Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

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.

SMC sierra monitor

Document Revision: 5.A
Web Configurator
Template Revision: 4

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

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

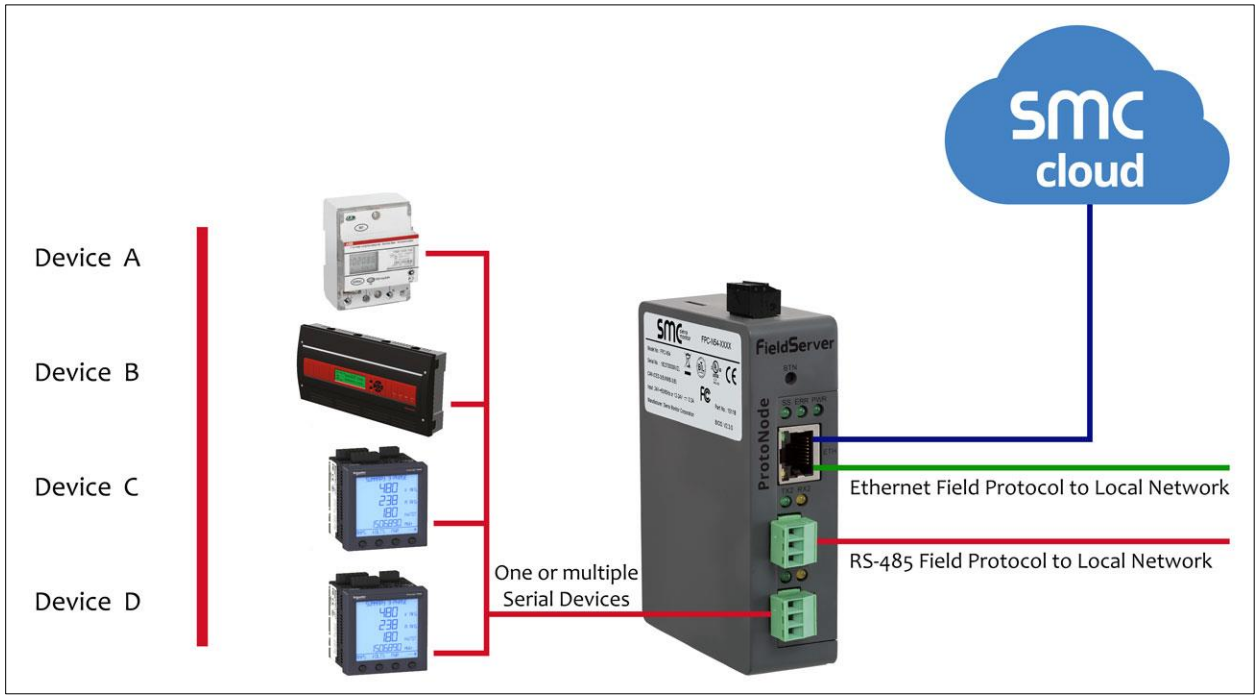
2 INTRODUCTION

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®[2] 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

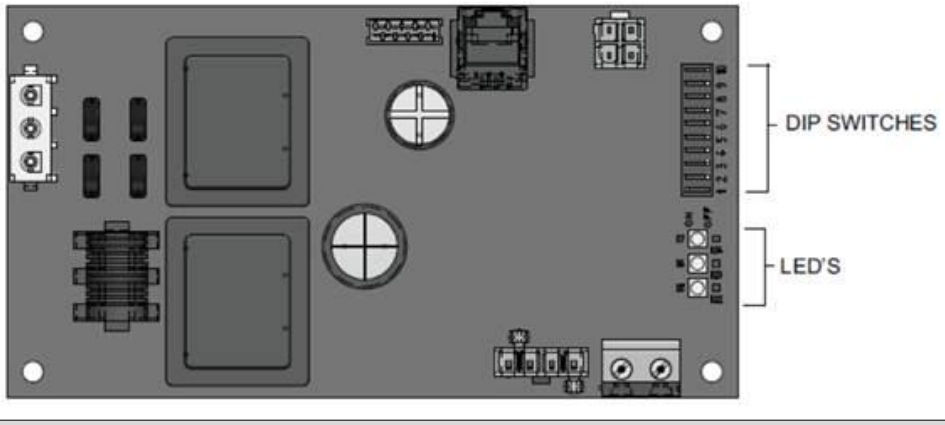


Figure 5: Lochinvar Modbus COM Board Showing Serial DIP Switches

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.

Device Pins	ProtoNode Pin Label	Pin Assignment
RS-485 +	TX +	RS-485 +
RS-485 -	RX -	RS-485 -
RS-485 GND	GND	RS-485 GND

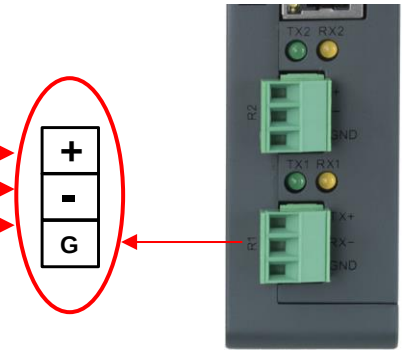


Figure 6: RS-485 Connections from Devices to the ProtoNode

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.

BMS Wiring	ProtoNode Pin Label	Pin Assignment
RS-485 +	+	RS-485 +
RS-485 -	-	RS-485 -
-	GND	RS-485 GND

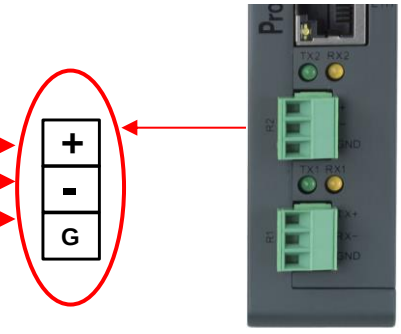


Figure 7: Connection from ProtoNode to RS-485 Field Network

4.3 Bias Resistors

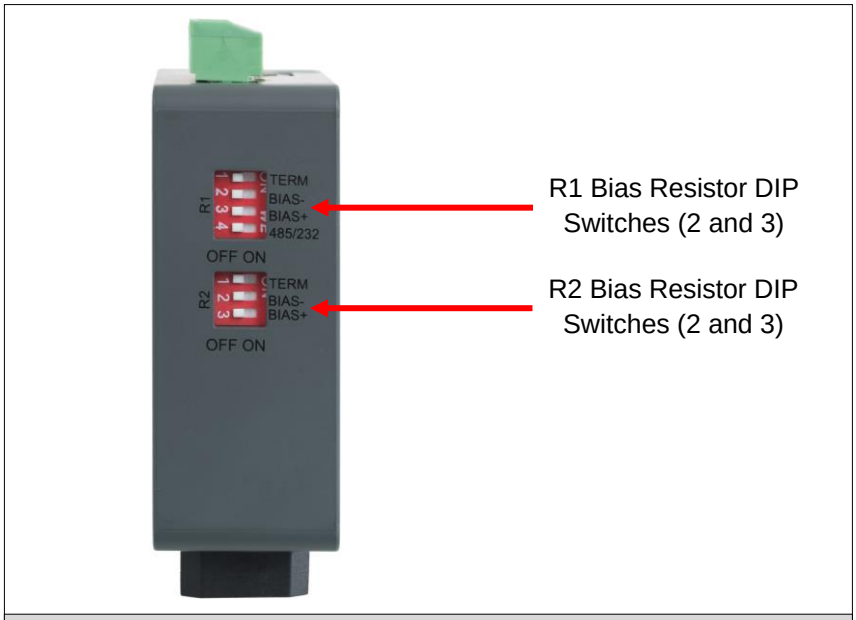


Figure 8: Bias Resistor DIP Switches

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 were 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

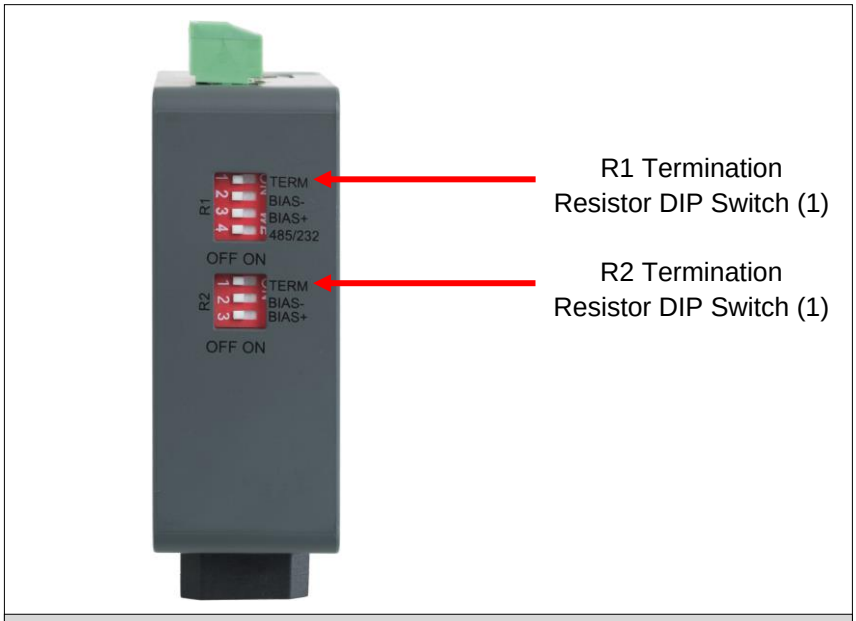


Figure 9: Termination Resistor DIP Switch

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.

Power to ProtoNode	ProtoNode Pin Label	Pin Assignment
Power In (+)	L +	V +
Power In (-)	N -	V -
Frame Ground	FG	FRAME GND

Figure 11: Power Connections

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.

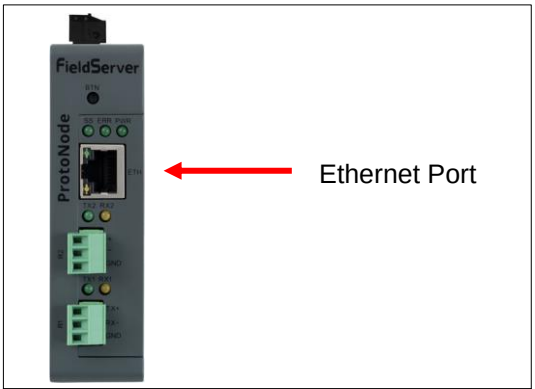


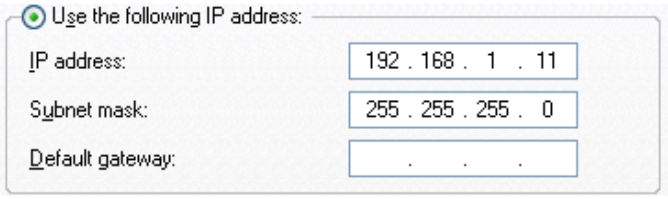
Figure 12: Ethernet Port Location

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.

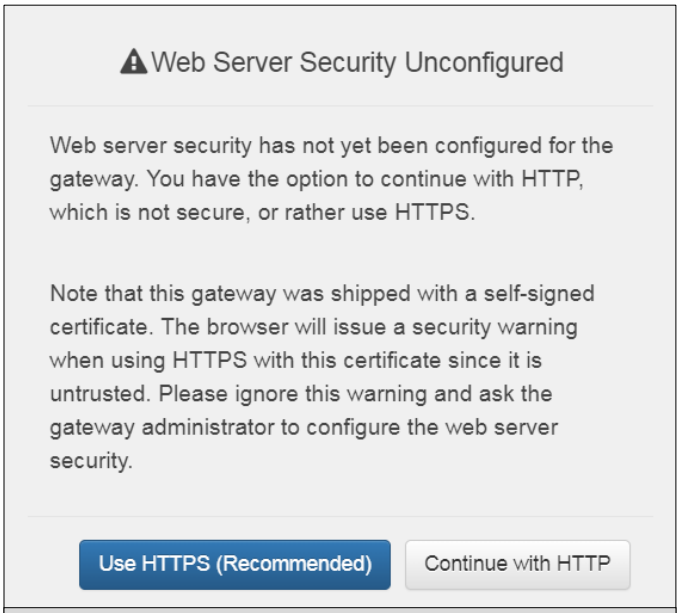


Figure 13: Web Server Security Unconfigured Window

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

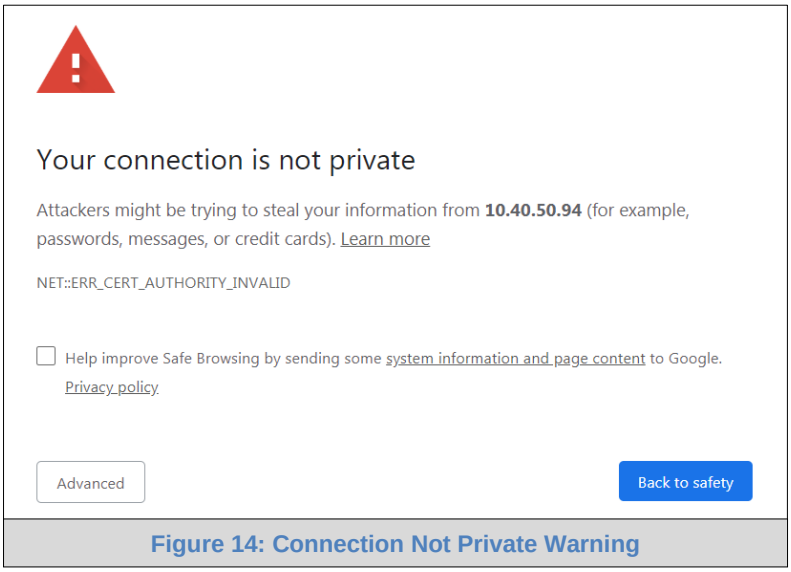


Figure 14: Connection Not Private Warning

- 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)".

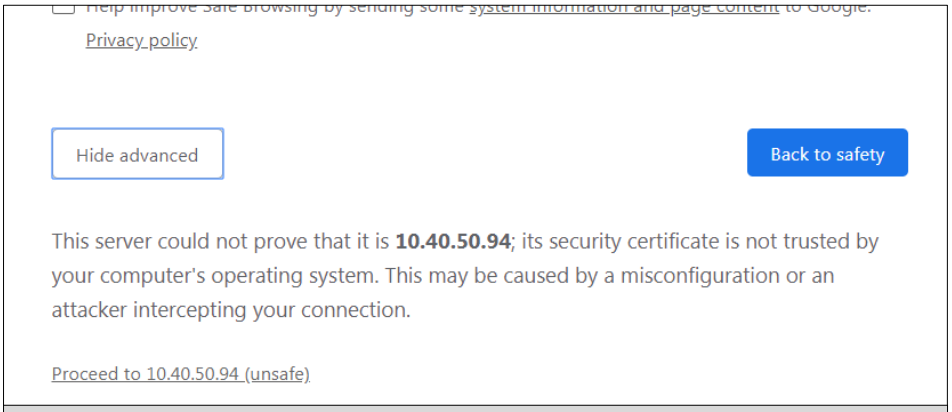


Figure 15: Warning Expanded Text

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

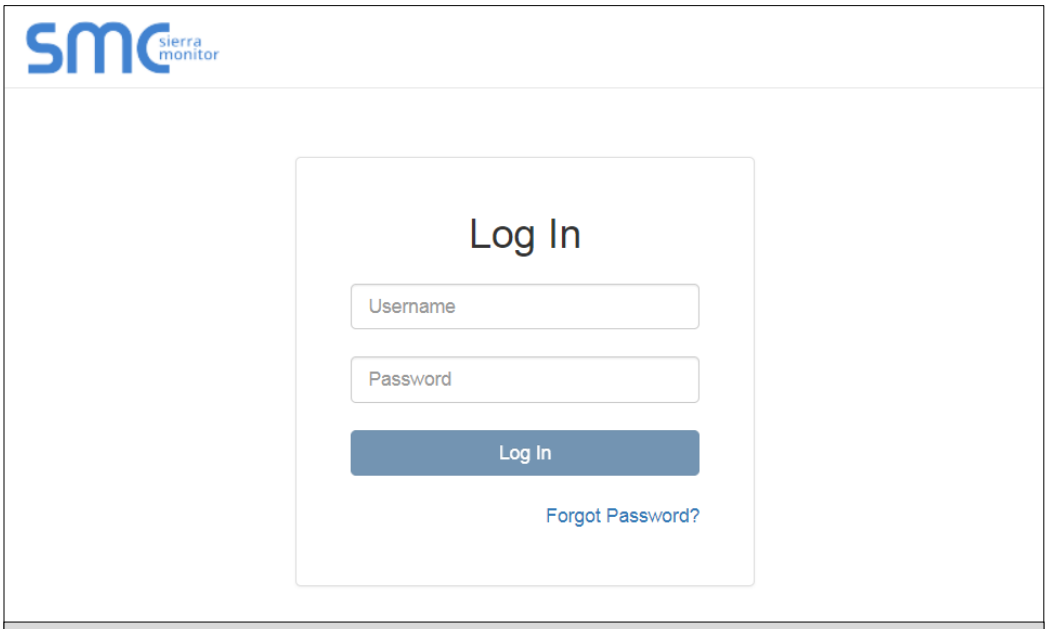


Figure 16: FieldServer Login

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.

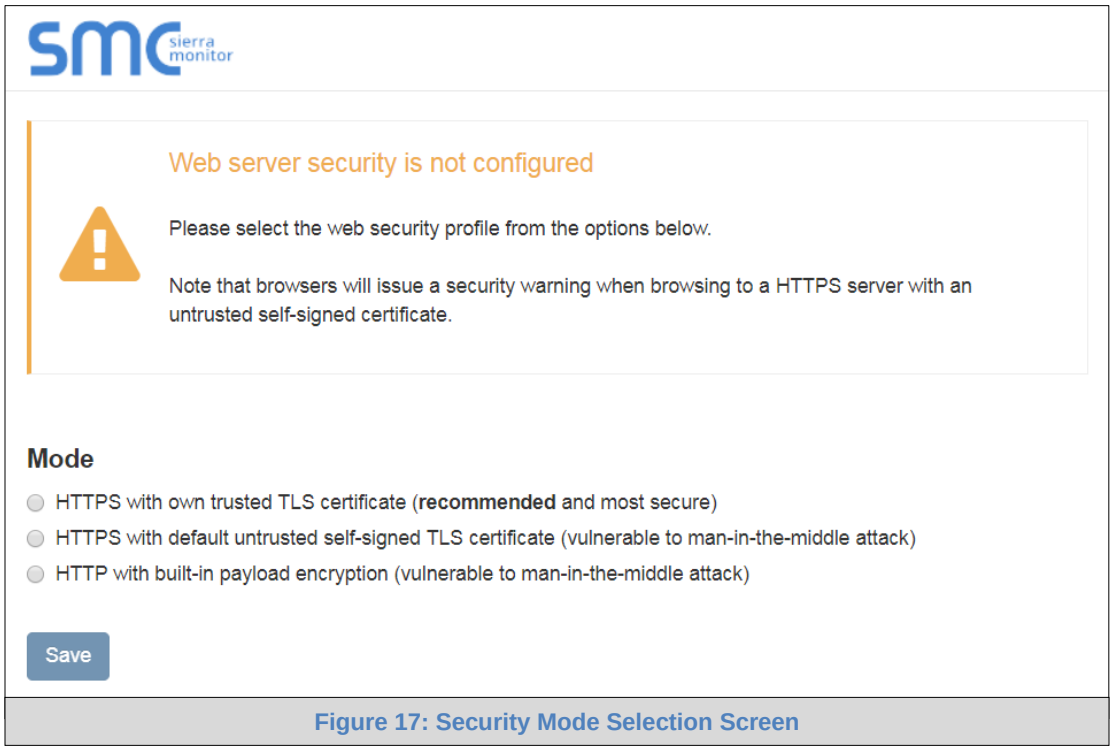


Figure 17: Security Mode Selection Screen

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.

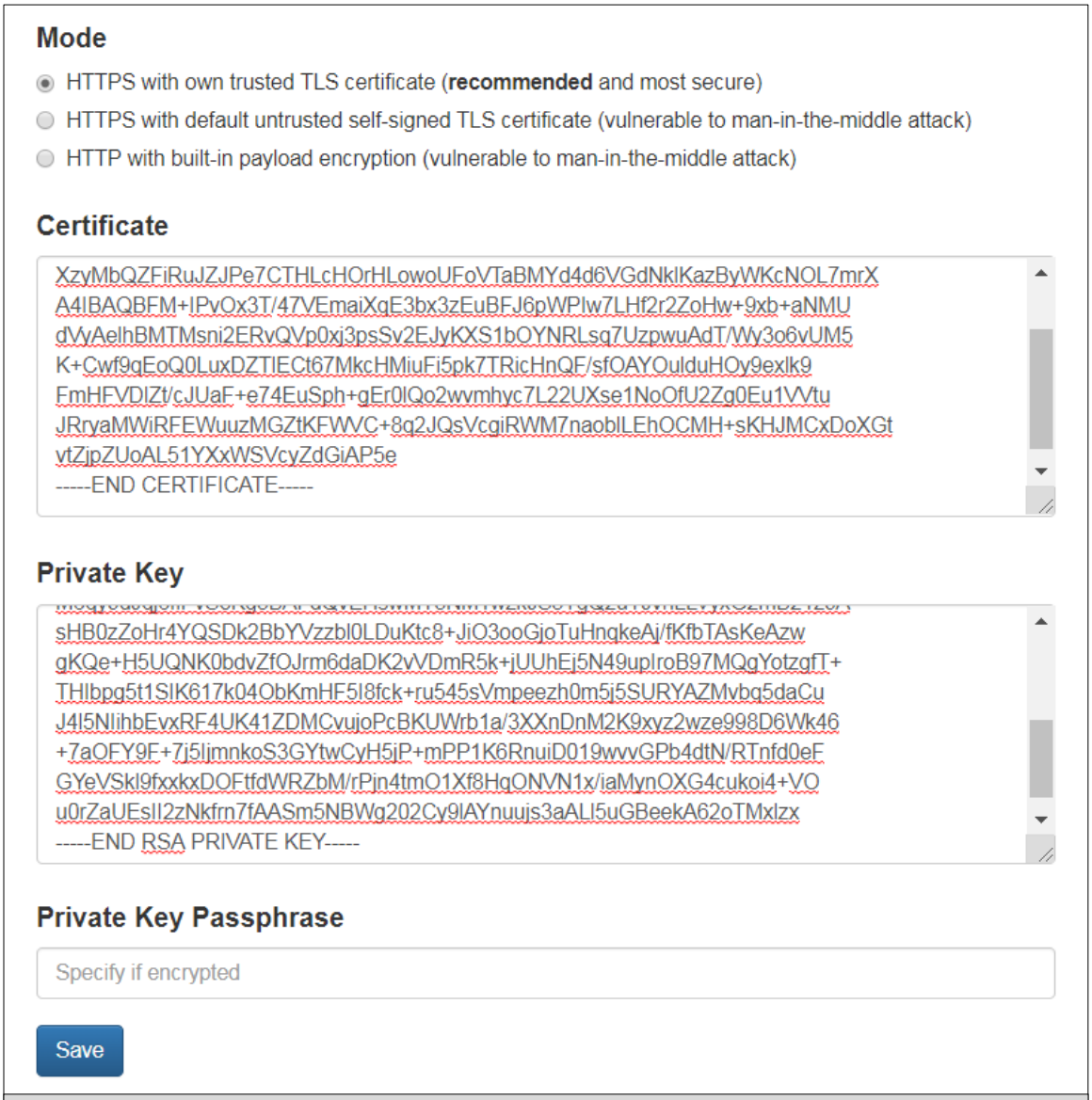


Figure 18: Security Mode Selection Screen

- 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.

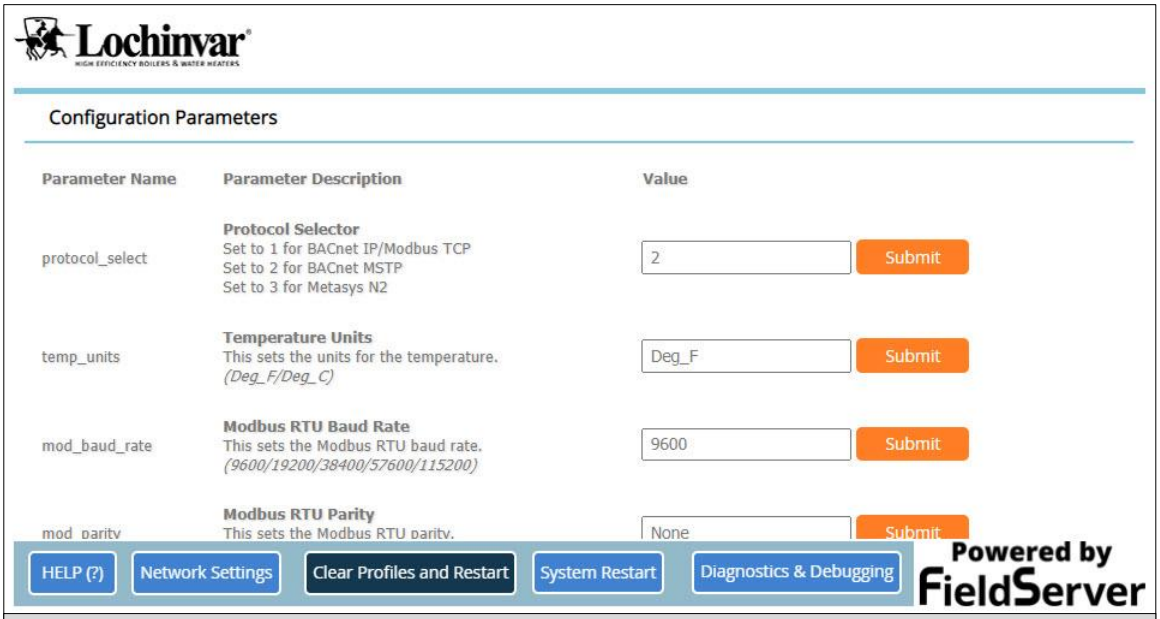


Figure 19: Web Configurator Showing Protocol Selector Parameter

- 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**)

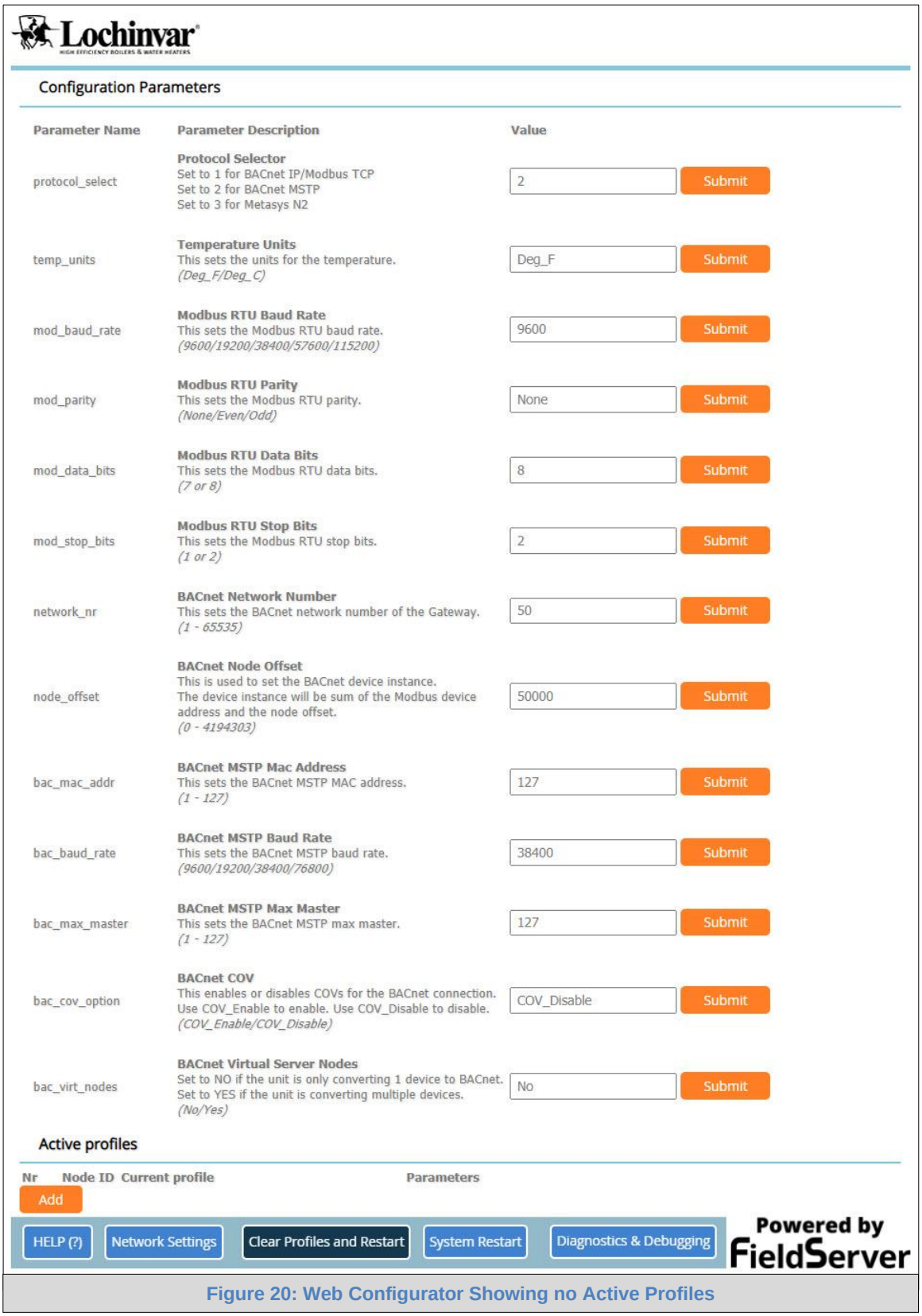


Figure 20: Web Configurator Showing no Active Profiles

- 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**.

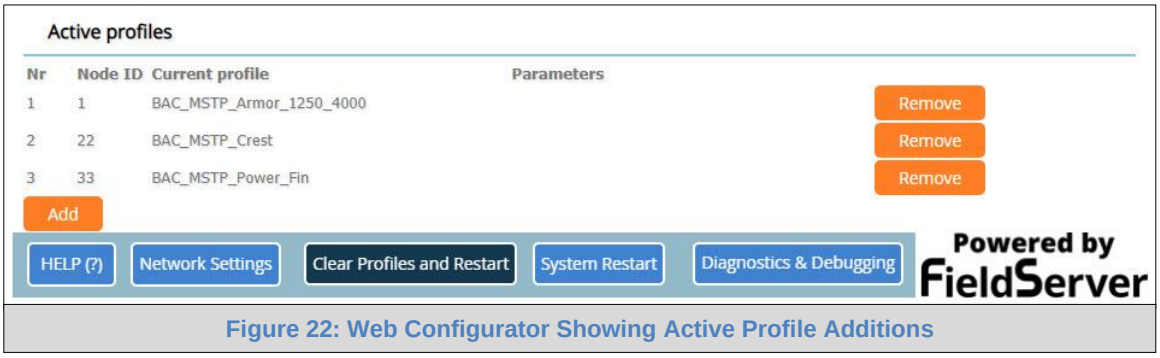


Figure 22: Web Configurator Showing Active Profile Additions

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.

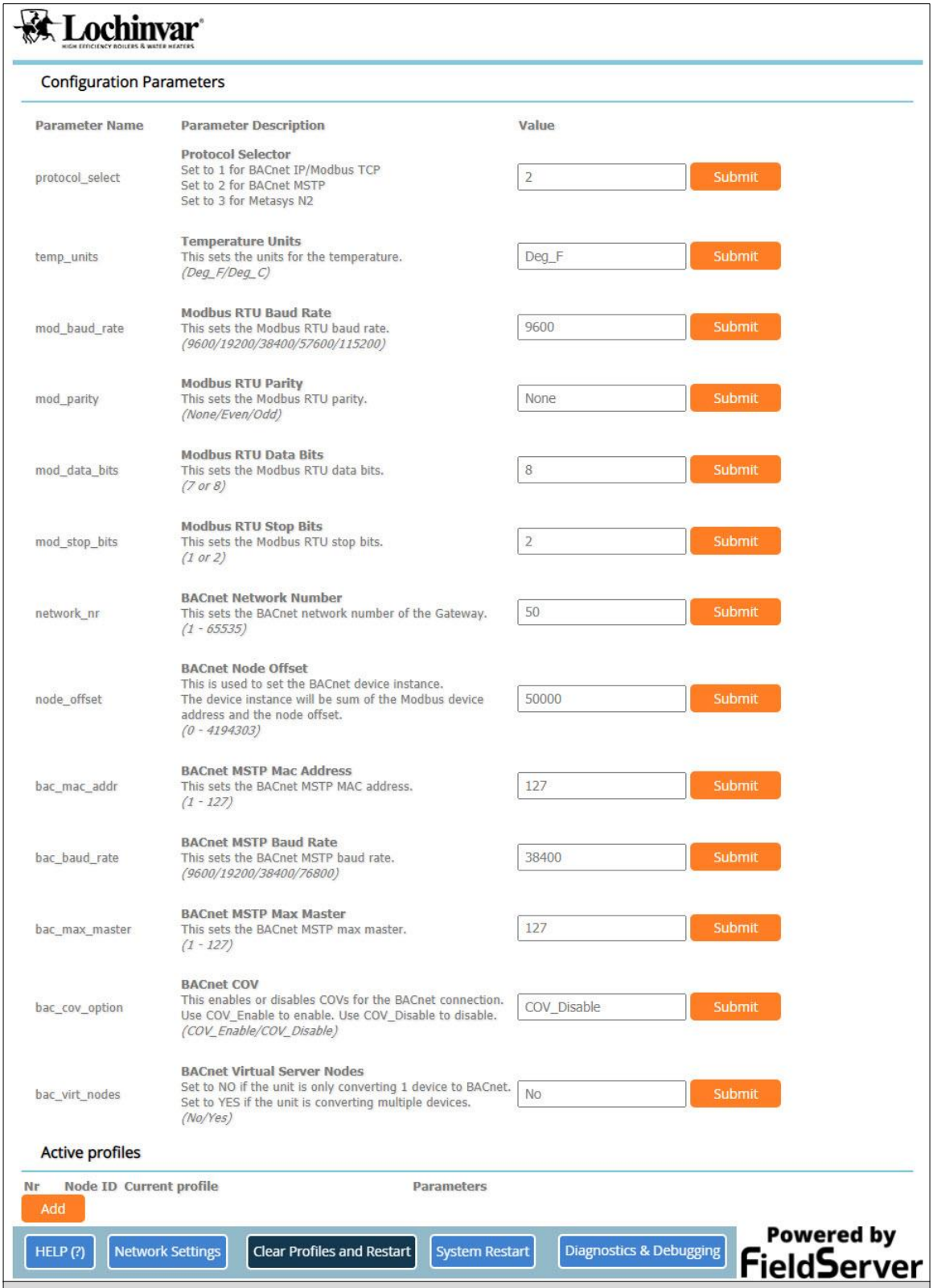


Figure 23: Web Configurator Screen

- 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)

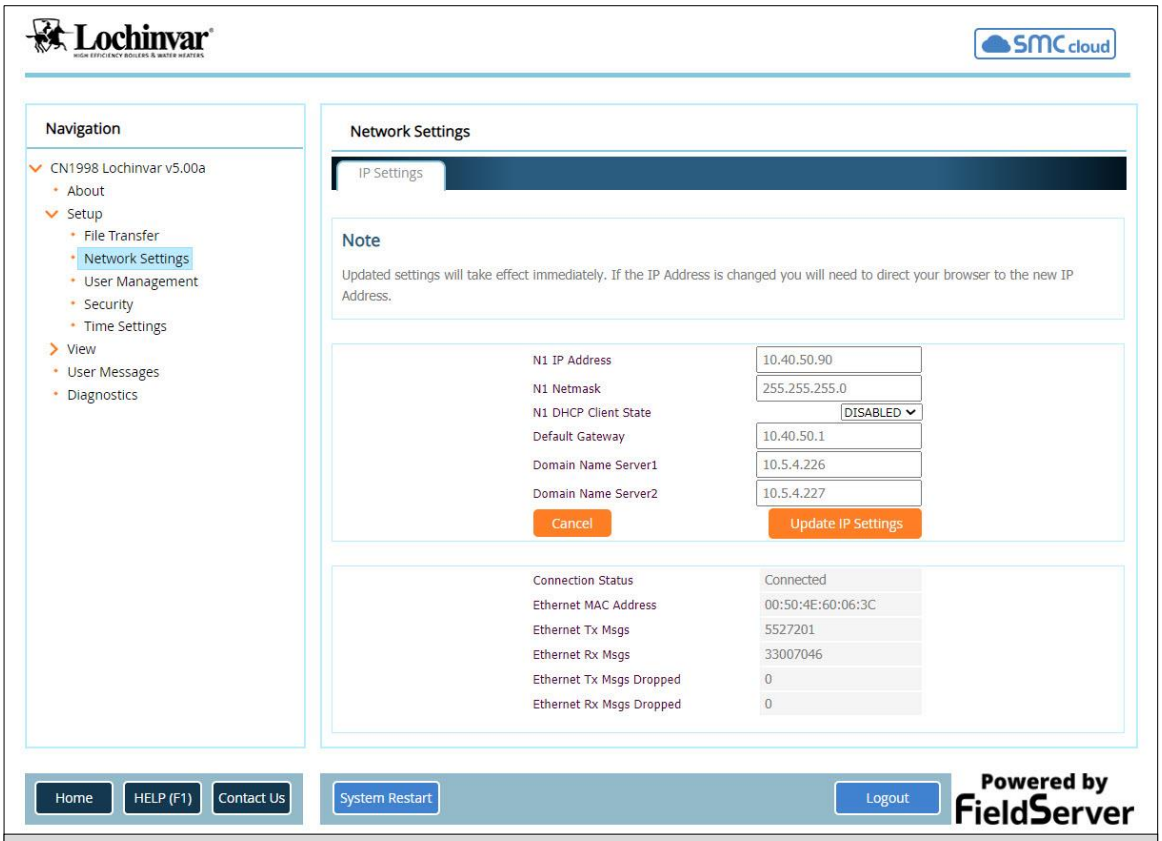


Figure 24: Changing IP Address via FS-GUI

- 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 SMC cloud (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:

  Device Instance (desired) = Node_Offset + 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 = 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.

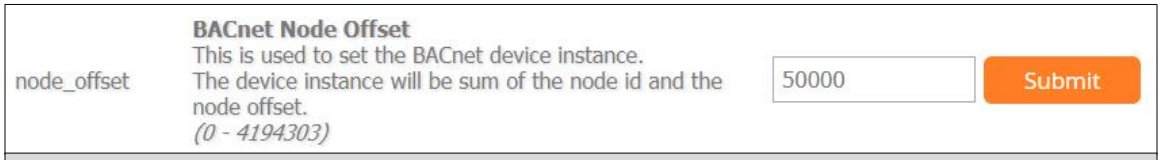


Figure 25: Web Configurator Node Offset Field

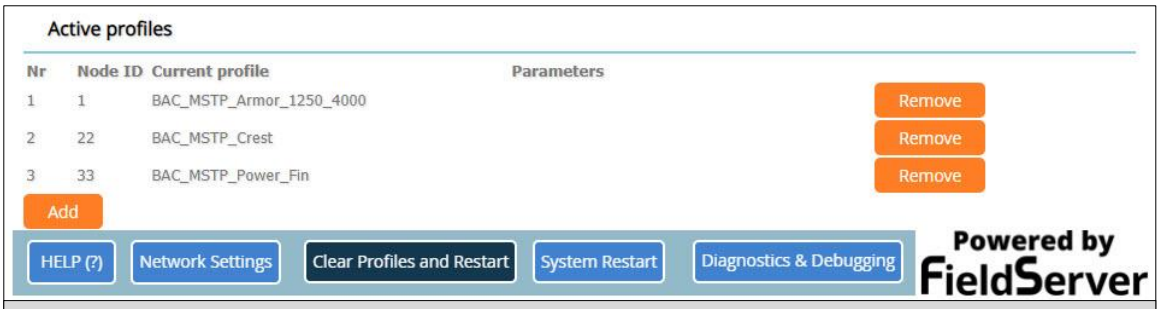


Figure 26: Active Profiles

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.

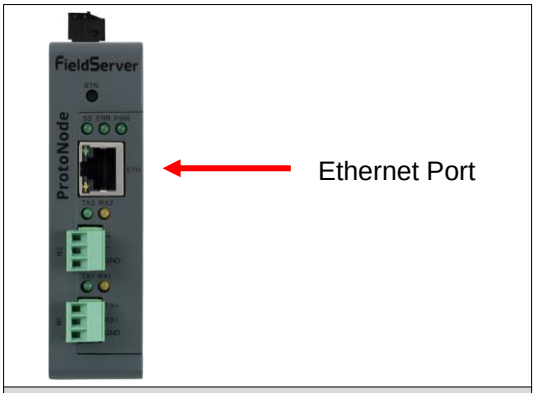
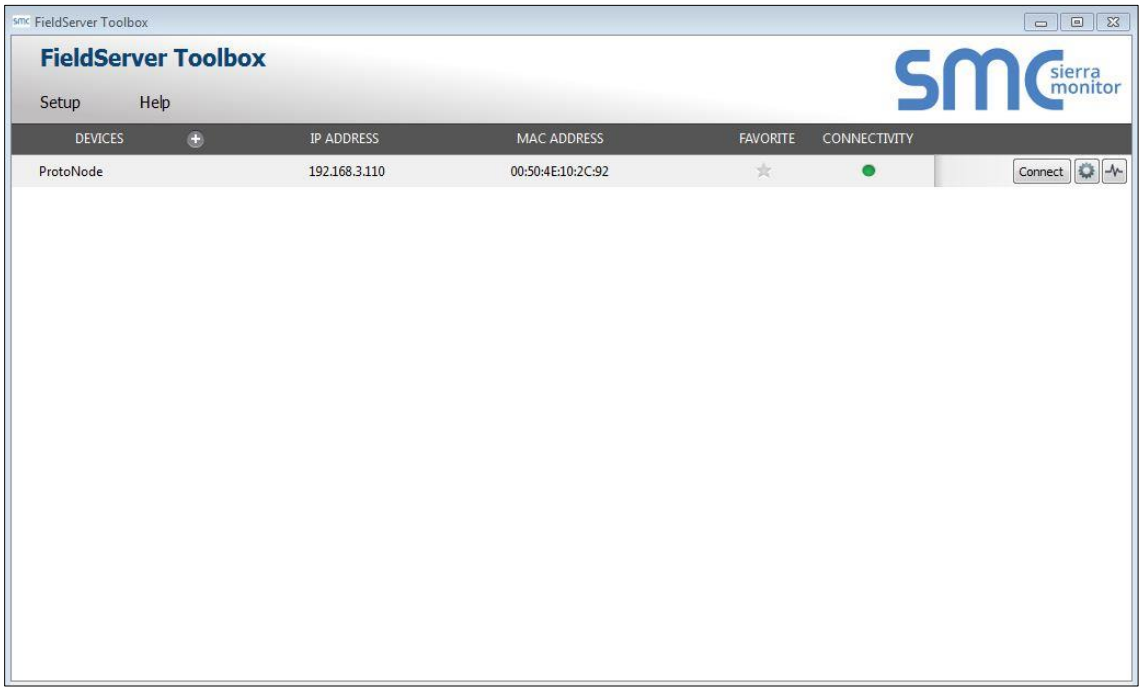


Figure 27: Ethernet Port Location

- 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.

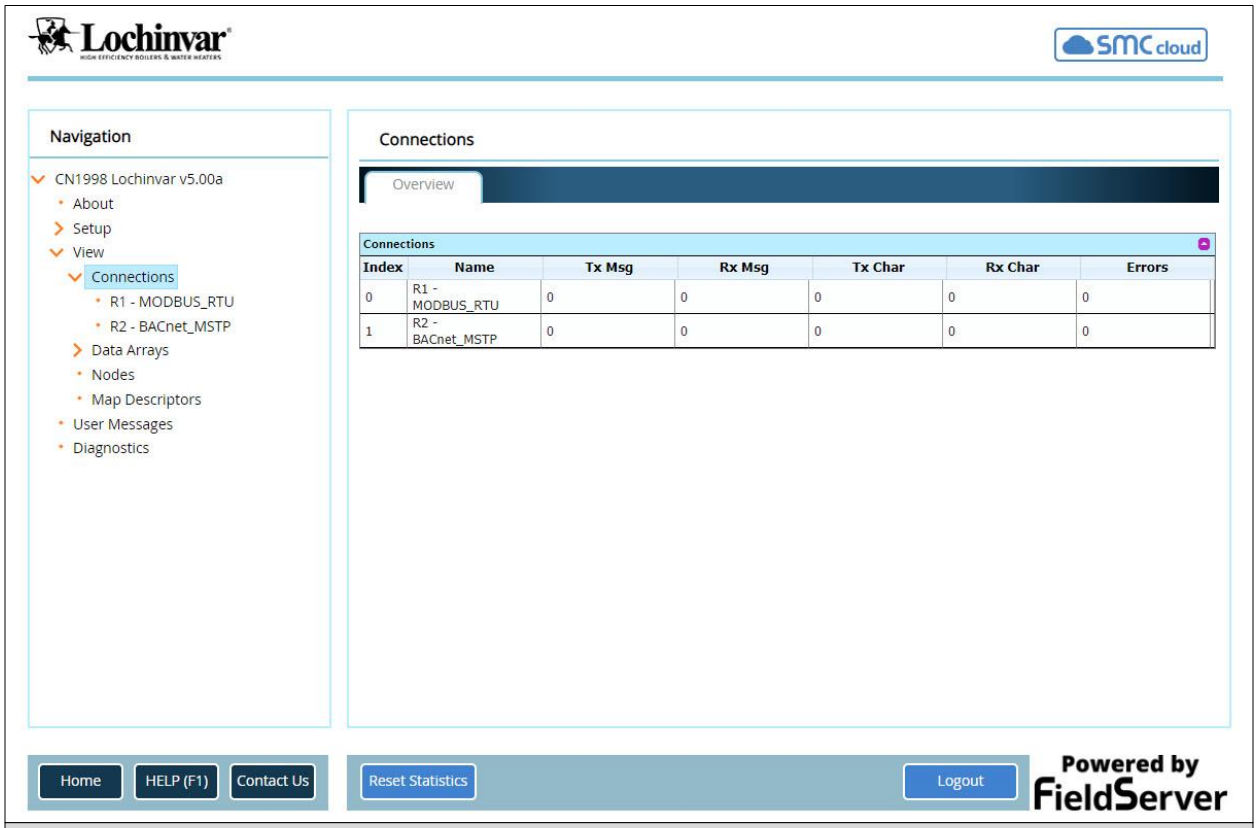


Figure 28: Error Messages Screen

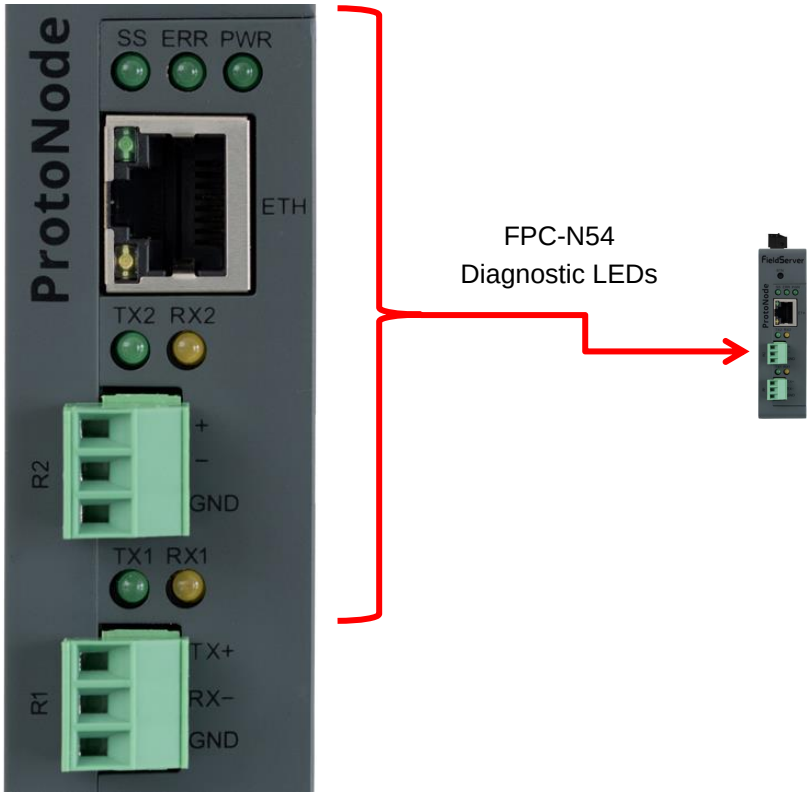
Appendix A.3 Checking Wiring and Settings

- 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.



Tag	Description
SS	The SS LED will flash once a second to indicate that the bridge is in operation.
ERR	The SYS ERR LED will go on solid indicating there is a system error. If this occurs, immediately report the related “system error” shown in the error screen of the FS-GUI interface to support for evaluation.
PWR	The power light should always show steady green when connected to a functioning power source.
RX	The RX LED will flash when a message is received on the serial port on the 3-pin connector. **If the serial port is not used, this LED is non-operational.** RX1 applies to the R1 connection while RX2 applies to the R2 connection.
TX	The TX LED will flash when a message is sent on the serial port on the 3-pin connector. **If the serial port is not used, this LED is non-operational.** TX1 applies to the R1 connection while TX2 applies to the R2 connection.

Figure 29: Diagnostic LEDs

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.

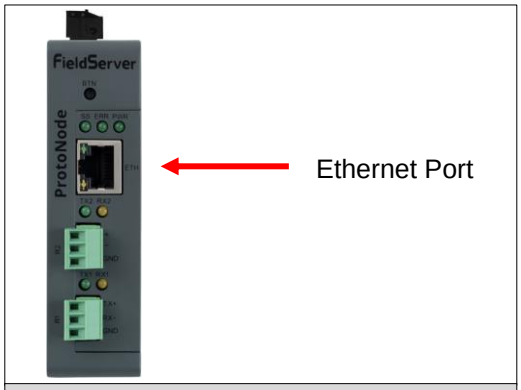
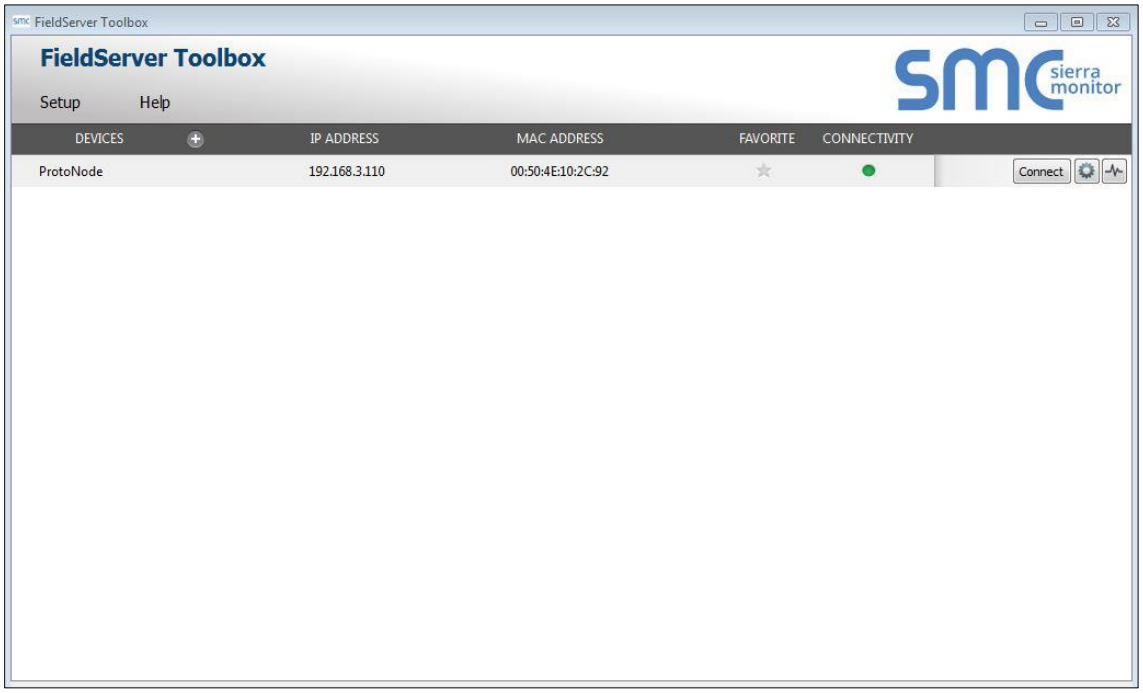


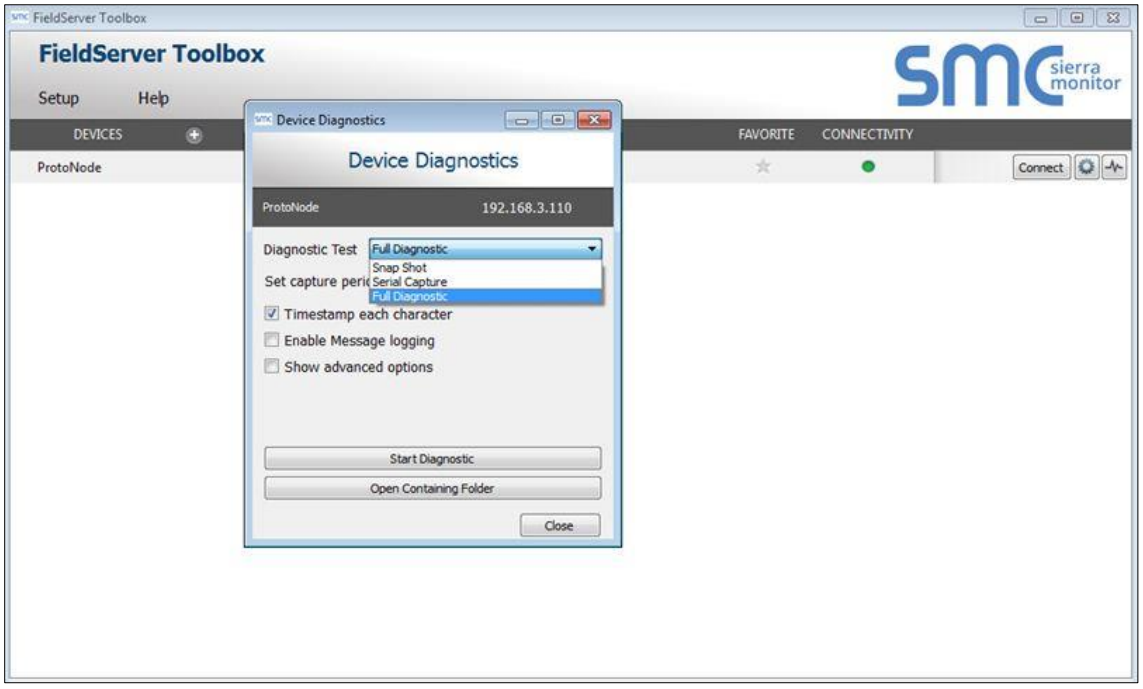
Figure 30: Ethernet Port Location

- 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

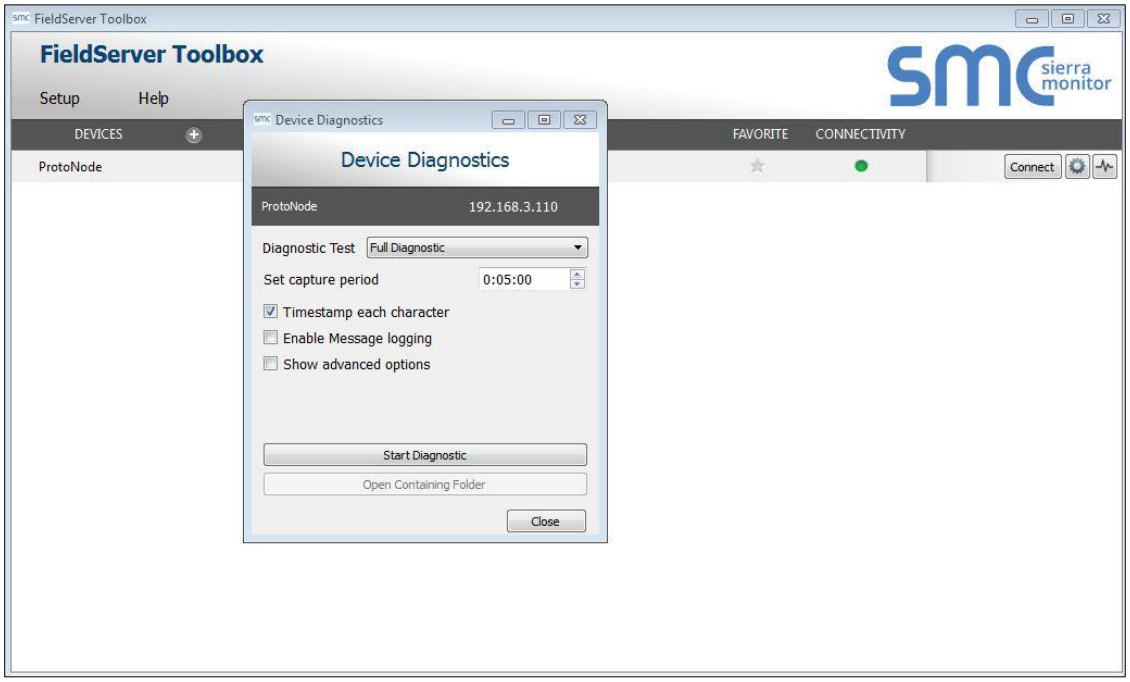


  - Ensure “Full Diagnostic” is selected (this is the default)



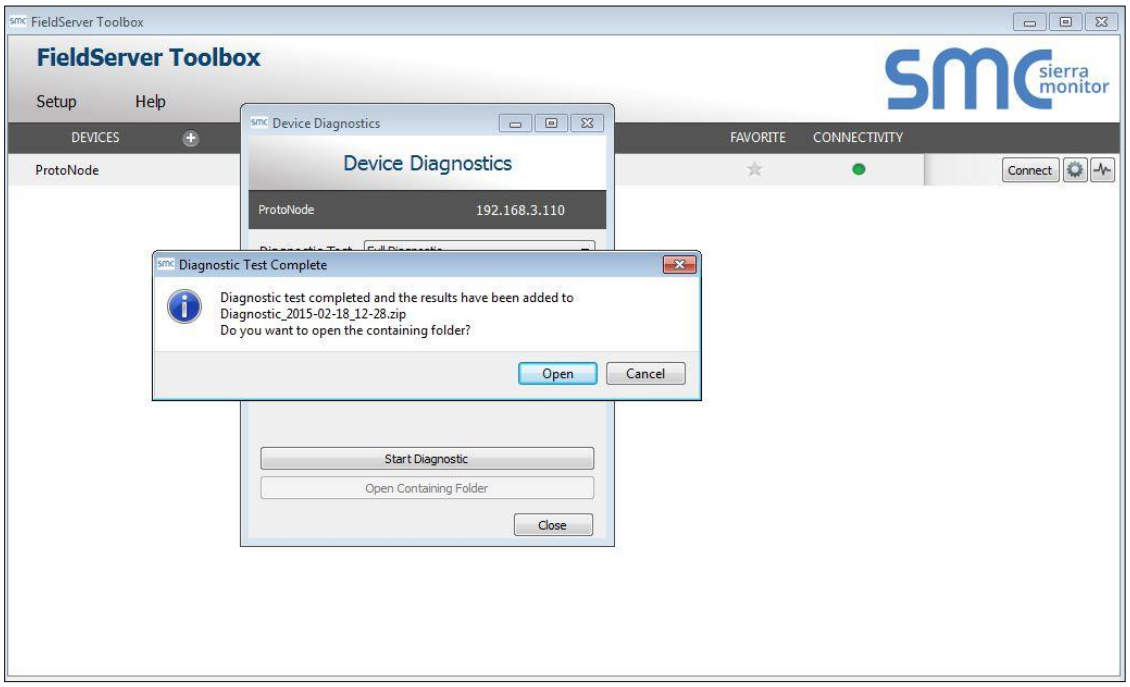
NOTE: If desired, the default capture period can be changed.

- 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

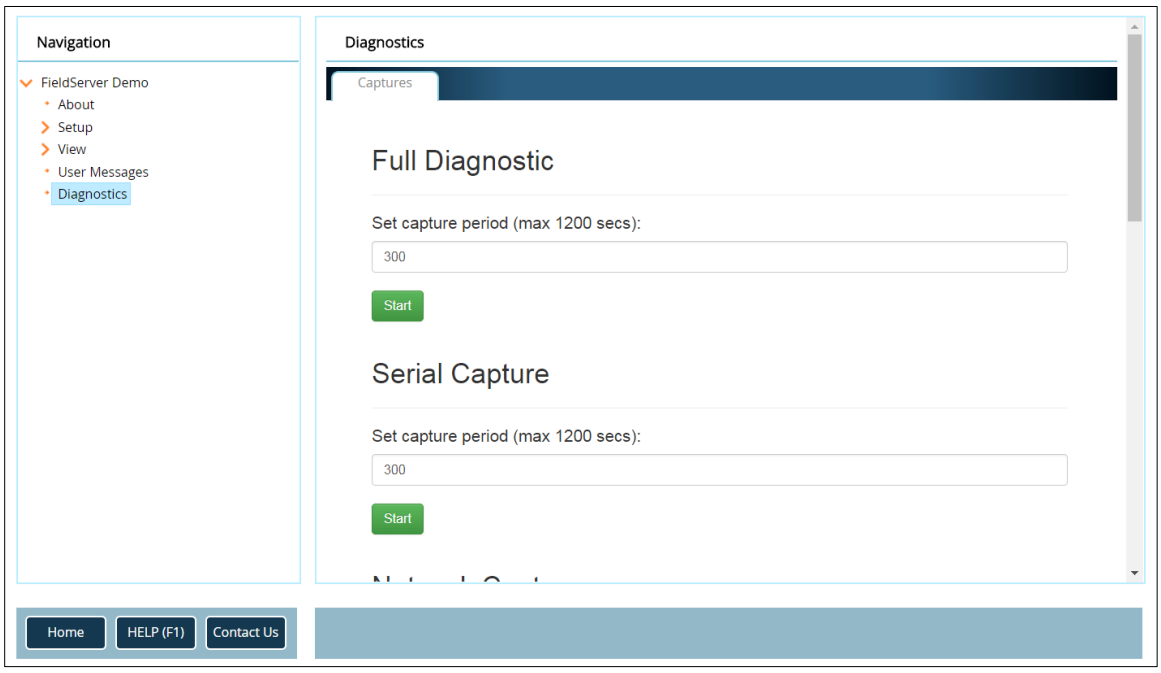


  - Choose “Open” to launch explorer and have it point directly at the correct folder
  - Email the diagnostic zip file to technical support.

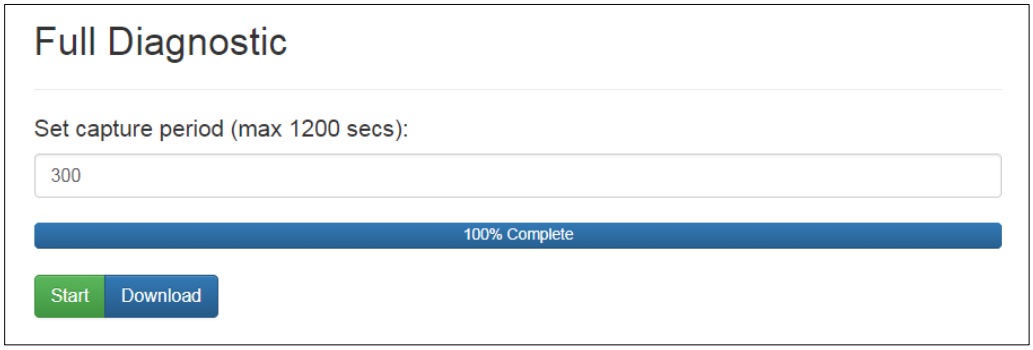
Appendix A.5.2 Using FS-GUI

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.
   - Default IP Address is 192.168.1.24
   - 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.

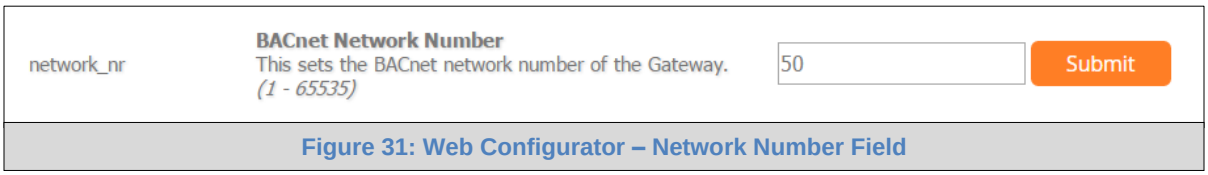


Figure 31: Web Configurator – Network Number Field

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.

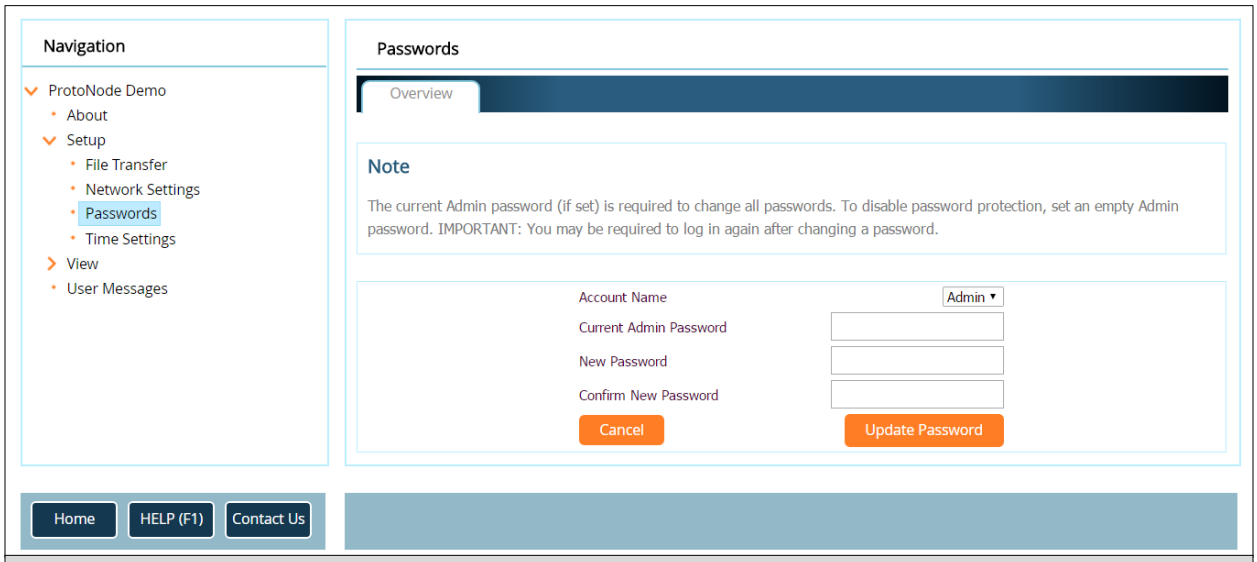


Figure 32: FS-GUI Passwords Page

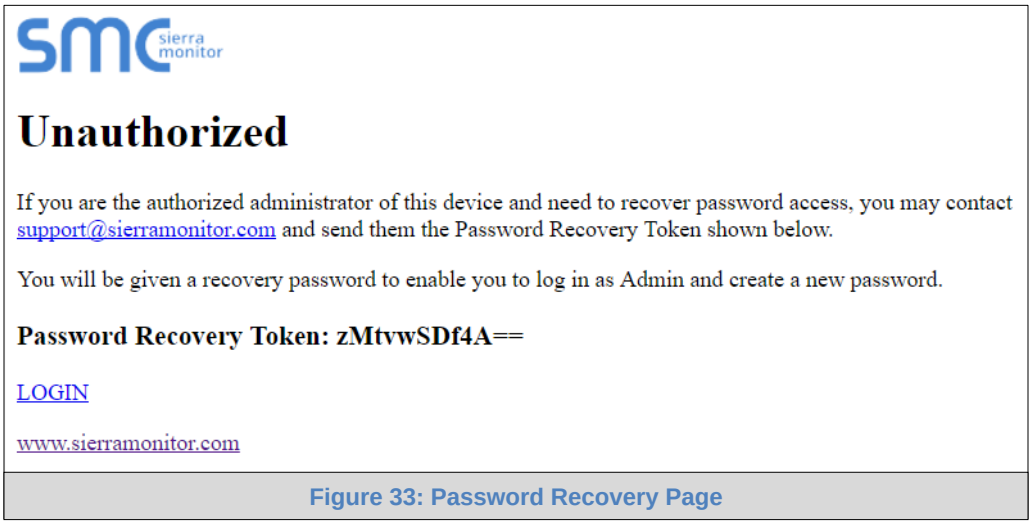


Figure 33: Password Recovery Page

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.

Figure 34: DIN Rail

Appendix B.7 Physical Dimension Drawing

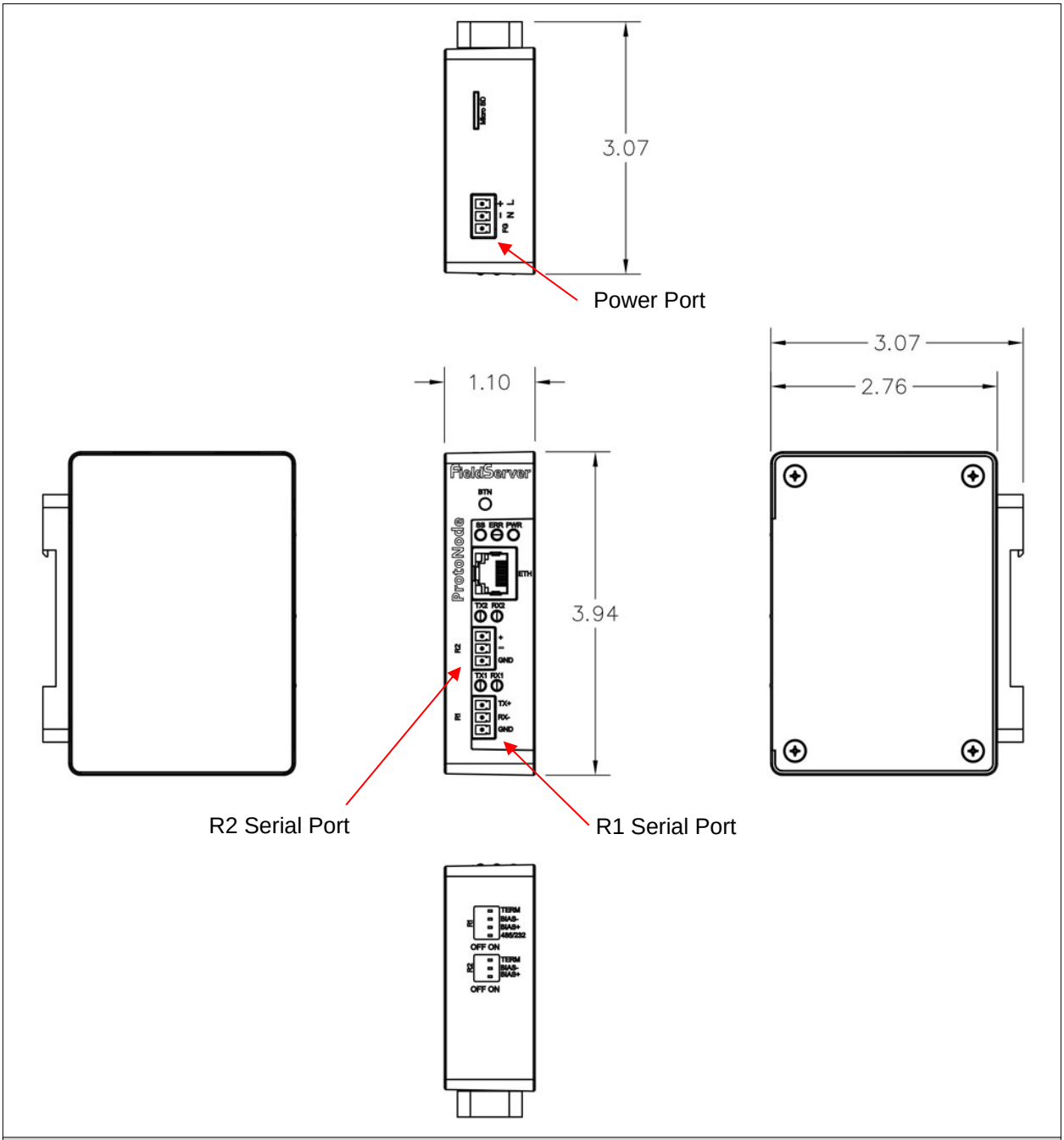


Figure 35: ProtoNode FPC-N54 Dimensions

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.

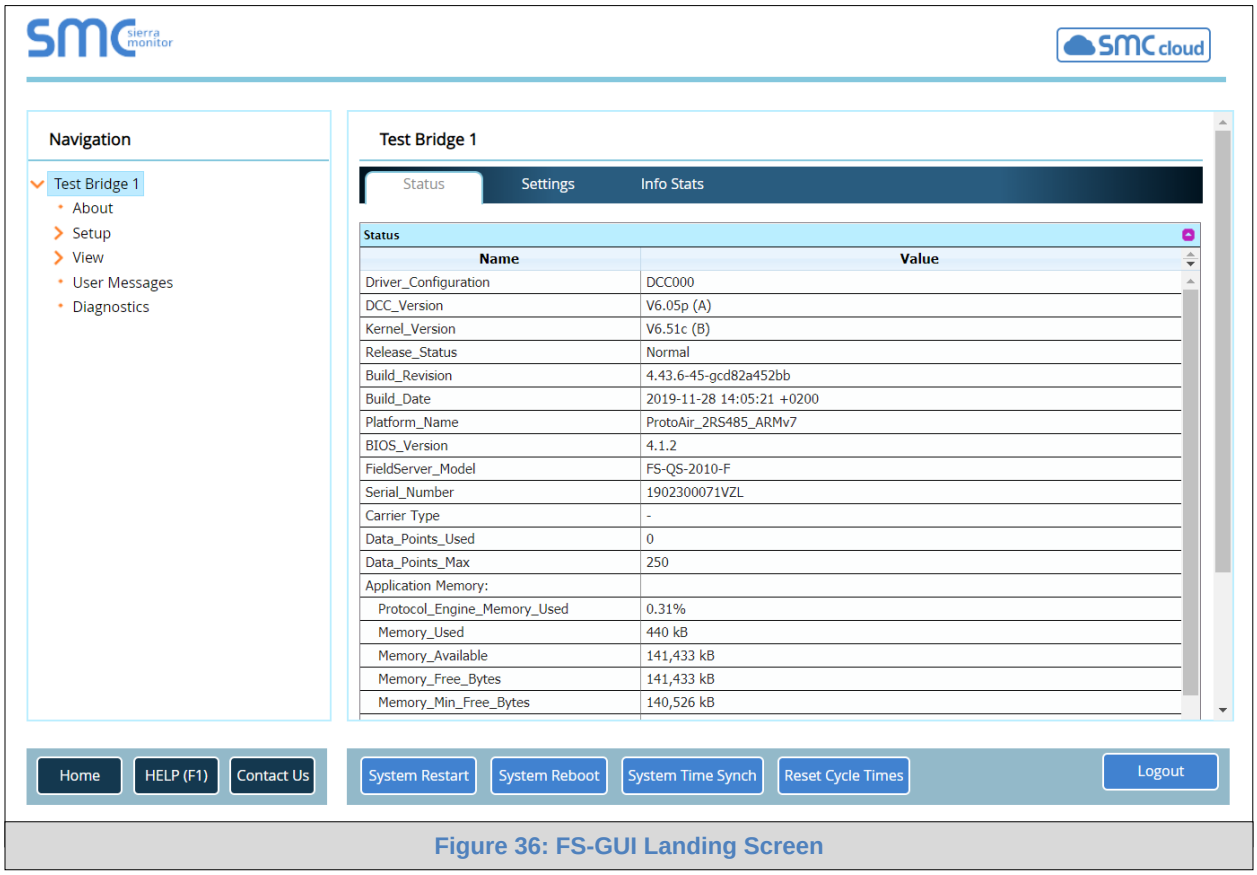


Figure 36: FS-GUI Landing Screen

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.

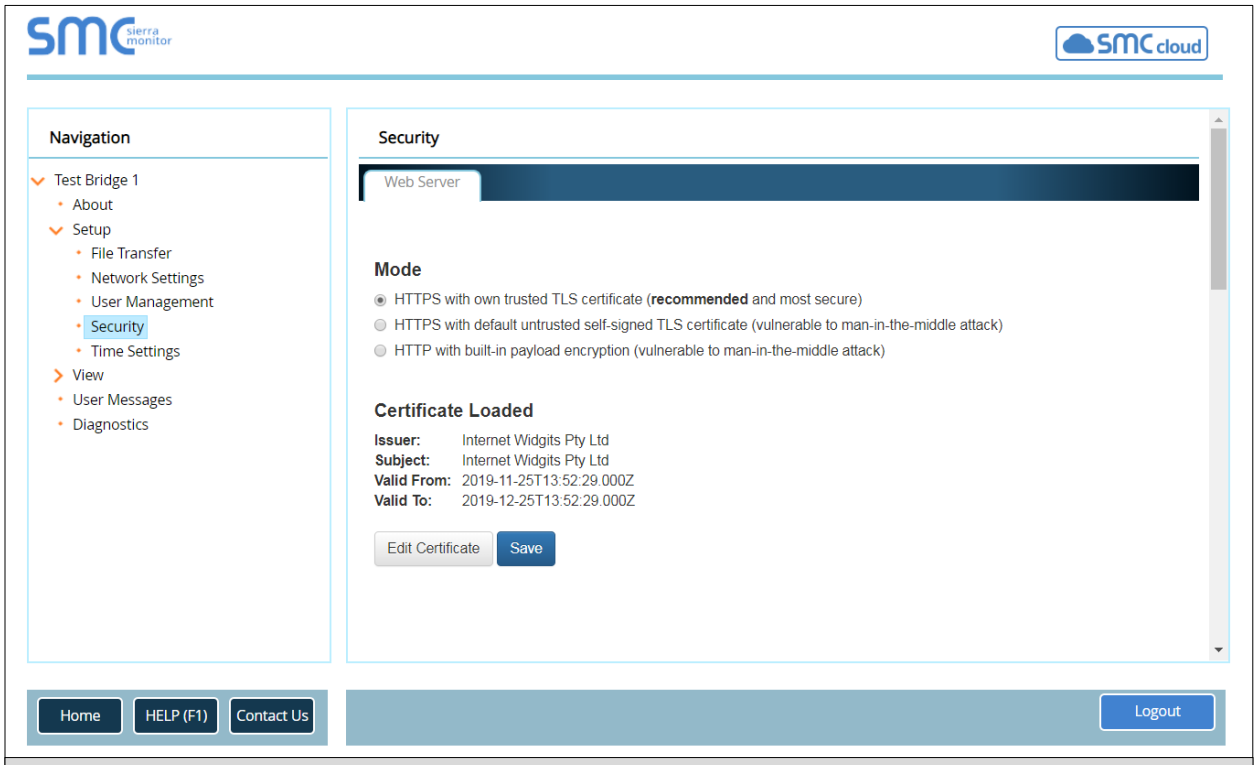


Figure 38: FS-GUI Security Setup – Certificate Loaded

- 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.

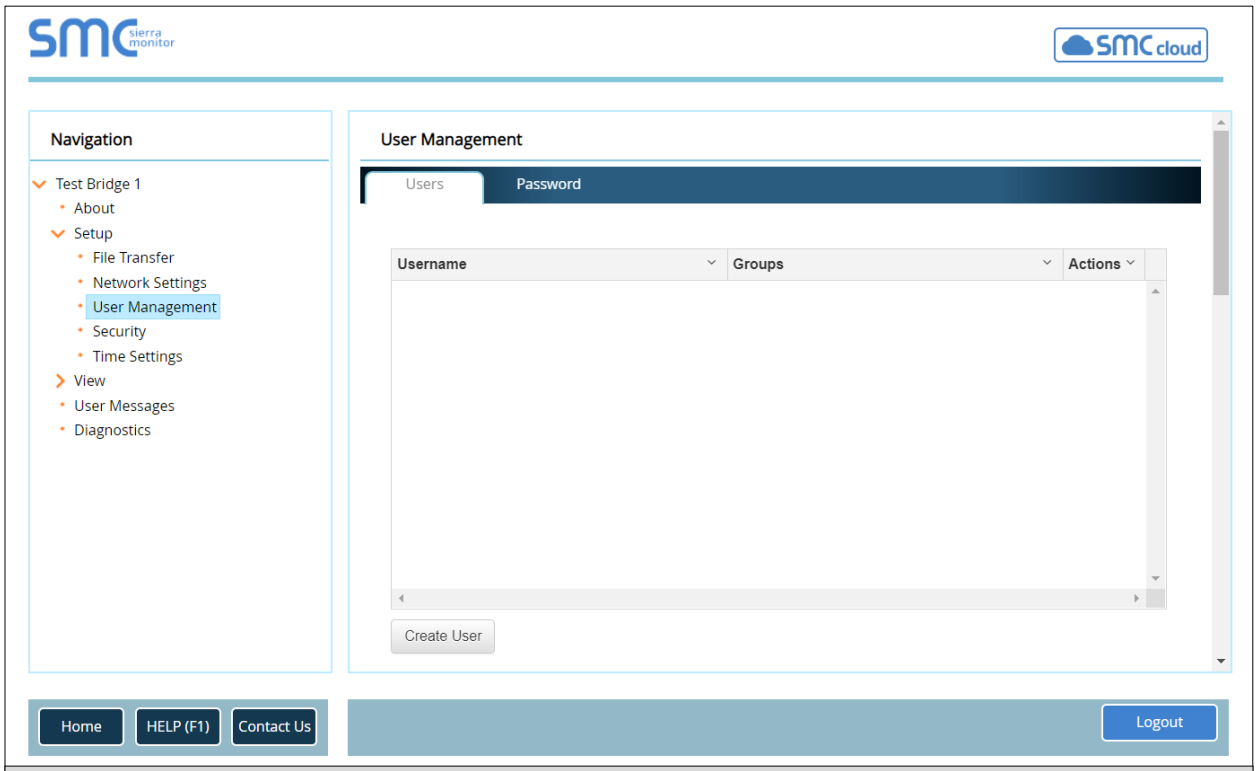


Figure 39: FS-GUI User Management

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.

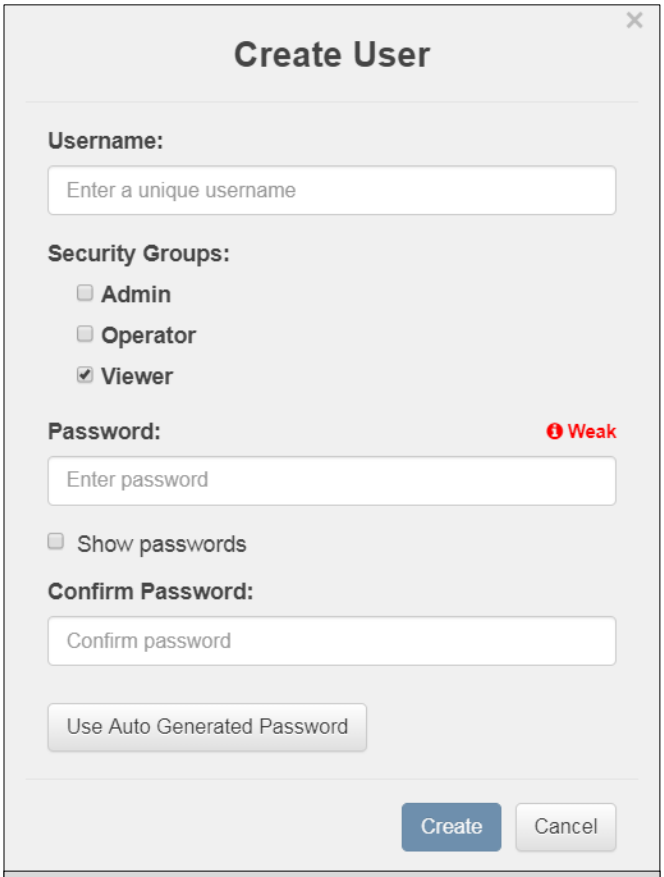


Figure 40: Create User Window

- 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.

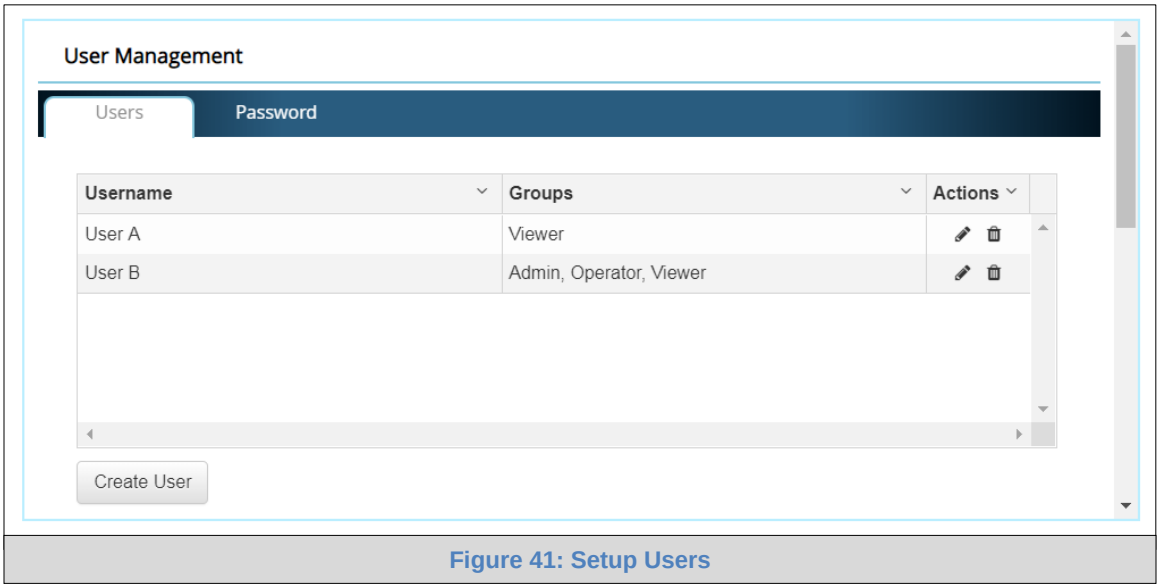


Figure 41: Setup Users

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

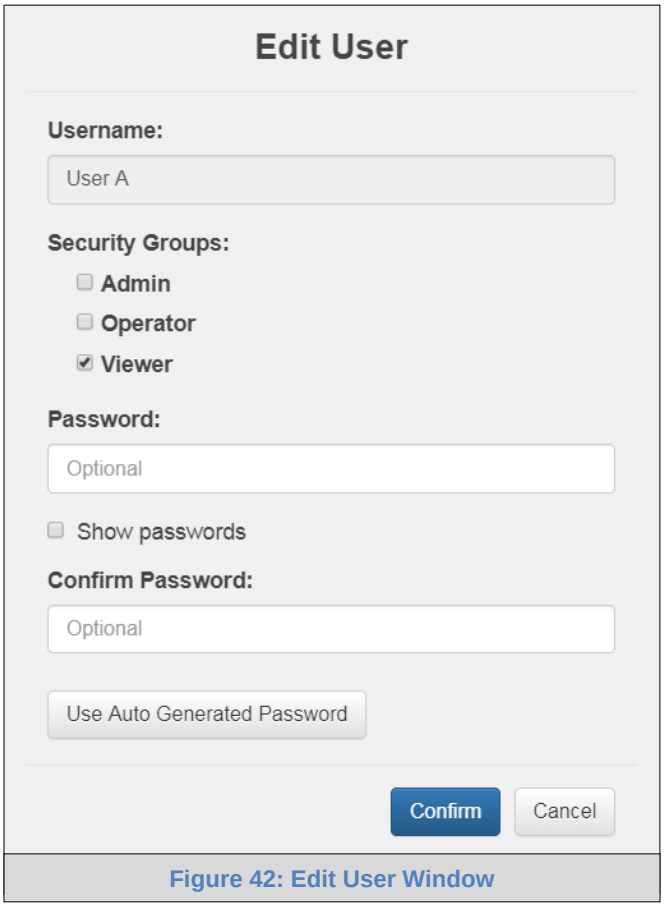


Figure 42: Edit User Window

- 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.

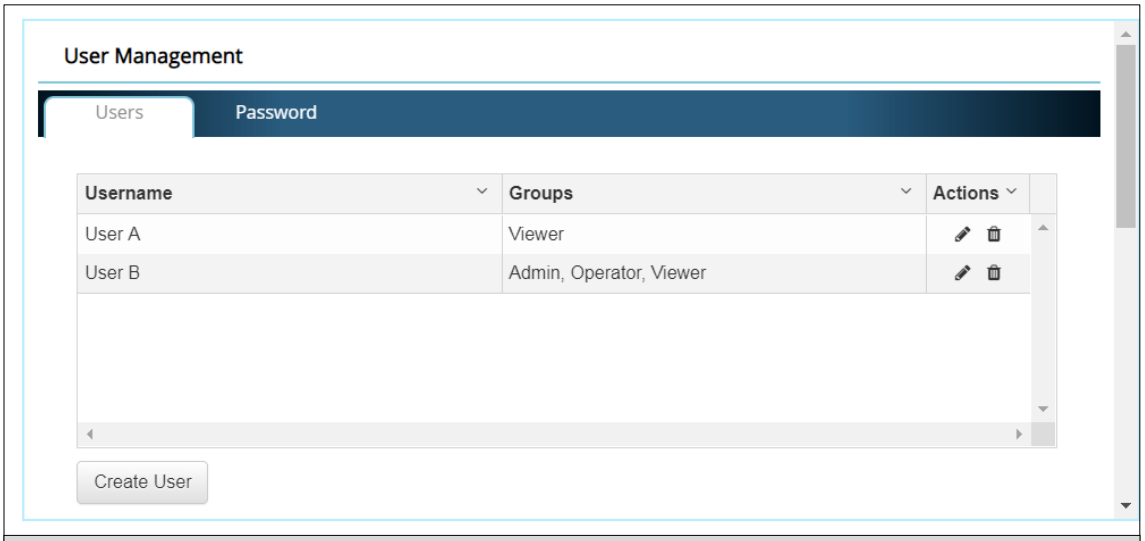


Figure 43: Setup Users

- When the warning message appears, click Confirm.

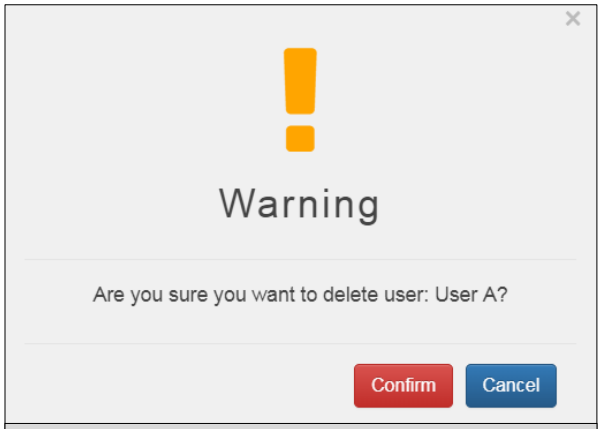


Figure 44: User Delete Warning

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.

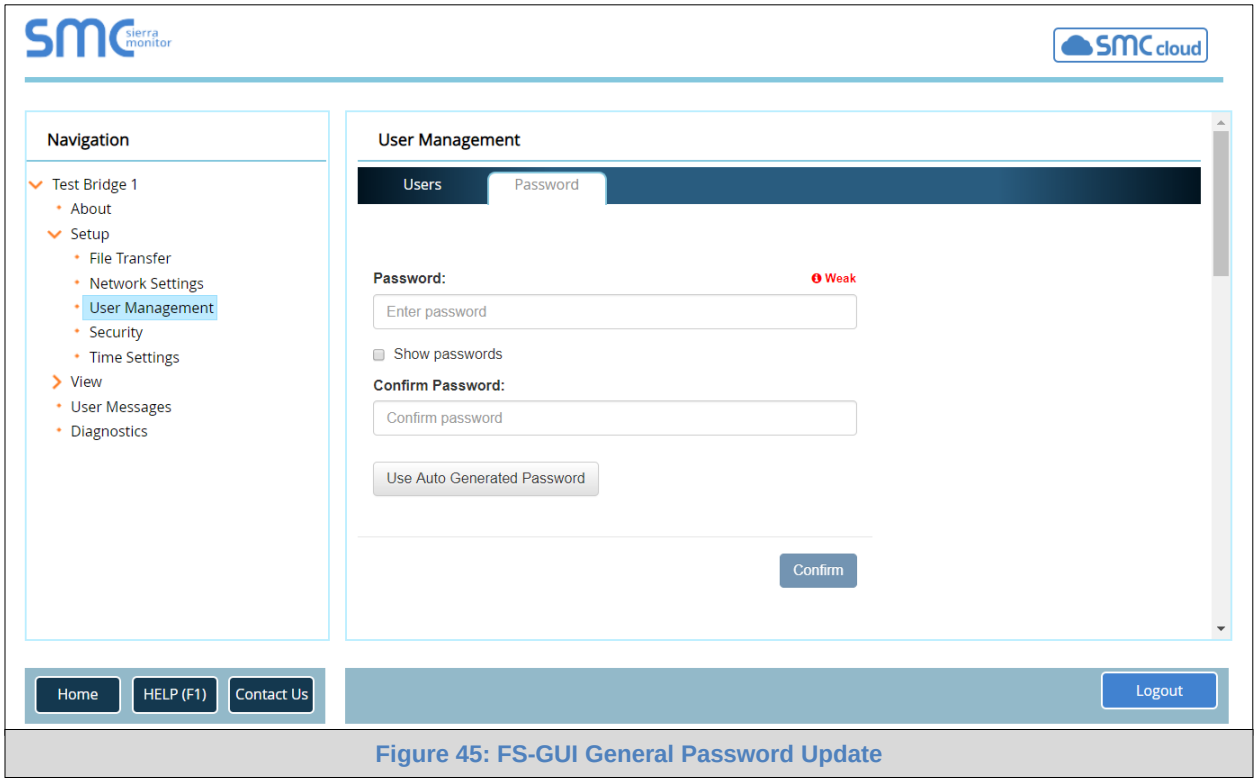


Figure 45: FS-GUI General Password Update

- 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	*Input Voltage:* 9-30VDC or 24VAC *Current draw:* 24VAC 0.125A *Max Power:* 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 to158°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.