member 7 | AI | 47 | AI | 47 |
| Configuration | AV | 48 | AO | 48 |
| Coils | AV | 49 | AO | 49 |
| 0-10 Volt Input/Rate Cmd/SP Cmd | AV | 50 | AO | 50 |
| Tank Setpoint | AV | 51 | AO | 51 |
| Tank Temperature | AV | 52 | AO | 52 |
| Outdoor Temperature | AV | 53 | AO | 53 |
| System Supply Temperature | AV | 54 | AO | 54 |
| System Return Temperature | AV | 55 | AO | 55 |

Appendix C.8 IPW Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|--------------------|--------------------|------------------|--------------|------------|
| Outlet Temperature | AI | 1 | AI | 1 |
| Inlet Temperature | AI | 2 | AI | 2 |
| Outlet Voltage | AI | 3 | AI | 3 |
| Setpoint | AV | 4 | AO | 4 |

Appendix C.9 Armor_1250_4000 Modbus RTU Mappings to BACnet and Metasys N2

| Point Name | BACnet Object Type | BACnet Object ID | N2 Data Type | N2 Address |
|---------------------------|--------------------|------------------|--------------|------------|
| Enable | BV | 0 | DO | 1 |
| Tank Thermostat | BV | 4 | DO | 5 |
| Manual Reset High Limit | BI | 0 | DI | 1 |
| Flow Switch | BI | 1 | DI | 2 |
| Gas Pressure Switch | BI | 2 | DI | 3 |
| Louver Proving Switch | BI | 3 | DI | 4 |
| Blocked Drain Switch | BI | 5 | DI | 6 |
| Auto Reset High Limit | BI | 6 | DI | 7 |
| Flame | BI | 7 | DI | 8 |
| Enable | BI | 8 | DI | 9 |
| Tank Thermostat | BI | 9 | DI | 10 |
| Run-time Contacts | BI | 32 | DI | 33 |
| Alarm Contacts | BI | 33 | DI | 34 |
| DHW Pump | BI | 35 | DI | 36 |
| Gas Valve | BI | 37 | DI | 38 |
| Recirculation Pump | BI | 38 | DI | 39 |
| Blower Power | BI | 48 | DI | 49 |
| Discrete Inputs 1 - 16 | AI | 0 | AI | 1 |
| Discrete Inputs 17 - 32 | AI | 1 | AI | 2 |
| Discrete Inputs 33 - 48 | AI | 2 | AI | 3 |
| System / Cascade Setpoint | AI | 3 | AI | 4 |
| Cascade Total Power | AI | 4 | AI | 5 |
| Cascade Current Power | AI | 6 | AI | 7 |
| Outlet Temperature | AI | 8 | AI | 9 |
| Inlet Temperature | AI | 9 | AI | 10 |
| Flue Temperature | AI | 19 | AI | 20 |
| Firing Rate | AI | 11 | AI | 12 |

| | | | | |
|---------------------------------|----|----|----|----|
| Status Code | AI | 13 | AI | 14 |
| Blocking Code | AI | 14 | AI | 15 |
| Lockout Code | AI | 15 | AI | 16 |
| Discrete Inputs 49 - 64 | AI | 25 | AI | 26 |
| Lockout Code Leader | AI | 26 | AI | 27 |
| Lockout Code Member 1 | AI | 27 | AI | 28 |
| Lockout Code Member 2 | AI | 28 | AI | 29 |
| Lockout Code Member 3 | AI | 29 | AI | 30 |
| Lockout Code Member 4 | AI | 30 | AI | 31 |
| Lockout Code Member 5 | AI | 31 | AI | 32 |
| Lockout Code Member 6 | AI | 32 | AI | 33 |
| Lockout Code Member 7 | AI | 33 | AI | 34 |
| Configuration | AV | 0 | AO | 1 |
| Coils | AV | 1 | AO | 2 |
| 0-10 Volt Input/Rate Cmd/SP Cmd | AV | 2 | AO | 3 |
| Tank Setpoint | AV | 3 | AO | 4 |
| Tank Temperature | AV | 4 | AO | 5 |

Appendix D Reference

Appendix D.1 Specifications



| ProtoNode FPC-N54 ³ | |
|--------------------------------|---|
| Electrical Connections | One 3-pin Phoenix connector with: RS-485/RS-232 (Tx+ / Rx- / gnd) One 3-pin Phoenix connector with: RS-485 (Tx+ / Rx- / gnd) One 3-pin Phoenix connector with: Power port (+ / - / Frame-gnd) One Ethernet 10/100 BaseT port |
| Power Requirements | <i>Input Voltage:</i> 9-30VDC or 24VAC <i>Current draw:</i> 24VAC 0.125A <i>Max Power:</i> 3 Watts 9-30VDC .25A @12VDC |
| Approvals | CE and FCC class B & C part 15, UL 60950-1, WEEE compliant, IC Canada, RoHS3 compliant, DNP 3.0 conformance tested, REACH compliant |
| Physical Dimensions | 4 x 1.1 x 2.7 in (10.16 x 2.8 x 6.8 cm) |
| Weight | 0.4 lbs (0.2 Kg) |
| Operating Temperature | -20°C to 70°C (-4°F to 158°F) |
| Humidity | 10-95% RH non-condensing |

Figure 46: 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.

³ Specifications subject to change without notice.

Appendix E Limited 2 Year Warranty

MSA Safety warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. MSA Safety 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 MSA Safety 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 MSA Safety'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 MSA Safety'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, MSA Safety 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 MSA Safety for damages including, but not limited to, consequential damages arising out of or in connection with the use or performance of the product.