



Installation and Operating Instructions
NTI ProtoNode Model FPC-N54-2217 P/N 6500656800

NTI Document #420012001000

Technical Support

Thank you for your purchase of NTI ProtoNode FPC-N54-2217.

For technical support contact NTI Boilers directly at (800) 688-2575 option 1.

If necessary NTI will engage MSA Safety to escalate your support request.

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1 About the ProtoNode

The ProtoNode is a high performance Building and Industrial Automation multi-protocol gateway providing protocol translation between serial/Ethernet devices and networks. The ProtoNode communicates with respective NTI Boilers (see the list below) using Modbus RTU protocol and RS485 electrical signalling interface.

NOTE: For troubleshooting assistance refer to [Section 9 Troubleshooting](#), or any of the troubleshooting appendices in the related driver supplements. Check the [MSA Safety website](#) for technical support resources and documentation that may be of assistance.

The ProtoNode is cloud ready and connects with MSA Safety's Grid. See [Section 8.4.1 Accessing the FieldServer Manager](#) for further information.

IMPORTANT: NTI ProtoNode FPC-N54-2217 is compatible **ONLY** with NTI Lx, TFT and FTG boiler models.

IMPORTANT: NTI ProtoNode FPC-N54-2217 is supplied factory-configured. No field configuration is required except:

1. Network configuration which may be needed for specific application requirements
2. Protocol selection, one of:
 - (1) BACnet/IP
 - (2) BACnet MS/TP
 - (3) BACnet MS/TP Single Node

IMPORTANT: The installer **MUST** have a personal computer (PC), preferably a laptop, with a wired Ethernet connection in order to perform configuration and troubleshooting of the ProtoNode.

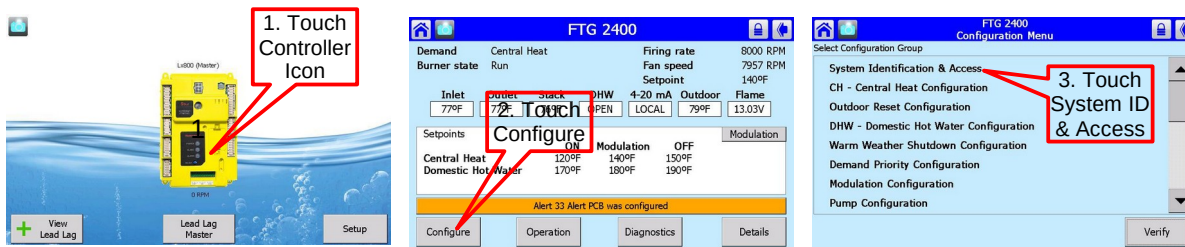
1.1 Quick Start Guide

- Configure Modbus communication settings in each boiler and its touchscreen (Section 2)
- Physically install the ProtoNode and connect wiring (Sections 2 & 3)
- Power up the ProtoNode (Section 4)
- Connect a PC to the ProtoNode (Section 5)
- Configure the ProtoNode (Section 8)

2 Equipment Setup

2.1 Configure Modbus Communication Settings in the Boiler(s)

For a single boiler, normally the Modbus address settings do not need to be modified. If the ProtoNode must communicate with more than one boiler, first make sure EACH boiler has its own UNIQUE Modbus address in accordance with Modbus rules. On the touchscreen, go to the System Identification and Access screen. Look at the “MB1 Modbus Address” line. Make sure you set the MB1 Modbus Address to a different number for each boiler. The numbers must be between 1 and 8, inclusive. For example, if there are 3 boilers, use 1, 2 and 3 as the addresses of the respective boilers. While not mandatory, it’s recommended to make the MB2 Modbus Address the same as MB1.



4.1 System Identification & Access

Figure 4-2 System Identification & Access Screen

The System Identification & Access page contains information about the controller. Login with the installer password is required to modify factory settings. Up to twenty (20) characters each may be entered for the Boiler name and Installation. The installer may use these areas to record installation-specific data.

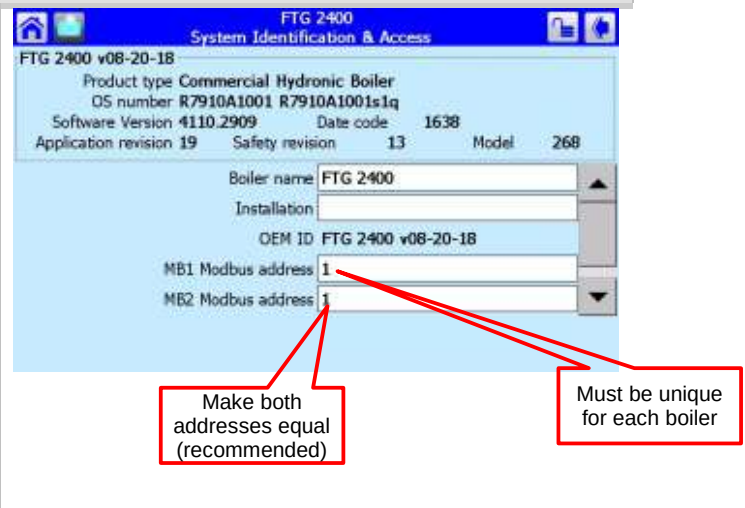


Table 4-2 System Identification & Access

Parameter	Description	Factory Settings
Boiler name *	Series and model no. of boiler or water heater unit, e.g. Tft60; limit 20 characters.	Model no.
Installation *	Installation specific data, e.g. installation date; limit 20 characters	Blank
MB1 Modbus Address *	Modbus communication address used by the display to identify the attached controller. Range: 1 – 8.	1
MB2 Modbus Address *	Unique controller I.D. needed when multiple units connected together in a Lead Lag cascade configuration; Lead-lag: each boiler needs unique address. Range: 1 – 8.	1

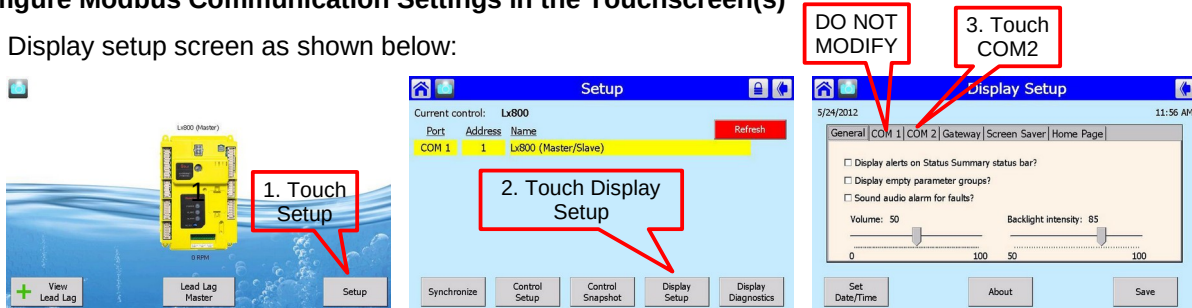
Password protected

10

Note: the above is an excerpt from the document “86570 Trinity Lx-Tft Appendix A - Controller and Touchscreen Display S7999D”. Please refer to this document for detailed information about interacting with and using the touchscreen display.

2.2 Configure Modbus Communication Settings in the Touchscreen(s)

Access the Display setup screen as shown below:

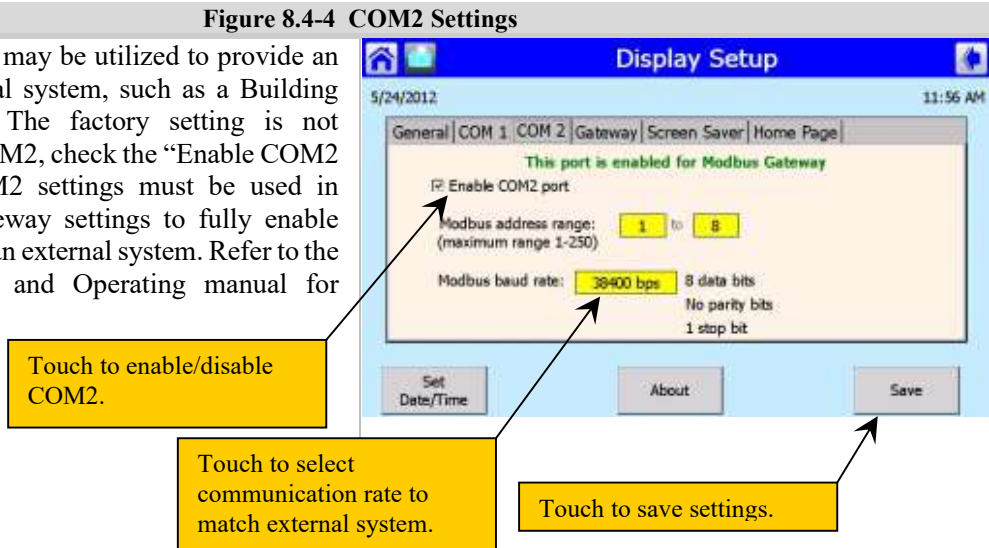


NOTE: DO NOT MODIFY THE COM1 FACTORY SETTINGS. Follow the instructions in the graphic below to enable the COM2 port and set the Gateway function. For the COM2 Serial Port, make sure the check box “Enable COM2 port” is checked. The “Modbus baud rate” must be set to 38400 bps. This is the factory default, but if it has been set to another value, reset it to 38400. For the Modbus Gateway, make sure the “Enable Modbus gateway?” check box is checked. Further, make sure that “Gateway on COM2 port” is selected. If you make any changes, make sure you touch the Save button in the lower right corner of the screen, then go to the Display Diagnostics screen and touch the Display Reset button to reboot the screen. You can turn the power off and then on instead if you wish.

COM2 Serial Port

Figure 8.4-4 COM2 Settings

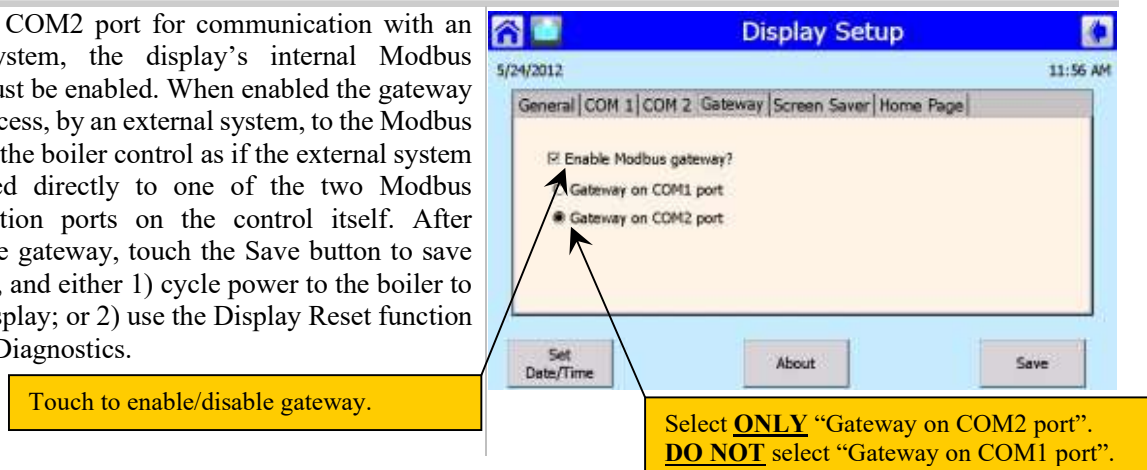
The COM2 serial port may be utilized to provide an interface to an external system, such as a Building Automation System. The factory setting is not enabled. To enable COM2, check the “Enable COM2 port” checkbox. COM2 settings must be used in conjunction with Gateway settings to fully enable communications with an external system. Refer to the appliance Installation and Operating manual for wiring details.



Modbus Gateway

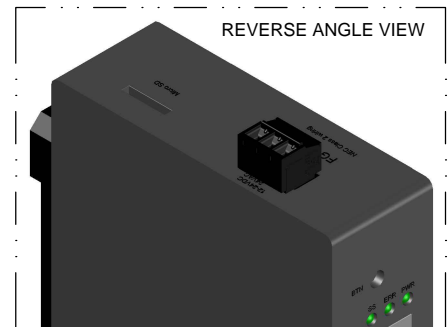
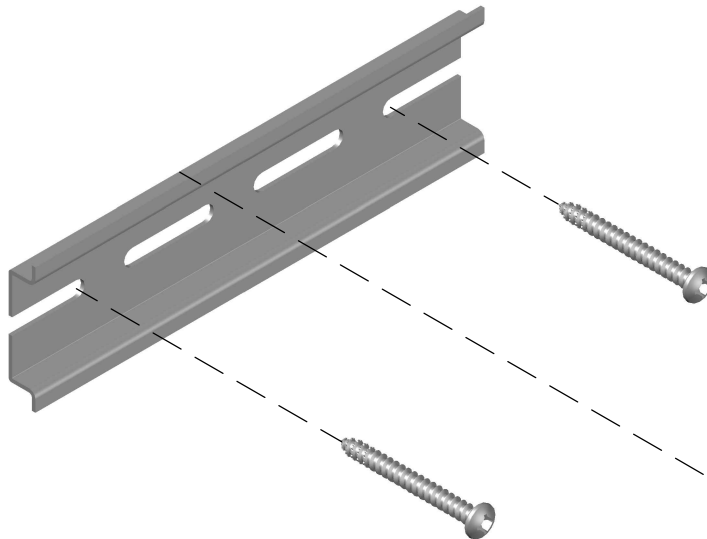
Figure 8.4-5 Gateway Settings

To use the COM2 port for communication with an external system, the display’s internal Modbus gateway must be enabled. When enabled the gateway provides access, by an external system, to the Modbus registers of the boiler control as if the external system is connected directly to one of the two Modbus communication ports on the control itself. After enabling the gateway, touch the Save button to save the settings, and either 1) cycle power to the boiler to reset the display; or 2) use the Display Reset function in Display Diagnostics.



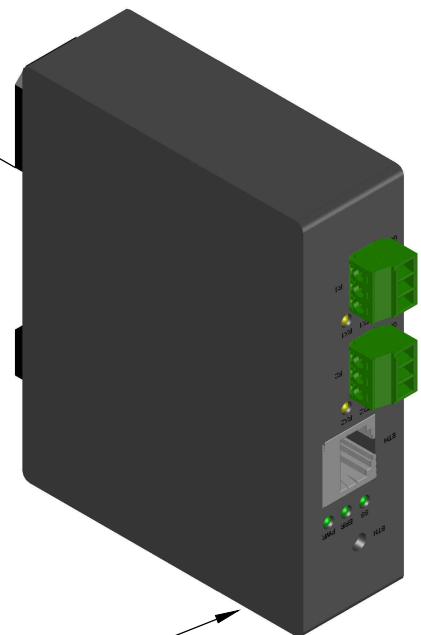
2.3 Mounting

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



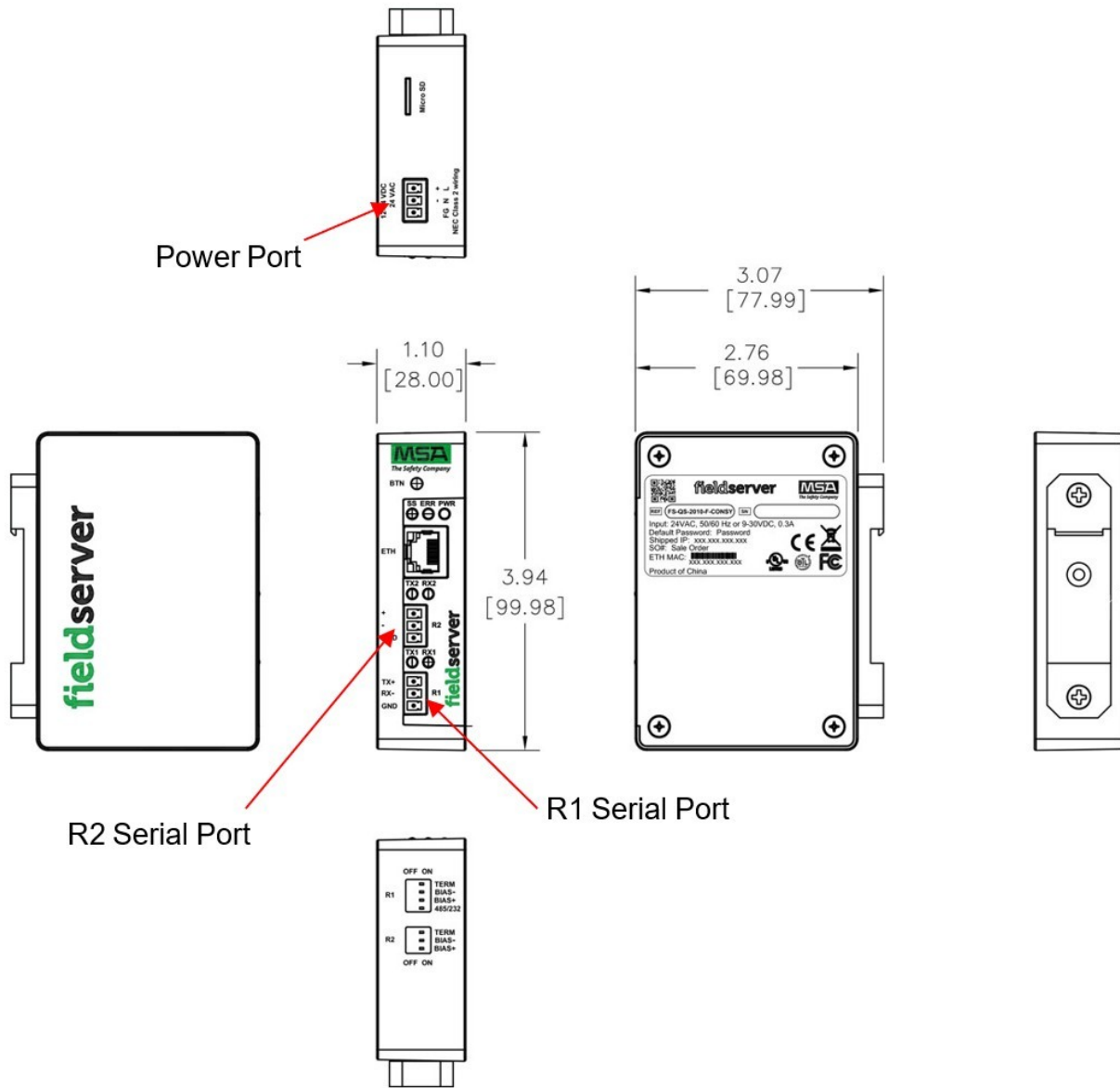
SUGGESTED MOUNTING:

1. USE PROPER PPE AND FOLLOW ALL LOCAL AND NATIONAL CODES
2. MAY BE MOUNTED ANY ORIENTATION, SUGGESTED VERTICAL AS ILLUSTRATED
3. USE FIELD SUPPLIED 35mm x 7.5mm SLOTTED DIN RAIL
4. ATTACH DIN RAIL TO VERTICAL SURFACE IN DRY LOCATION AND SECURE IN PLACE WITH APPROPRIATE FIELD SUPPLIED FASTENERS
5. BE SURE TO PROVIDE PROPER ADEQUATE STRAIN RELIEF FOR WIRING
6. PROVIDE POWER AS DESCRIBED IN THIS GUIDE
7. CONNECT COMMUNICATION WIRING BETWEEN PROTONODE AND BOILER(S) AS DETAILED HEREIN



POWER CONNECTION
SEE REVERSE ANGLE VIEW

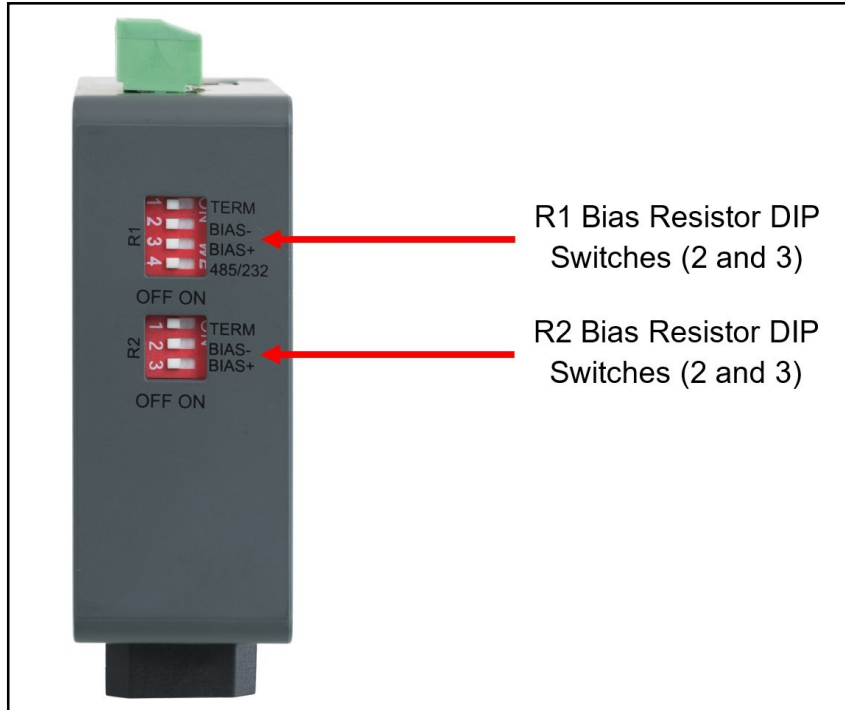
2.4 Physical Dimensions



3 Installation

3.1 DIP Switch Settings

3.1.1 Bias Resistors



To enable Bias Resistors, move both the BIAS- and BIAS+ dip switches to the right in the orientation shown above.

The 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.

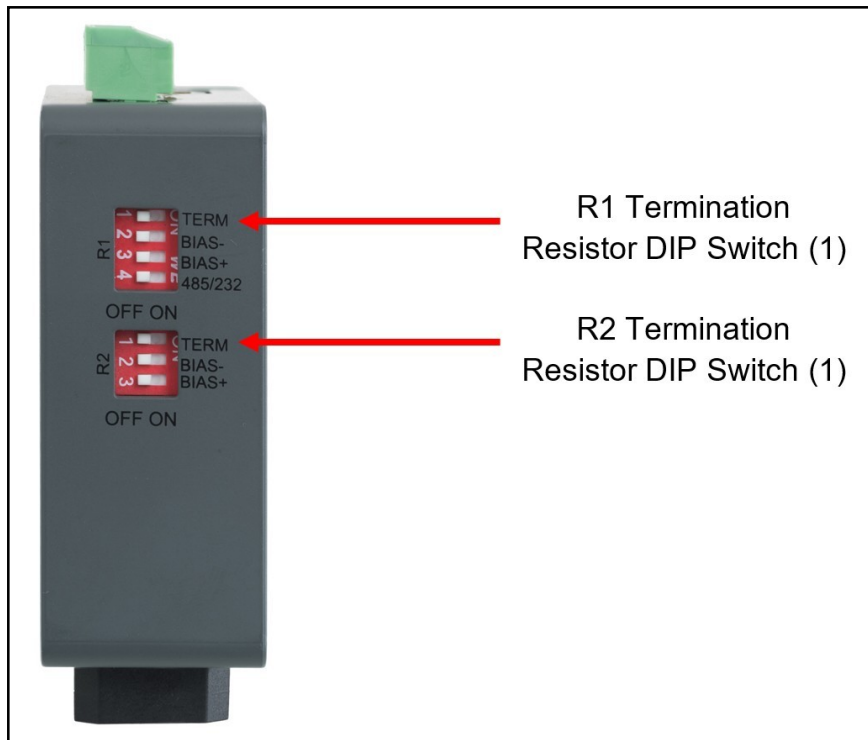
The bias resistor is 510 ohms which is in line with the BACnet spec. It should only be enabled at one point on the bus (for example, on the field port where there are very weak bias resistors of 100k). Since there are no jumpers, many ProtoNodes can be put on the network without running into the bias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

NOTE: See the [Termination and Bias Resistance Enote](#) for additional information.

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.

3.1.2 Termination Resistor



If the gateway 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 above.**

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.

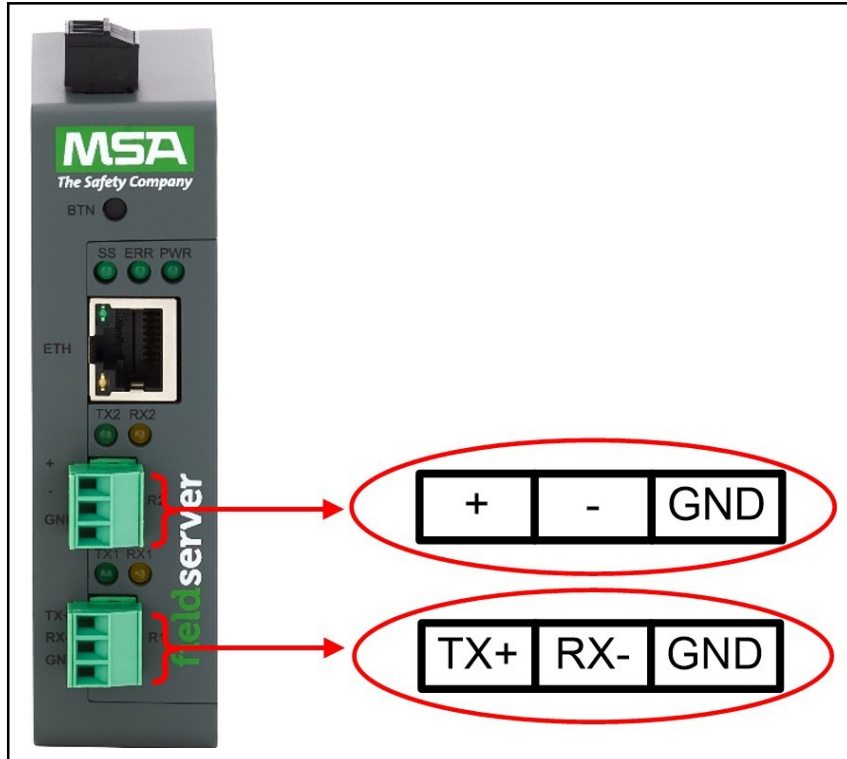
NOTE: If the gateway is already powered on, DIP switch settings will not take effect unless the unit is power cycled.

3.2 Connecting the R1 & R2 Ports

For the R1 Port only: Switch between RS-485 and RS-232 by moving the number 4 DIP Switch left for RS-485 and right for RS-232 (see images in **Section 3.1 DIP Switch Settings**).

The R2 Port is RS-485.

Connect to the 3-pin connector(s) as shown below.



The following baud rates are supported on the R2 Port: 9600, 19200, 38400, 57600, 76800, 115000
The R1 port baud rate is fixed at 38400

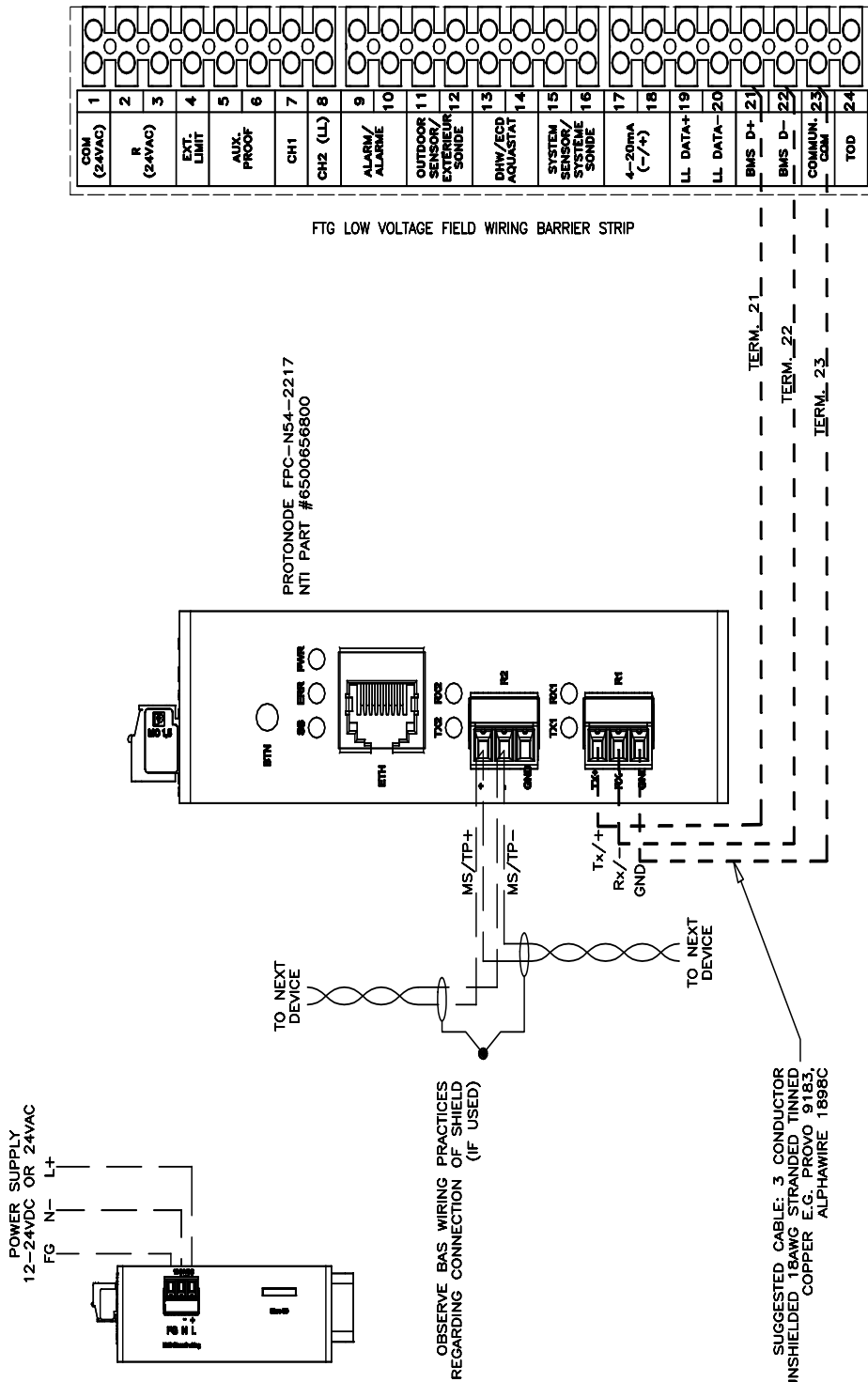
NOTE: Not all baud rates listed are supported by all protocols. Check the specific protocol driver manual for a list of the supported baud rates.

3.2.1 Wiring

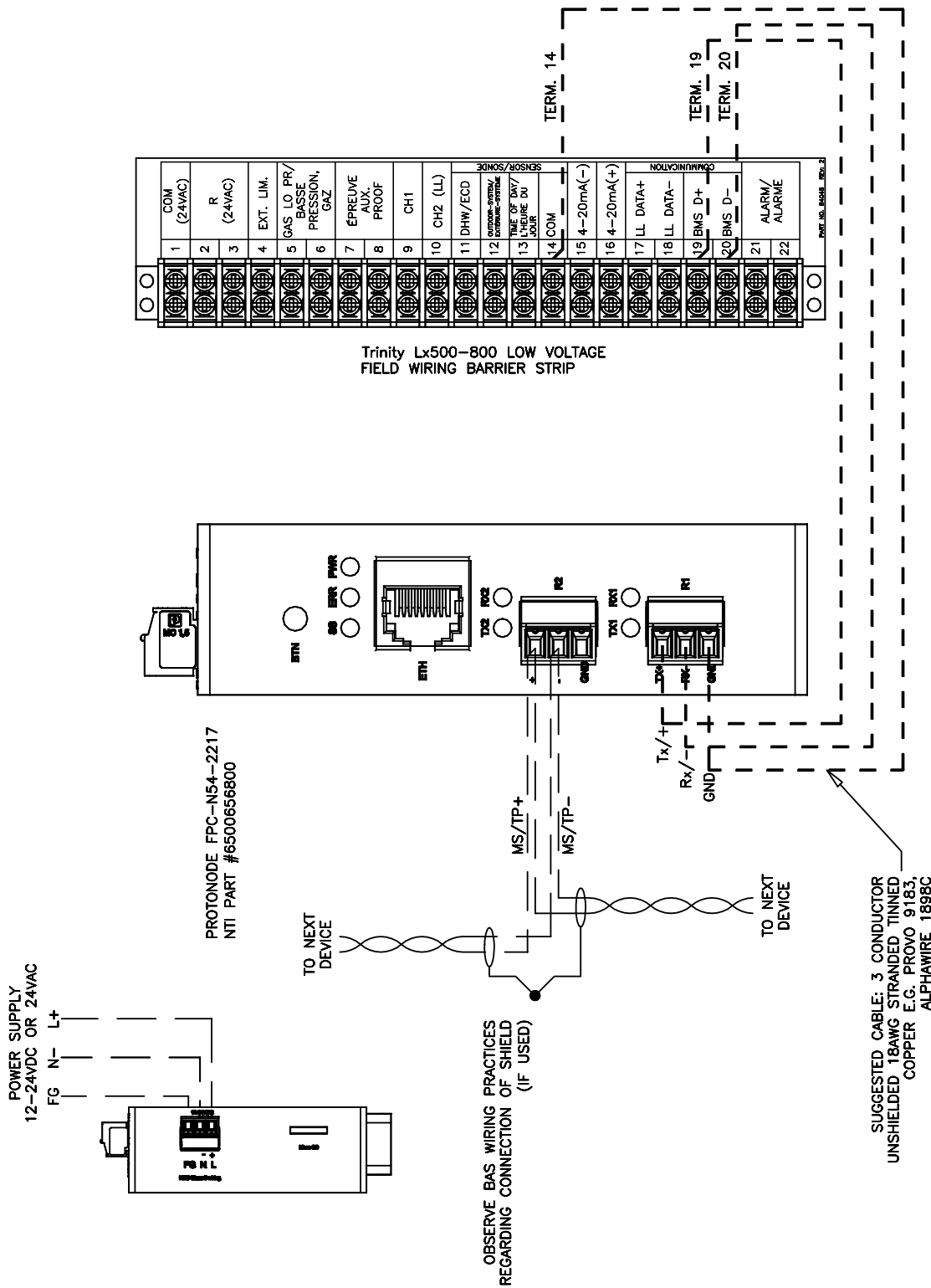
RS-485		RS-232	
BMS RS-485 Wiring	Gateway Pin Assignment	BMS RS-485 Wiring	Gateway Pin Assignment
RS-485 +	TX +	RS-232 -	TX +
RS-485 -	RX -	RS-232 +	RX -
GND	GND	GND	GND

NOTE: Use standard grounding principles for GND.

FTG Boiler Models Wiring

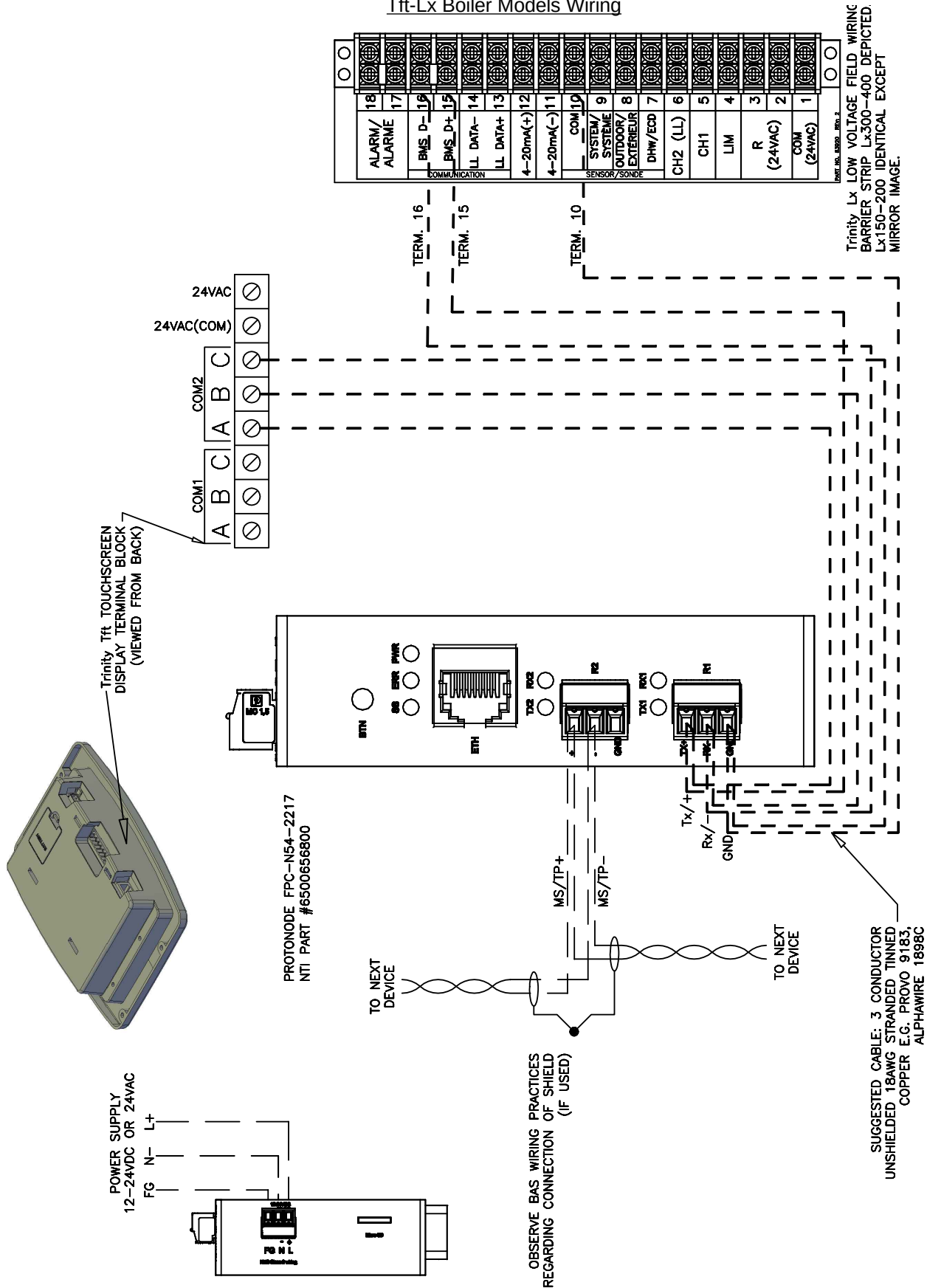


Lx Commercial Boiler Models Wiring



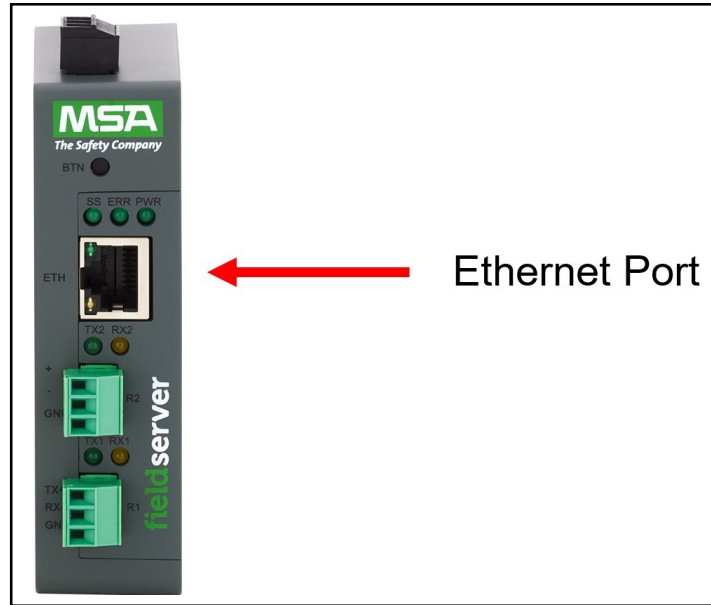
NOTE:
1. **IMPORTANT!** MODBUS GATEWAY IN TOUCHSCREEN DISPLAY MUST BE ENABLED. REFER TO TRINITY Lx AND TRINITY Tt4 IOM MANUALS APPENDIX A FOR INSTRUCTIONS.
2. MULTIPLE BOILERS (UP TO 8) MAY BE DAISY-CHAINED BY CONNECTING LIKE-NUMBERED TERMINALS.

Tft-Lx Boiler Models Wiring



3.3 10/100 Ethernet Connection Port

NOTE: Do not use shielded Ethernet cables.



The Ethernet Port is used both for Ethernet protocol communications and for configuring the gateway via the Web App. To connect the gateway, either connect the PC to the router's Ethernet port or connect the router and PC to an Ethernet switch. Use Cat-5 cables for the connection.

NOTE: The Default IP Address of the gateway is 192.168.1.24, Subnet Mask is 255.255.255.0.

4 Power up the Gateway

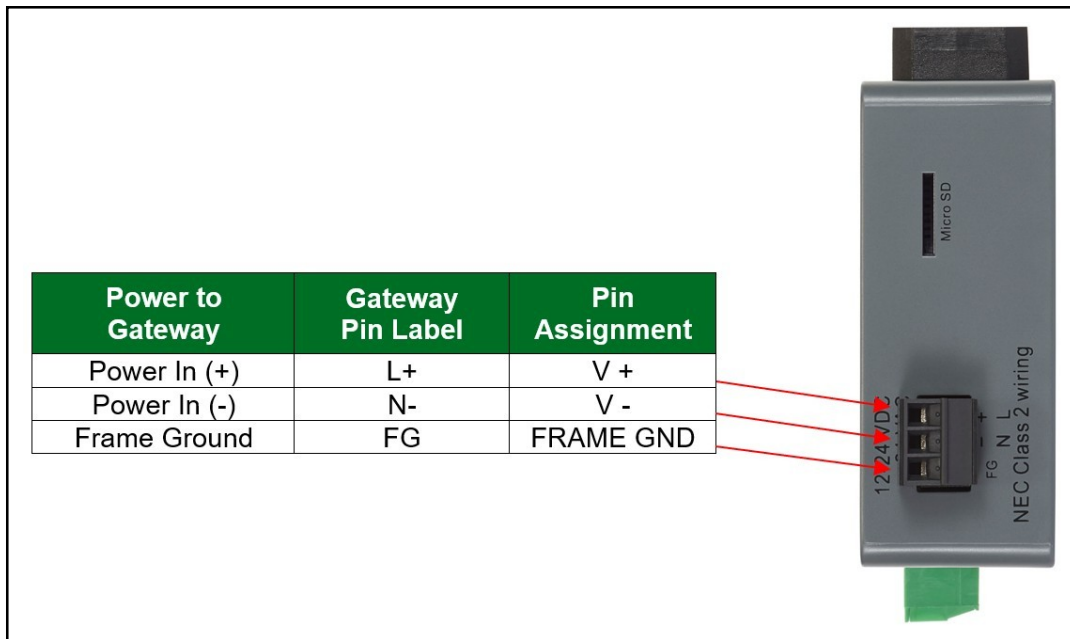
Check power requirements in the table below:

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.

Apply power to the ProtoNode as shown below. Ensure that the power supply used complies with the specifications provided in [Section 10.4 Specifications](#).

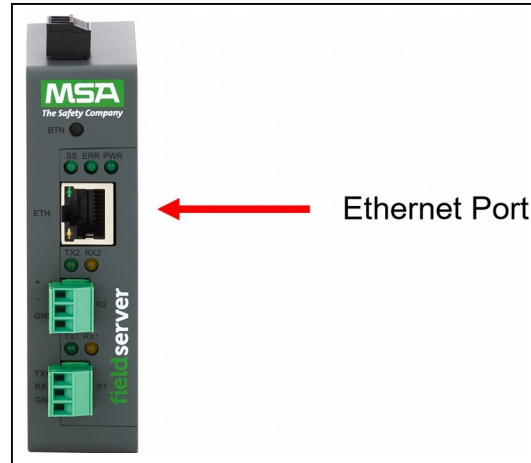
- The gateway accepts 9-30VDC or 24VAC on pins L+ and N-.
 - Supports both Full-Wave and Half-Wave AC
- Frame GND should be connected.



5 Connect the PC to the Gateway

5.1 Connecting to the Gateway via Ethernet

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

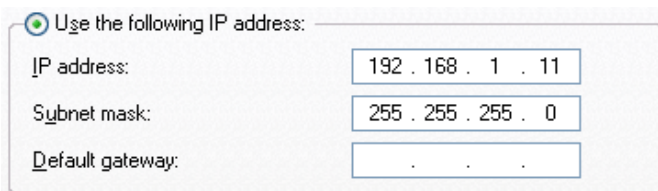


5.1.1 Changing the Subnet of the Connected PC

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:

- Use the search field in the local computer’s taskbar (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 exit the Ethernet Properties window.

5.2 Navigate to the Login Page

- Open a web browser and connect to the FieldServer’s default IP Address. The default IP Address of the FieldServer is **192.168.1.24**, Subnet Mask is **255.255.255.0**.

NOTE: If the IP Address of the ProtoNode has been changed, the IP Address can be discovered using the FS Toolbox utility. See Section [9.1 Lost or Incorrect IP Address](#) for instructions.

6 Setup Web Server Security

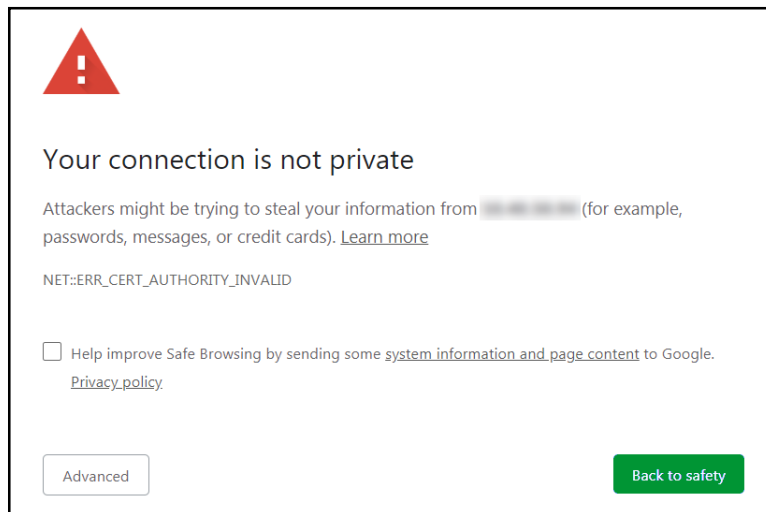
6.1 Login to the FieldServer

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.

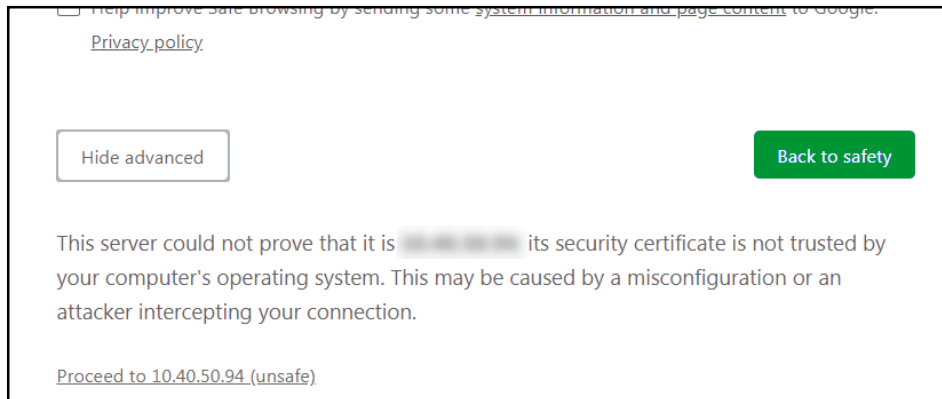
- When the Web Server Security Unconfigured window appears, read the text and choose whether to move forward with HTTPS or HTTP.



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

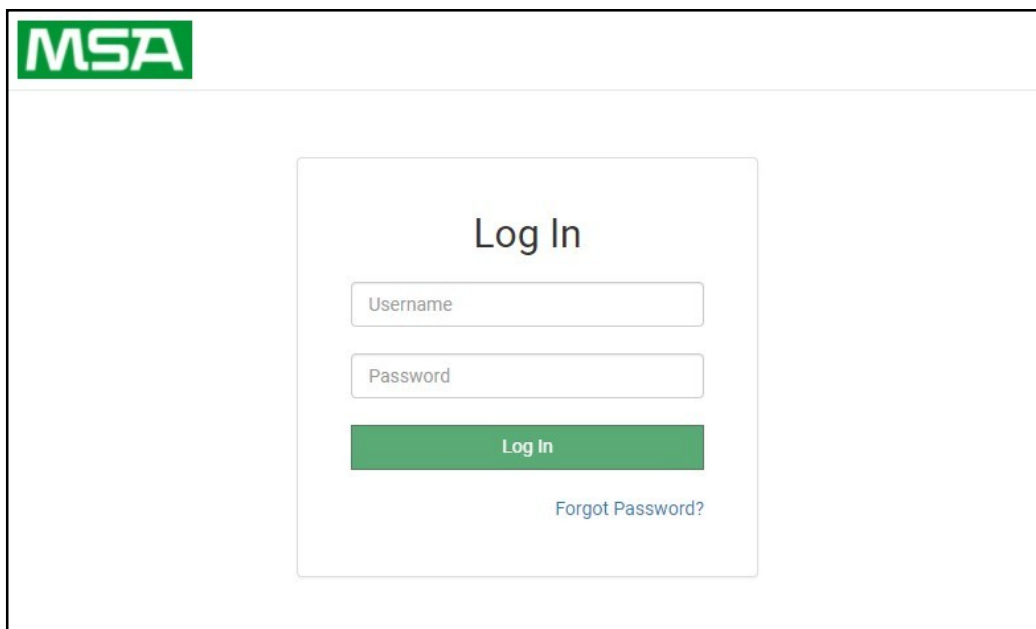


- Additional text will expand below the warning, click the underlined text to go to the IP Address. In the example below this text is “[Proceed to <FieldServer IP> \(unsafe\)](#)”.



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

NOTE: There is also a QR code in the top right corner of the FieldServer label that shows the default unique password when scanned.




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 [Section 10.3 Change User Management Settings](#).

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.

Web server security is not configured



Please select the web security profile from the options below.

Note that browsers will issue a security warning when browsing to a HTTPS server with an untrusted self-signed certificate.

Mode

- HTTPS with default trusted TLS certificate (requires internet connection to be trusted)
- HTTPS with own trusted TLS certificate
- HTTP (not secure, vulnerable to man-in-the-middle attacks)

Save

NOTE: Cookies are used for authentication.

NOTE: To change the web server security mode after initial setup, go to [Section 10.2 Change Web Server Security Settings After Initial Setup](#).

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. **Please contact your IT department to find out if you can obtain a TLS certificate from your company before proceeding with the Own Trusted TLS Certificate option.**

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

Certificate

```
XzyMbQZFIRuJZJPe7CTHLcHOrHLOWoUFoVTaBMYd4d6VGdNklKazByWKcNOL7mrX
A41BAQBfM+IPvOx3T/47VEmaiXqE3bx3zEuBFJ6pWPlw7LHf2r2ZoHw+9xb+aNMU
dVyAelhBMTmsni2ERvQVp0xj3psSv2EJyKXS1bOYNRLsq7UzpwuAdT/Wy3o6vUM5
K+Cwf9qEoQ0LuxDZTIEct67MkcHMiuFi5pk7TRicHnQf/sfOAYOulduHOy9exlk9
FmHFVDIZf/cJUaF+e74EuSph+qEr0lQo2wvmhyc7L22UXse1NoOfUJ2Zq0Eu1Vvtu
JRryaMWIRFEWuuzMGZtKFWVC+8q2JQsVcqiRWM7naoblEhOCMH+sKHJMCxDoXGT
vtZjpZUoAL51YXxWSVcyZdGiAP5e
-----END CERTIFICATE-----
```

Private Key

```
sHB0zZoHr4YQSDk2BbYVzzbl0LDuKtc8+JiO3ooGjoTuHnqkeAj/fKfbTAsKeAzw
gKQe+H5UQNk0bdvZfOJrm6daDK2vVDmR5k+jUUhEj5N49uplroB97MQgYotzqfT+
THlbpq5t1SIK617k04ObKmHF5l8fck+ru545sVmpeeZh0m5j5SURYAZMvbq5daCu
J4l5NlIhbEvxRF4UK41ZDMCvujopCbkUWrb1a/3XXnDnM2K9xyz2wze998D6Wk46
+7aOFY9F+7j5lJmnkoS3GYtwCyH5iP+mPP1K6RnuiD019wvGPb4dtN/RTnfd0eF
GYeVSkI9fxxkxDOFtdWRZbM/rPin4tmO1Xf8HqONVN1x/iaMynOXG4cukoi4+VO
u0rZaUESll2zNkfrn7fAASm5NBWg202Cy9IAYnuujs3aALl5uGBEEK62oTMxlzx
-----END RSA PRIVATE KEY-----
```

Private Key Passphrase

Specify if encrypted

- 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. After a short time, the FieldServer GUI will open.

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

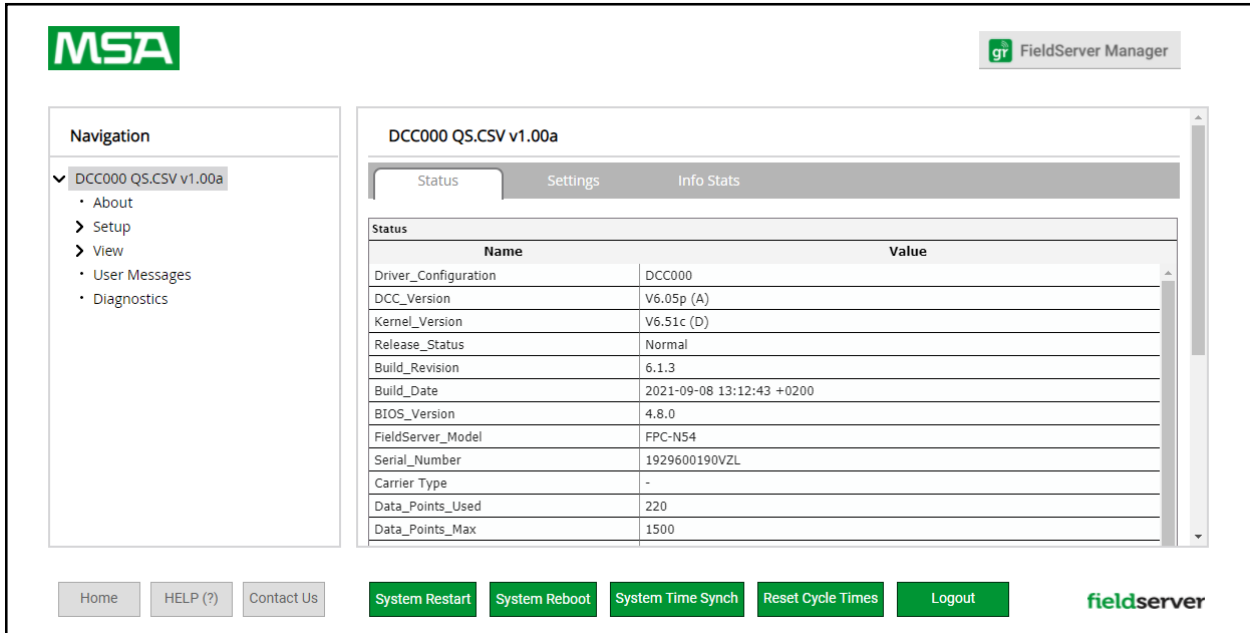
- Select one of these options and click the Save button.
- A “Redirecting” message will appear. After a short time, the FieldServer GUI will open.

7 Setup Network

7.1 Using FS-GUI to Input Network Settings

To navigate from the FS-GUI page to the Network Settings page follow the below instructions:

- Find the Navigation tree across the left side of the screen.
- Click the arrow next to the FieldServer title/CN number to expand the tree.



The screenshot shows the MSA FieldServer Manager interface. On the left is a navigation tree with the following structure:

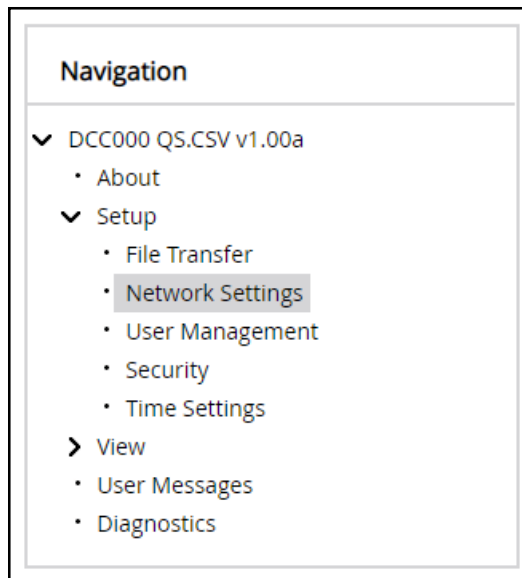
- Navigation
 - ▼ DCC000 QS.CSV v1.00a
 - About
 - ▶ Setup
 - ▶ View
 - User Messages
 - Diagnostics

The main content area displays the 'DCC000 QS.CSV v1.00a' status page. It has tabs for 'Status', 'Settings', and 'Info Stats'. The 'Status' tab is active, showing a table of system parameters:

Name	Value
Driver_Configuration	DCC000
DCC_Version	V6.05p (A)
Kernel_Version	V6.51c (D)
Release_Status	Normal
Build_Revision	6.1.3
Build_Date	2021-09-08 13:12:43 +0200
BIOS_Version	4.8.0
FieldServer_Model	FPC-N54
Serial_Number	1929600190VZL
Carrier_Type	-
Data_Points_Used	220
Data_Points_Max	1500

At the bottom of the interface, there are several buttons: Home, HELP (?), Contact Us, System Restart, System Reboot, System Time Synchron, Reset Cycle Times, and Logout. The 'fieldserver' logo is also present in the bottom right corner.

- Click on the arrow next to Setup to expand the tree.
- Click on Network Settings.



This close-up screenshot shows the navigation tree with the following structure:


- Navigation
 - ▼ DCC000 QS.CSV v1.00a
 - About
 - ▼ Setup
 - File Transfer
 - **Network Settings**
 - User Management
 - Security
 - Time Settings
 - ▶ View
 - User Messages
 - Diagnostics

The 'Network Settings' option under the 'Setup' menu is highlighted with a grey background.

7.2 Routing Settings

The Routing settings make it possible to set up the IP routing rules for the FieldServer's internet and network connections.

- Click the Add Rule button to add a new row and set a new Destination Network, Netmask and Gateway IP Address as needed.
- Set the Priority for each connection (1-255 with 1 as the highest priority and 255 as the lowest).
- Click the Save button to activate the new settings.

ETH 1
Routing 

Set up the IP routing rules of your FieldServer for internet access and access to other networks.

If you want to reach another device that is not connected to the local network, you can add a rule to determine on which gateway the device must be routed to.

Interface	Destination Network	Netmask	Gateway IP Address	Priority ?
ETH v	Default	-	10.40.50.1	255
ETH v	10.40.50.10	255.255.255.255	10.40.50.1	254 v

+ Add Rule

Cancel
Save

There are unsaved settings

7.3 Ethernet 1 Network Settings

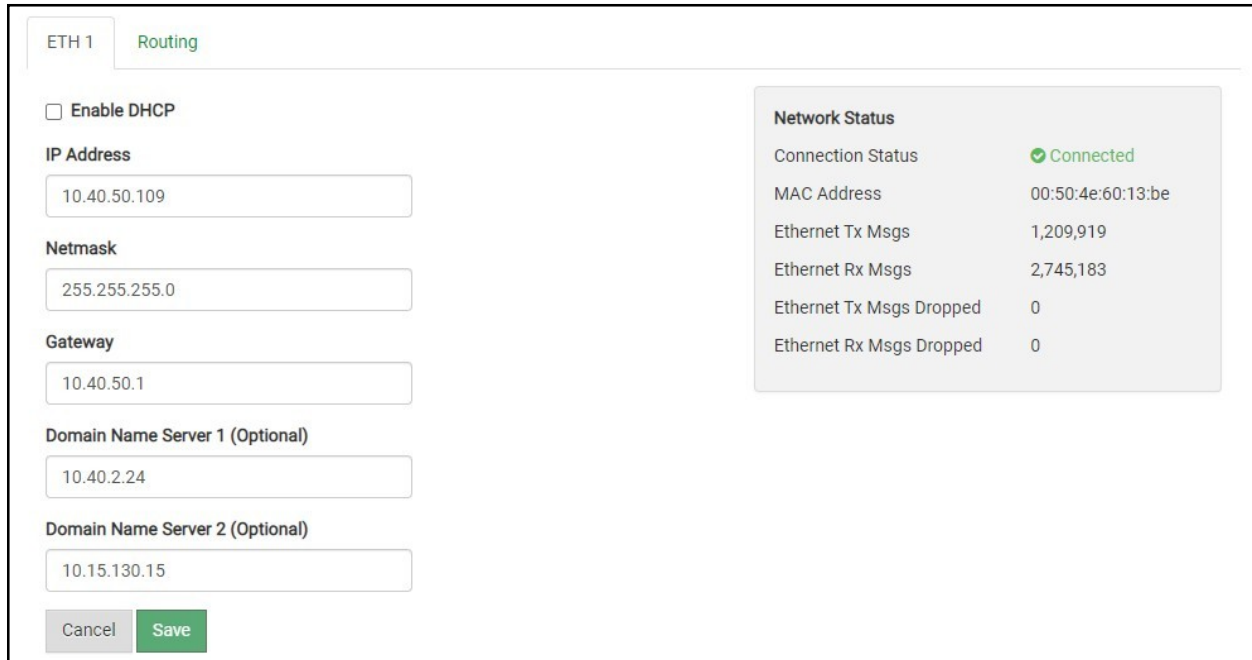
To change the FieldServe IP Settings, follow these instructions:

- Enable DHCP to automatically assign IP Settings or modify the IP Settings manually as needed, via these fields: IP Address, Netmask, Default Gateway, and Domain Name Server1/2.

NOTE: If the FieldServer is connected to a router, the IP Gateway of the FieldServer should be set to the same IP Address of the router.

- Click Save to record and activate the new IP Address.
- Connect the FieldServer to the local network or router.

NOTE: The browser needs to be updated to the new IP Address of the FieldServer before the settings will be accessible again.



ETH 1 Routing

Enable DHCP

IP Address
10.40.50.109

Netmask
255.255.255.0

Gateway
10.40.50.1

Domain Name Server 1 (Optional)
10.40.2.24

Domain Name Server 2 (Optional)
10.15.130.15

Cancel Save

Network Status	
Connection Status	Connected
MAC Address	00:50:4e:60:13:be
Ethernet Tx Msgs	1,209,919
Ethernet Rx Msgs	2,745,183
Ethernet Tx Msgs Dropped	0
Ethernet Rx Msgs Dropped	0

8 Configuring the ProtoNode

8.1 Configuration Parameters

Navigate to the Configuration Parameters page. This is normally the first page displayed after login. Change settings as required for the specific installation:



Configuration Parameters

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 BACnet MSTP (single node)	<input type="text" value="2"/> <input type="button" value="Submit"/>
temp_units	Temperature Units This sets the units for the temperature. (Deg_F/Deg_C)	<input type="text" value="Deg_F"/> <input type="button" value="Submit"/>
network_nr	BACnet Network Number This sets the BACnet network number of the Gateway. (1 - 65535)	<input type="text" value="50"/> <input type="button" value="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)	<input type="text" value="50000"/> <input type="button" value="Submit"/>
bac_mac_addr	BACnet MSTP Mac Address This sets the BACnet MSTP MAC address. (1 - 127)	<input type="text" value="127"/> <input type="button" value="Submit"/>
bac_baud_rate	BACnet MSTP Baud Rate This sets the BACnet MSTP baud rate. (9600/19200/38400/76800)	<input type="text" value="38400"/> <input type="button" value="Submit"/>
bac_max_master	BACnet MSTP Max Master This sets the BACnet MSTP max master. (1 - 127)	<input type="text" value="127"/> <input type="button" value="Submit"/>
bac_max_info_fr	BACnet MSTP Max Info Frames This sets the max number of information frames the connection may send before it must pass the token. (1 - 65535)	<input type="text" value="50"/> <input type="button" value="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)	<input type="text" value="COV_Disable"/> <input type="button" value="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)	<input type="text" value="No"/> <input type="button" value="Submit"/>

Active profiles

Nr	Node ID	Current profile	Parameters
<input type="button" value="Add"/>			

Example: Type protocol number in Value box and click Submit

Example: Type Baud rate number in Value box and click Submit

Note: Selections are made by typing the characters as indicated in Parameter Description into the Value box. For example, to select the temperature units as degrees C, type "Deg_C" (without the "") in the Value box. Click "Submit" after each parameter selection to activate the selection and restart the ProtoNode. Multiple selections cannot be submitted simultaneously.

8.2 Confirm Configuration Settings and Restart

After entering parameter selections/settings and clicking submit, a prompt to confirm the configuration update appears:



Configuration update complete. Please restart the system to load the new Configuration.

Configuration Parameters

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 BACnet MSTP (single node)	<input type="text" value="3"/> <input type="button" value="Submit"/>

Click "System Restart" to confirm and restart the ProtoNode:

(No/Yes)

Active profiles

Nr	Node ID	Current profile	Parameters
<input type="button" value="Add"/>			

System Restart

Click "OK" to accept changes and restart the ProtoNode, or Cancel to discard the changes:

r71pwctx.tunnel.fieldpop.io says

System about to restart.

Press OK to continue

8.3 Activate Connected Boiler Profiles

Ensure that the ProtoNode is physically wired to the boiler(s) as described in Section 3 above. Also, ensure that each boiler is configured with a unique Modbus address. Refer to the boiler installation and operating manual for details. The ProtoNode is shipped from the factory with no active profiles, as illustrated. Profiles may be added manually or through automatic Discovery.

8.3.1 Add Profiles Manually

Add a profile manually as illustrated:

Active profiles

Nr	Node ID	Current profile	Parameters
<div style="display: flex; justify-content: space-between; align-items: center;"> HELP (?) Discovery Mode Clear Profiles and Restart System Restart Diagnostics & Debugging </div>			



Active profiles

Nr	Node ID	Current profile	Parameters
1		BAC_MSTP_Sola	

HELP (?)
Discovery Mode
Clear Profiles and Restart
System Restart
Diagnostics & Debugging
Submit
Cancel

1. Key in Modbus address

2. Verify Profile type as shown

3. Click Submit to activate

The activated device profile should appear as shown below, and the ProtoNode's Modbus activity LEDs TX1 and RX1 should flash rapidly:

Active profiles

Nr	Node ID	Current profile	Parameters
1	1	BAC_MSTP_Sola	Remove

HELP (?)
Discovery Mode
Clear Profiles and Restart
System Restart
Diagnostics & Debugging

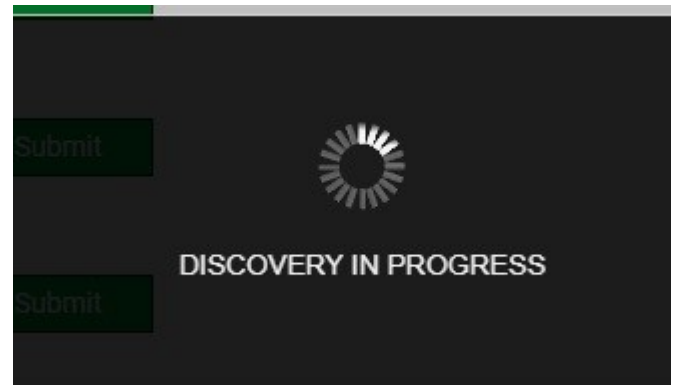
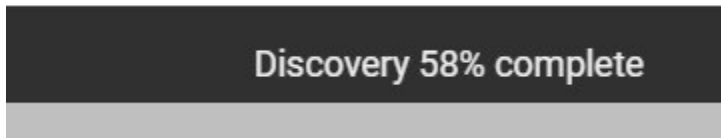
8.3.2 Add Profiles By Automatic Discovery

To add profiles by Automatic Discovery, first click “Clear Profiles and Restart”, and confirm. Then click the “Discovery Mode” button to initiate automatic discovery:

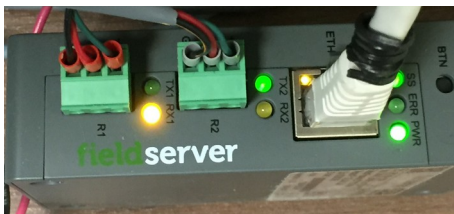
Active profiles

Nr	Node ID	Current profile	Parameters
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="background-color: #008000; color: white; padding: 5px 10px; border-radius: 5px;">Add</div> </div>			
<div style="display: flex; justify-content: space-around; gap: 10px;"> <div style="background-color: #cccccc; padding: 5px 10px; border-radius: 5px;">HELP (?)</div> <div style="background-color: #008000; color: white; padding: 5px 10px; border-radius: 5px; display: flex; align-items: center; gap: 5px;"> ● Discovery Mode </div> <div style="background-color: #008000; color: white; padding: 5px 10px; border-radius: 5px;">Clear Profiles and Restart</div> <div style="background-color: #008000; color: white; padding: 5px 10px; border-radius: 5px;">System Restart</div> <div style="background-color: #008000; color: white; padding: 5px 10px; border-radius: 5px;">Diagnostics & Debugging</div> </div>			
<div style="border: 2px solid red; padding: 10px; display: inline-block; margin-bottom: 10px;"> <p>Click to select click OK to start</p> </div> <div style="border: 1px solid #ccc; padding: 10px; width: fit-content; margin: auto;"> <p>r71pwctx.tunnel.fieldpop.io says</p> <p>Press OK to restart the device and start discovery</p> <div style="display: flex; justify-content: flex-end; gap: 10px;"> <div style="background-color: #0056b3; color: white; padding: 5px 15px; border-radius: 15px;">OK</div> <div style="border: 1px solid #ccc; padding: 5px 15px; border-radius: 15px; background-color: #f0f0f0;">Cancel</div> </div> </div>			

Discovery progress is displayed:



After completion of Discovery, the TX1 and RX1 LED's will flash rapidly in a sustained alternating pattern.



8.4 Disable Discovery Mode

On Discovery completion the “Discovery Mode” button remains active:

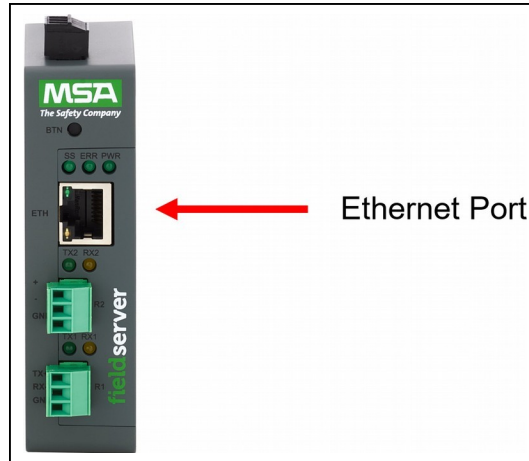


It is recommended that Discovery Mode be de-activated by clicking the button and confirming the de-activation. This is to prevent the ProtoNode from remaining in Discovery Mode. In the event of a power cycle, the ProtoNode will initiate a new Discovery if Discovery Mode remains active. This could result in corrupted profiles and require manual intervention to clear the profiles and re-discover the boilers.

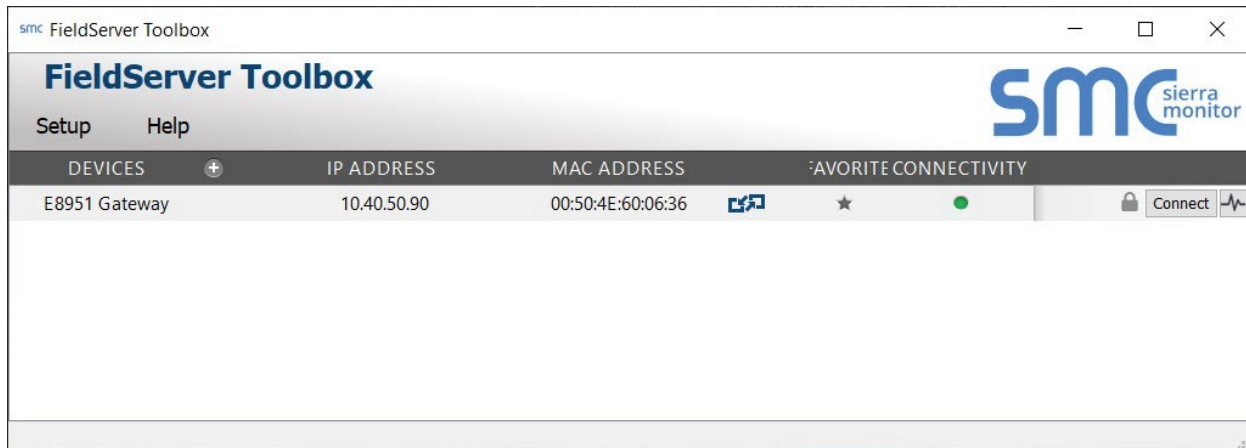
9 Troubleshooting

9.1 Lost or Incorrect IP Address

- Ensure that FieldServer Toolbox is loaded onto the local PC. Otherwise, download the FieldServer-Toolbox.zip via the MSA Safety website.
- Extract the executable file and complete the installation.

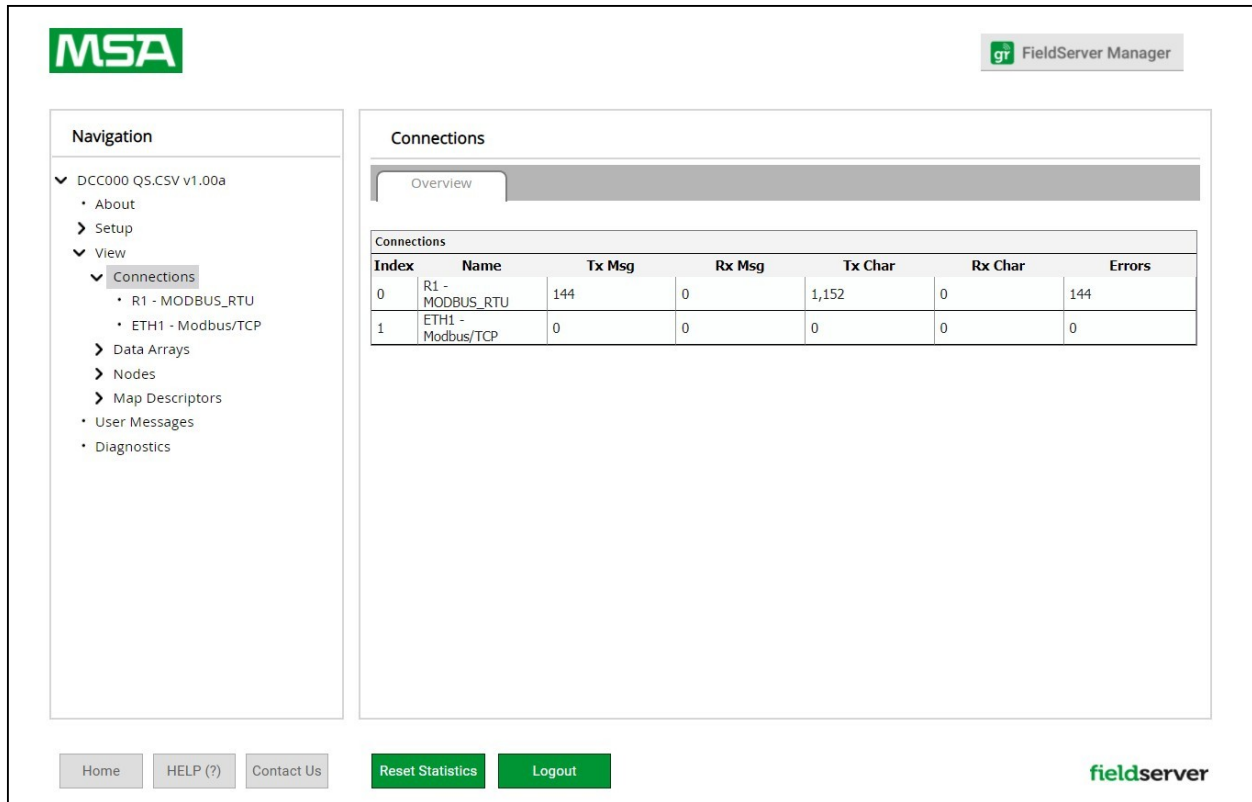


- Connect a standard Cat-5 Ethernet cable between the user's PC and ProtoNode.
- Double click on the FS Toolbox Utility and click Discover Now on the splash page.
- Check for the IP Address of the desired gateway.



9.2 Viewing Diagnostic Information

- Type the IP Address of the FieldServer into the web browser or use the FieldServer Toolbox to connect to the FieldServer.
- Click on Diagnostics and Debugging Button, then click on view, and then on connections.
- If there are any errors showing on the Connection page, refer to **Section 9.3 Checking Wiring and Settings** for the relevant wiring and settings.



The screenshot shows the FieldServer Manager interface. On the left is a navigation menu with options like 'About', 'Setup', 'View', 'Connections', 'Data Arrays', 'Nodes', 'Map Descriptors', 'User Messages', and 'Diagnostics'. The 'Connections' section is active, showing a table of connection statistics.

Index	Name	Tx Msg	Rx Msg	Tx Char	Rx Char	Errors
0	R1 - MODBUS_RTU	144	0	1,152	0	144
1	ETH1 - Modbus/TCP	0	0	0	0	0

At the bottom of the interface, there are buttons for 'Home', 'HELP (?)', 'Contact Us', 'Reset Statistics', and 'Logout'. The 'fieldserver' logo is visible in the bottom right corner.

9.3 Checking Wiring and Settings

No COMS on the Serial side. If the Tx/Rx LEDs are not flashing rapidly then there is a COM issue. To fix this problem, check the following:

- Visual observations of LEDs on the ProtoNode. ([Section 9.5 LED Functions](#))
- Check baud rate, parity, data bits, stop bits.
- Check device address.
- Verify wiring.
- Verify the device is connected to the same subnet as the ProtoNode.


Field COM problems:

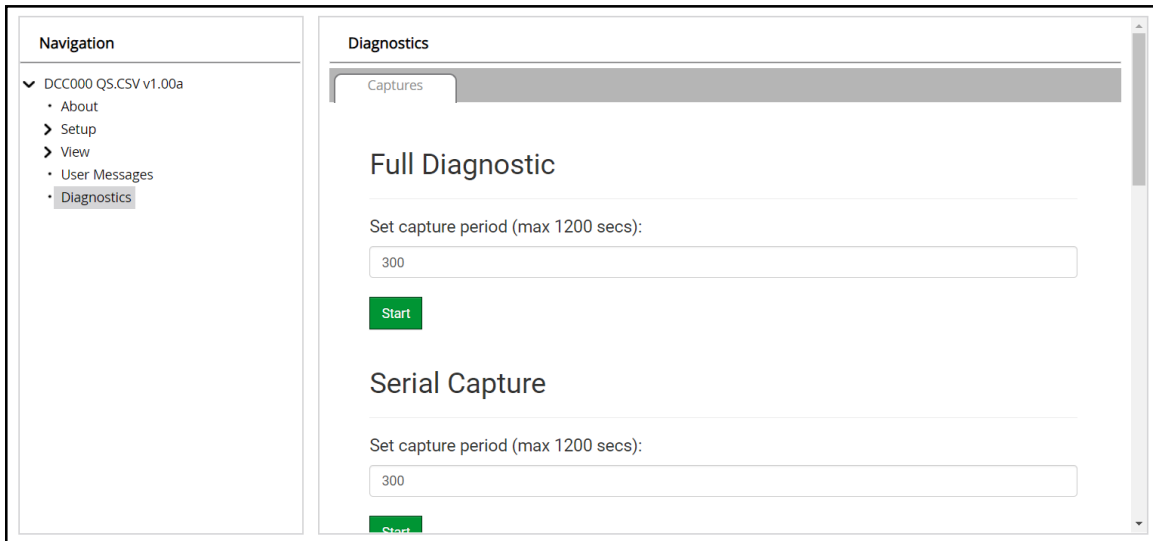
- Visual observations of LEDs on the ProtoNode. ([Section 9.5 LED Functions](#))
- Verify wiring.
- Verify IP Address setting.

NOTE: If the problem still exists, a Diagnostic Capture needs to be taken and sent to support. ([Section 9.4 Taking a FieldServer Diagnostic Capture](#))

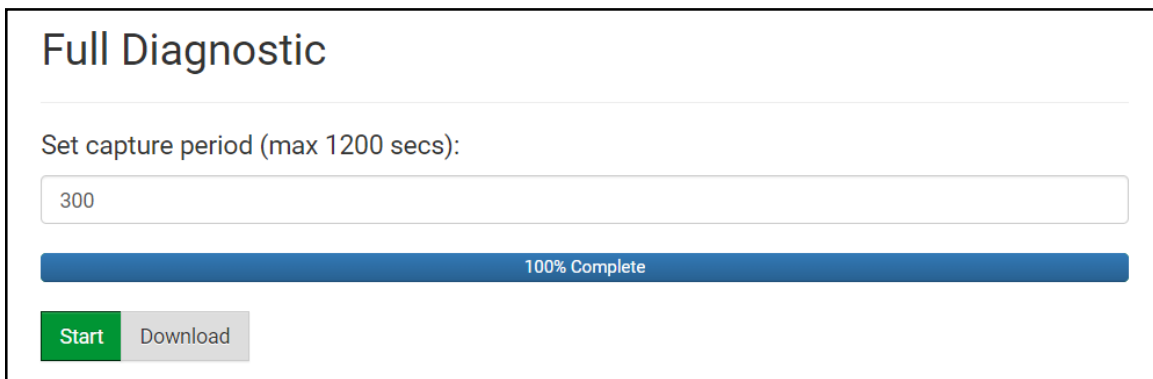
9.4 Taking a FieldServer Diagnostic Capture

When there is a problem on-site that cannot easily be resolved, perform a Diagnostic Capture before contacting support. Once the Diagnostic Capture is complete, contact NTI technical support at 800-688-2575 option 1. Describe the problem and request to send the diagnostic log file by email. The technical support agent will provide an address. The Diagnostic Capture will accelerate diagnosis of the problem.

- Access the FieldServer Diagnostics page via one of the following methods:
 - Open the FieldServer FS-GUI page and click on Diagnostics in the Navigation panel
 - Open the FieldServer Toolbox software and click the diagnose icon  of the desired device



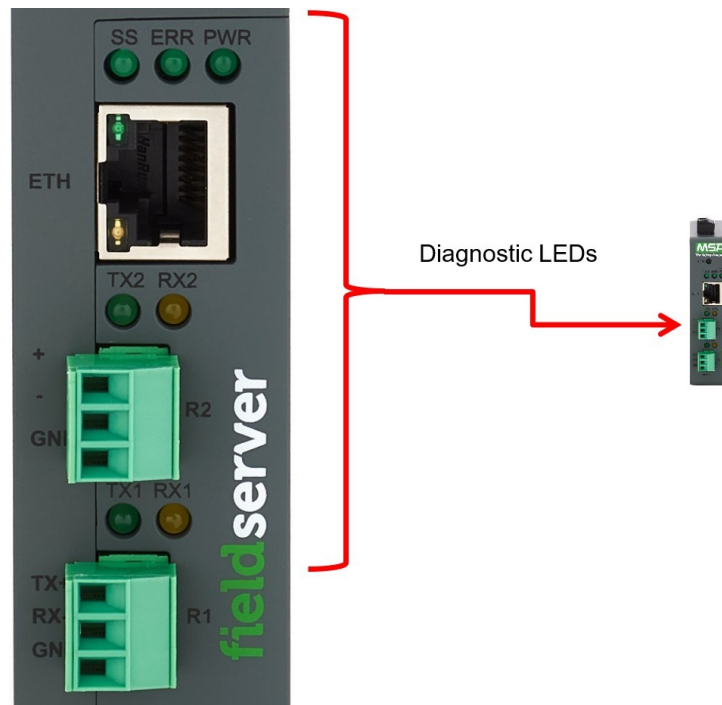
- Go to Full Diagnostic and select the capture period. A 300 second capture period (default) is recommended.
- Click the Start button under the Full Diagnostic heading to start the capture.
 - If possible, during the capture period, try to trigger the operation or event that caused the problem condition
 - 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 NTI Technical Support at the email address provided by the agent as explained above.

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

9.5 LED Functions



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	This is the power light and should always be steady green when the unit is powered.
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.

9.6 Factory Reset Instructions

IMPORTANT: Perform this action **ONLY** on the instruction of NTI technical support

For instructions on how to reset a FieldServer back to its factory released state, see [ENOTE FieldServer Next Gen Recovery](#), available at the MSA Safety website at <https://us.msasafety.com>

9.7 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.

10 Additional Information

10.1 Update Firmware

IMPORTANT: Perform this action **ONLY** on the instruction of NTI technical support

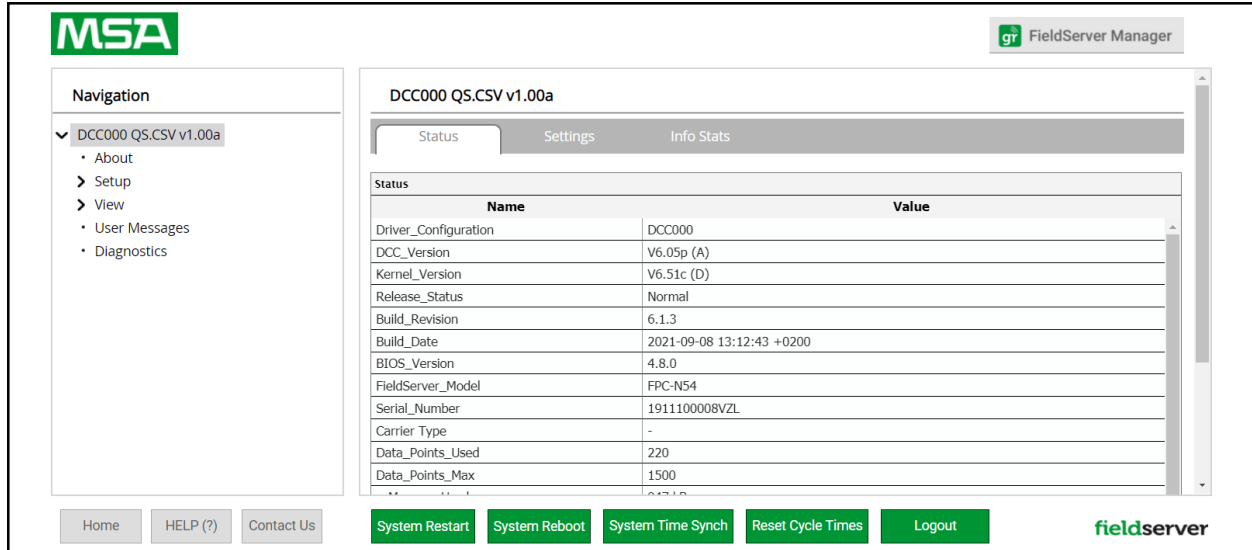
To load a new version of the firmware, follow these instructions:

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 ([Section 9.1 Lost or Incorrect IP Address](#))
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.

10.2 Change Web Server Security Settings After Initial Setup

NOTE: Any changes will require a FieldServer reboot to take effect.

- Navigate from the ProtoNode landing page to the FS-GUI by clicking the blue “Diagnostics” text on the bottom of the screen.
- The ProtoNode landing page is the FS-GUI.
- Click Setup in the Navigation panel.



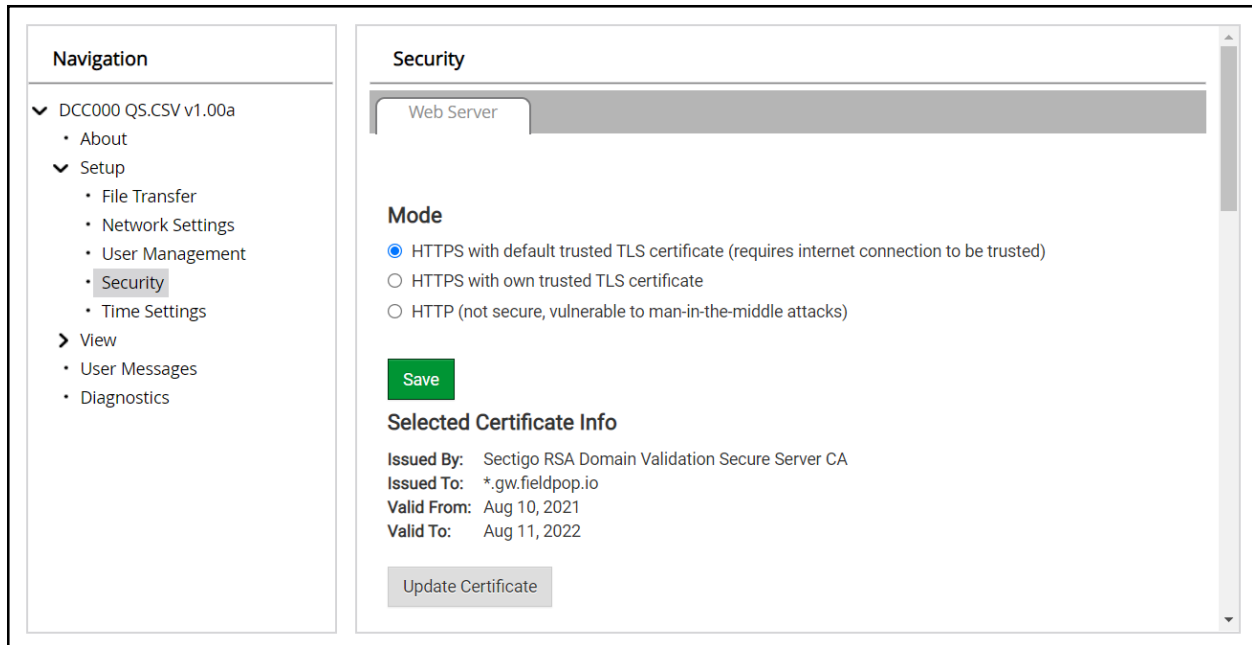
The screenshot displays the FieldServer Manager interface. On the left is a navigation menu with options: About, Setup, View, User Messages, and Diagnostics. The main area shows the 'Status' tab for 'DCC000 QS.CSV v1.00a'. Below the tabs is a table with system parameters:

Name	Value
Driver_Configuration	DCC000
DCC_Version	V6.05p (A)
Kernel_Version	V6.51c (D)
Release_Status	Normal
Build_Revision	6.1.3
Build_Date	2021-09-08 13:12:43 +0200
BIOS_Version	4.8.0
FieldServer_Model	FPC-N54
Serial_Number	1911100008VZL
Carrier_Type	-
Data_Points_Used	220
Data_Points_Max	1500

At the bottom of the interface, there are several action buttons: Home, HELP (?), Contact Us, System Restart, System Reboot, System Time Synch, Reset Cycle Times, and Logout. The 'fieldserver' logo is visible in the bottom right corner.

10.2.1 Change Security Mode

- Click Security in the Navigation panel.

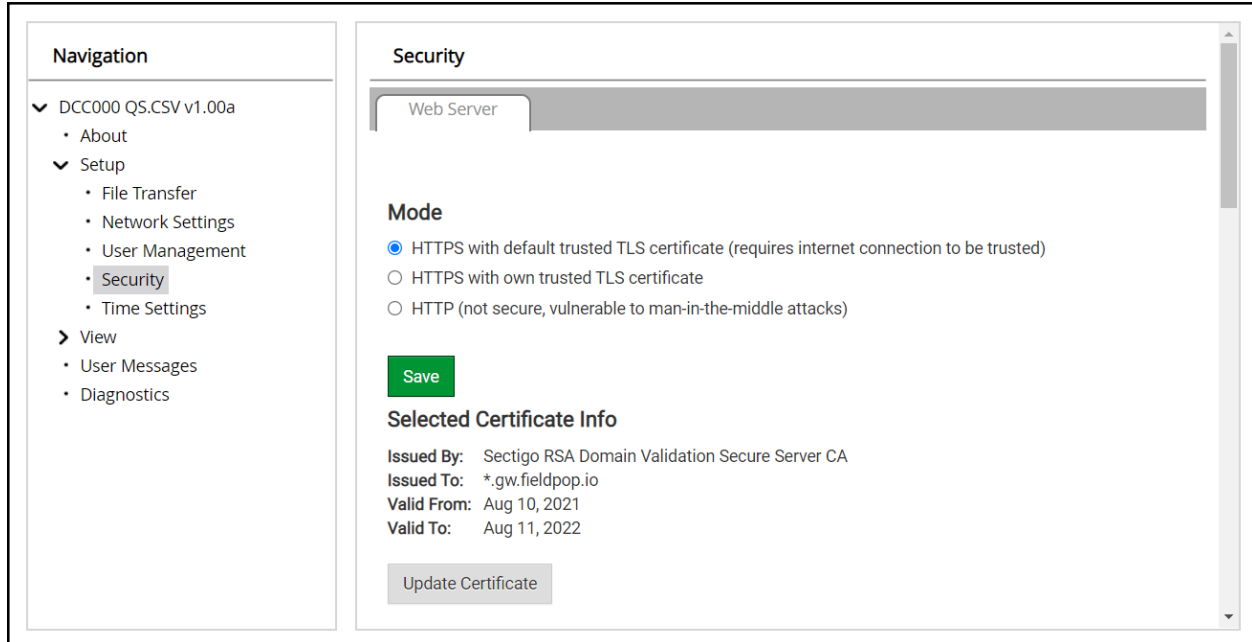


- Click the Mode desired.
 - If HTTPS with own trusted TLS certificate is selected, follow instructions in [Section 6.2.1 HTTPS with Own Trusted TLS Certificate](#)
- Click the Save button.

10.2.2 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.



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

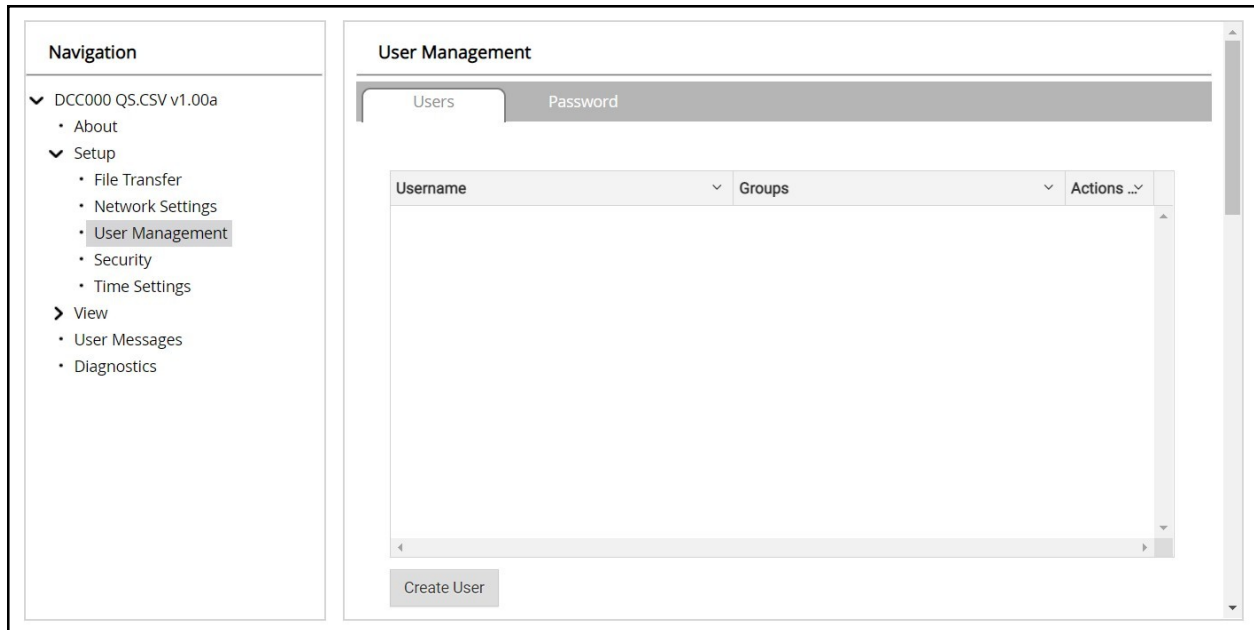
10.3 Change User Management Settings

- From the FS-GUI page, click Setup in the Navigation panel.
- Click User Management in the navigation panel.

NOTE: If the passwords are lost, the unit can be reset to factory settings to reinstate the default unique password on the label. For recovery instructions, see the FieldServer Next Gen Recovery document. If the default unique password is lost, then the unit must be mailed back to the factory.

NOTE: Any changes will require a FieldServer reboot to take effect.

- Check that the Users tab is selected.



User Types:

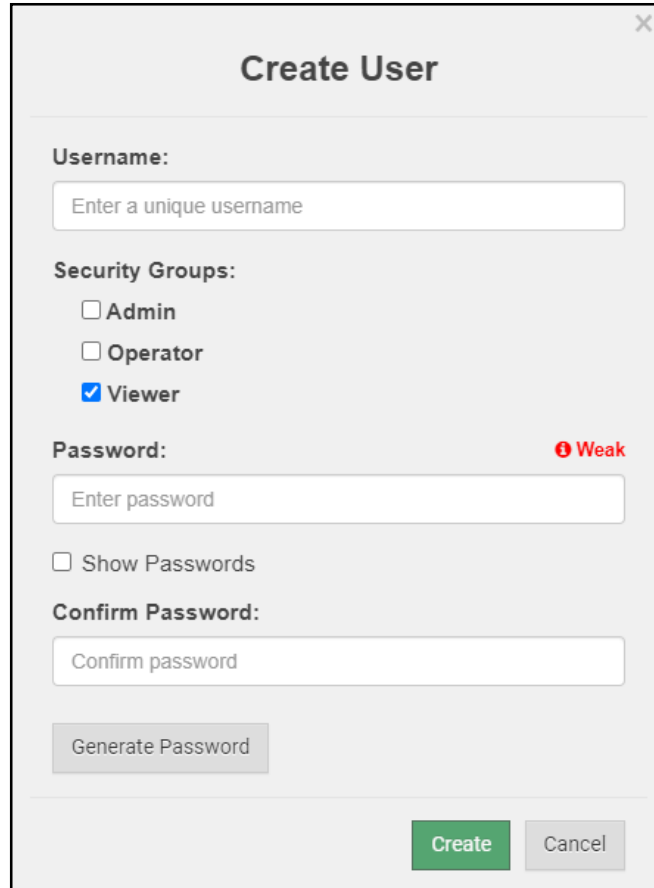
Admin – Can modify and view any settings on the FieldServer.

Operator – Can modify and view any data in the FieldServer array(s).

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

10.3.1 Create Users

- Click the Create User button.



The image shows a 'Create User' dialog box with the following fields and options:

- Username:** A text input field with the placeholder text 'Enter a unique username'.
- Security Groups:** Three radio button options: 'Admin', 'Operator', and 'Viewer'. The 'Viewer' option is selected.
- Password:** A text input field with the placeholder text 'Enter password'. To the right of the field is a red indicator 'Weak'.
- Show Passwords:** A checkbox option that is currently unchecked.
- Confirm Password:** A text input field with the placeholder text 'Confirm password'.
- Generate Password:** A button located below the password fields.
- Create:** A green button at the bottom right.
- Cancel:** A grey button at the bottom right.

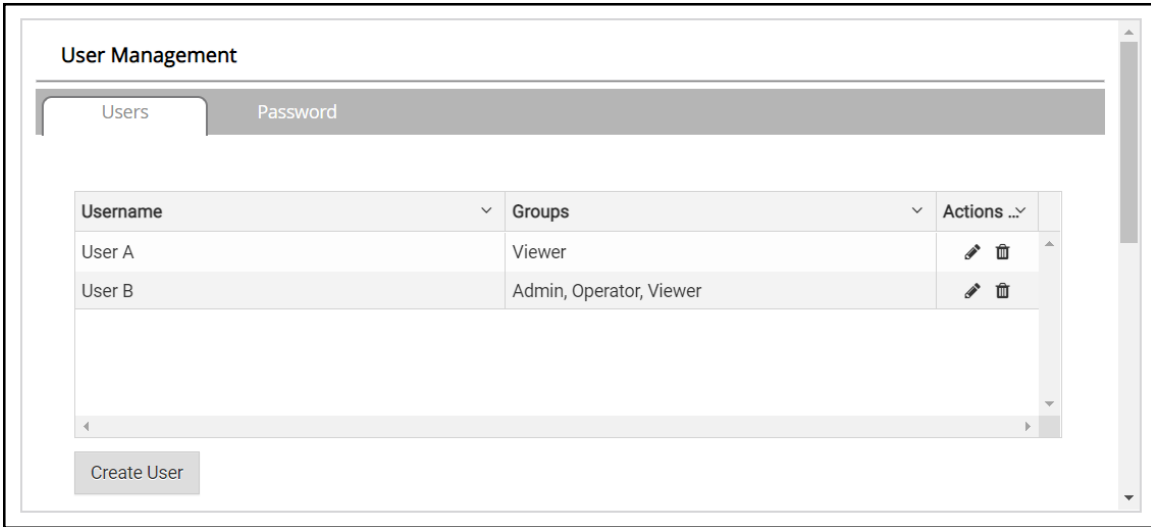
- Enter the new User fields: Name, Security Group and Password.
 - **User details are hashed and salted**

NOTE: The password must meet the minimum complexity requirements. An algorithm automatically checks the password entered and notes the level of strength on the top right of the Password text field.

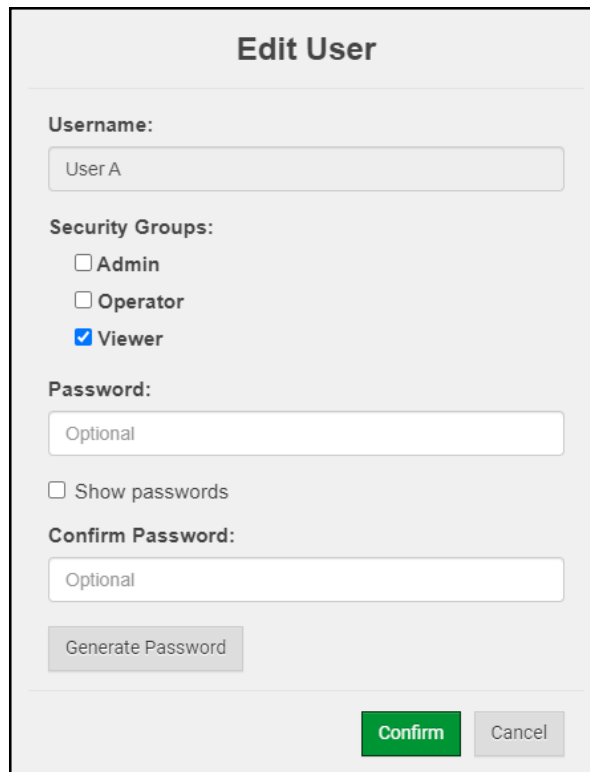
- Click the Create button.
- Once the Success message appears, click OK.

10.3.2 Edit Users

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



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



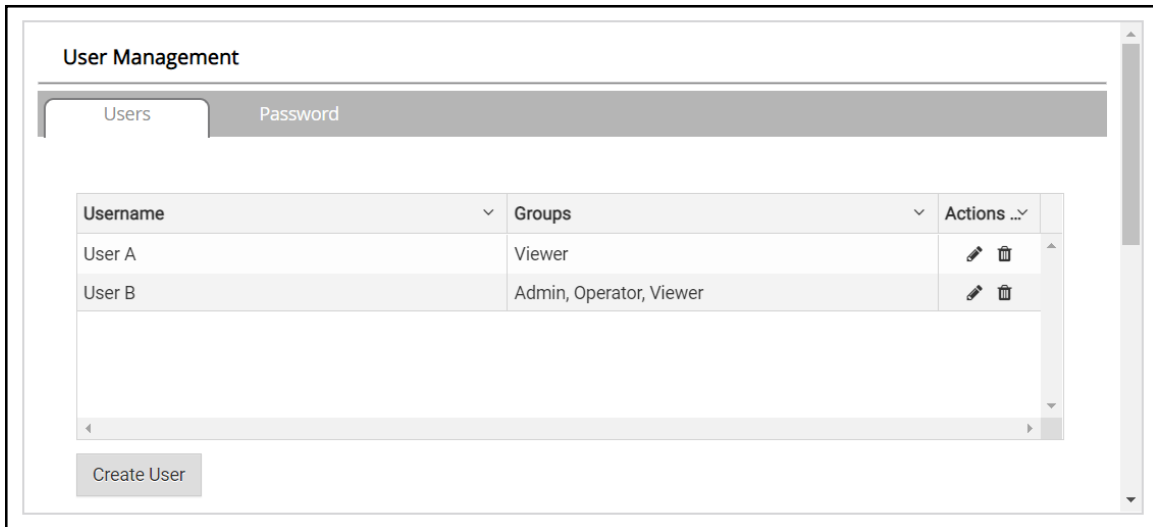
The 'Edit User' form contains the following fields and options:

- Username:** A text input field containing 'User A'.
- Security Groups:** Three checkboxes: 'Admin' (unchecked), 'Operator' (unchecked), and 'Viewer' (checked).
- Password:** A text input field containing 'Optional'.
- Show passwords
- Confirm Password:** A text input field containing 'Optional'.
-
- (green)
-

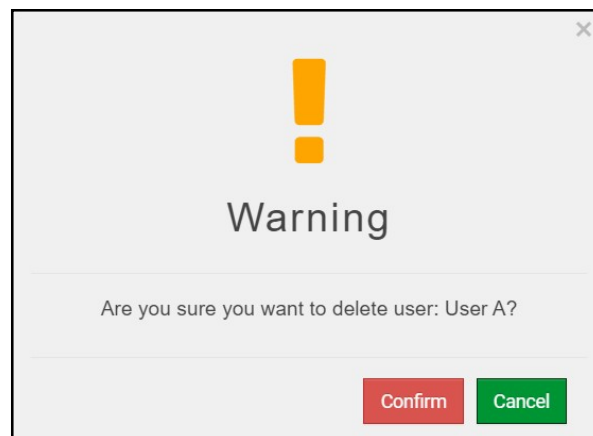
- Click Confirm.
- Once the Success message appears, click OK.

10.3.3 Delete Users

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

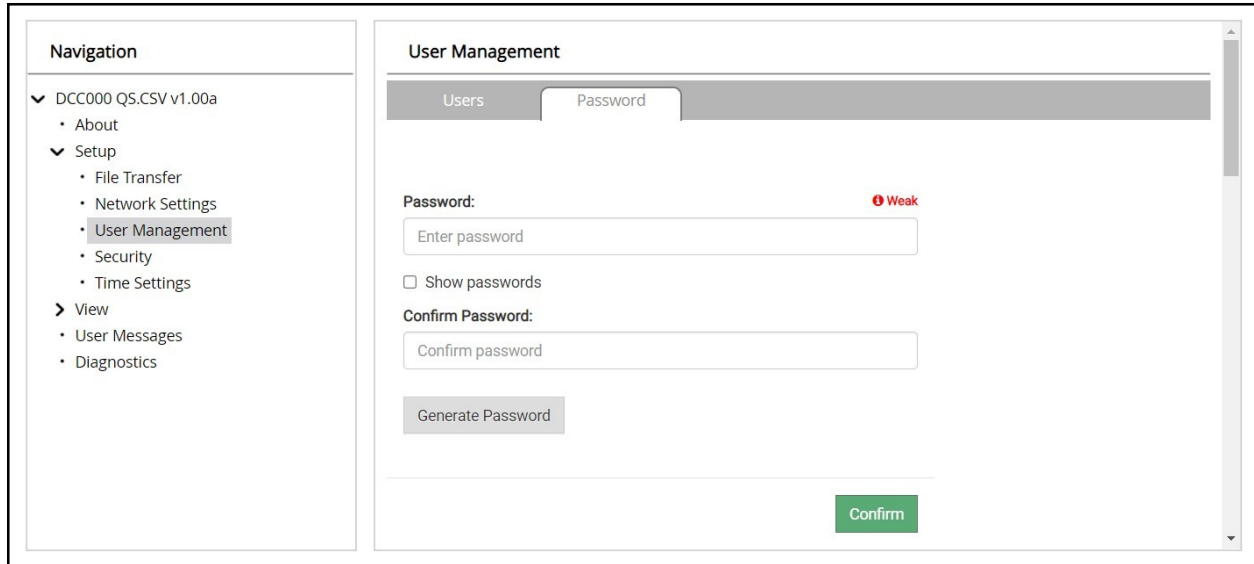


- When the warning message appears, click Confirm.



10.3.4 Change FieldServer Password

- Click the Password tab.



The screenshot shows the 'User Management' section of the FieldServer interface. On the left is a 'Navigation' sidebar with a tree view containing 'DCC000 QS.CSV v1.00a', 'About', 'Setup' (with sub-items: 'File Transfer', 'Network Settings', 'User Management', 'Security', 'Time Settings'), 'View' (with sub-items: 'User Messages', 'Diagnostics'), and 'Diagnostics'. The 'User Management' section has two tabs: 'Users' and 'Password'. The 'Password' tab is active and contains a 'Password:' label with a red 'Weak' indicator, a text input field with the placeholder 'Enter password', a 'Show passwords' checkbox, a 'Confirm Password:' label, another text input field with the placeholder 'Confirm password', a 'Generate Password' button, and a green 'Confirm' button at the bottom right.

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

NOTE: The password must meet the minimum complexity requirements. An algorithm automatically checks the password entered and notes the level of strength on the top right of the Password text field.

10.4 Specifications



	FPC-N54
Electrical Connections	One 3-pin Phoenix connector with: RS-485/RS-232 (Tx+ / Rx- / gnd) One 3-pin Phoenix connector with: RS-485 (+ / - / 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>Max Power:</i> 3 Watts <i>Current draw:</i> 24VAC 0.125A 9-30VDC 0.25A @12VDC
Approvals	FCC Part 15 B, UL 60950-1 and CAN/CSA C22.2, EN IEC 62368-1, WEEE compliant, RoHS compliant, DNP 3.0 and Modbus conformance tested, BTL Marked, REACH compliant, UKCA and CE compliant, ODVA conformant, CAN ICES-003(B) / NMB-003(B)
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

NOTE: Specifications subject to change without notice.

10.5 Warnings

FCC Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

10.6 Compliance with EN IEC 62368-1

For EN IEC compliance, the following instructions must be met when operating the 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 the FieldServer
- 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.

11 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.

12 Points List

Item	Label	BACnet Object	Modbus Register			Access	Format	Object Type	Mask	Units	Range	Notes
			Decimal Base 0	Hex Base 1	Hex Base 0							
1	Outlet Temperature (S354 sensor)	AI 1	7	8	7	Read-only	Signed 16-bit	Analog Input		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
2	Fan speed	AI 2	9	10	9	Read-only	Unsigned 16-bit	Analog Input	RPM		Model Specific; see manual	Actual fan speed from tachometer feedback
3	Flame signal	AI 3	10	11	A	Read-only	Unsigned 16-bit	Analog Input		µAmps	0 TO 50 (0.01 precision)	
4	Inlet Temperature (S1 sensor)	AI 4	11	12	B	Read-only	Signed 16-bit	Analog Input		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
5	DHW Temperature (S6 sensor)	AI 5	12	13	C	Read-only	Signed 16-bit	Analog Input		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
6	Outdoor Temperature (S5 sensor)	AI 6	13	14	D	Read-only	Signed 16-bit	Analog Input		Degrees	-40°C TO 130°C (0.1°C precision)	Model specific; see manual
7	Stack Temperature (S8S9 sensor)	AI 7	14	15	E	Read-only	Signed 16-bit	Analog Input		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
8	4-20mA Input	AI 8	15	16	F	Read-only	Unsigned 16-bit	Analog Input		mA	4 TO 20 mA (0.1mA precision)	See Sola Software Interface Specification
9	Firing rate	AV 1	8	9	8	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	Commanded demand rate from PID
10	Active CH setpoint	AV 2	16	17	10	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	Based on CH Setpoint source; see Sola Software Interface Specification
11	Active DHW setpoint	AV 3	17	18	11	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	Based on DHW Setpoint source; see Sola Software Interface Specification
12	Active Lead Lag setpoint	AV 4	18	19	12	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	Based on LL Setpoint source; see Sola Software Interface Specification
13	Active CH operating point	AV 5	25	26	19	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
14	Active DHW operating point	AV 6	26	27	1A	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
15	Active Lead Lag operating point	AV 7	27	28	1B	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
16	Active System operating point	AV 8	28	29	1C	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
17	Active System setpoint	AV 9	29	30	1D	Read-only	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
18	Active System On Hysteresis	AV 10	30	31	1E	Read-only	Unsigned 16-bit	Analog Value		Degrees	0°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
19	Active System Off Hysteresis	AV 11	31	32	1F	Read-only	Unsigned 16-bit	Analog Value		Degrees	0°C TO 130°C (0.1°C precision)	See Sola Software Interface Specification
20	Burner cycle count	AV 12	128	129	80	Read-only	Unsigned 32-bit	Analog Value		Cycles	0 - 999,999	
21	Burner run time	AV 13	130	131	82	Read-only	Unsigned 32-bit	Analog Value		Hours	0 - 999,999	
22	CH pump cycle count	AV 14	132	133	84	Read-only	Unsigned 32-bit	Analog Value		Cycles	0 - 999,999	
23	DHW pump cycle count	AV 15	134	135	86	Read-only	Unsigned 32-bit	Analog Value		Cycles	0 - 999,999	
24	Boiler pump cycle count	AV 16	138	139	8A	Read-only	Unsigned 32-bit	Analog Value		Cycles	0 - 999,999	
25	CH maximum modulation rate	AV 17	193	194	C1	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	
26	DHW maximum modulation rate	AV 18	194	195	C2	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	
27	Minimum modulation rate	AV 19	195	196	C3	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	
28	Lightoff rate	AV 20	197	198	C5	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	
29	Manual Firing Rate	AV 21	205	206	CD	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	
30	CH setpoint	AV 22	211	212	D3	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
31	CH TOD setpoint	AV 23	212	213	D4	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
32	CH on hysteresis	AV 24	213	214	D5	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
33	CH off hysteresis	AV 25	214	215	D6	Read-only	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
34	Postpurge time	AV 26	236	237	EC	Read-only	Unsigned 16-bit	Analog Value		Seconds	0 TO 64800 seconds (18 hours)	
35	DHW priority override time	AV 27	452	453	1C4	Read-only	Unsigned 16-bit	Analog Value		Seconds	0 TO 65534 seconds (1092.2 minutes)	
36	DHW setpoint	AV 28	453	454	1C5	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
37	DHW TOD setpoint	AV 29	454	455	1C6	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
38	DHW on hysteresis	AV 30	455	456	1C7	Read/Write	Unsigned 16-bit	Analog Value		Degrees	0°C TO 130°C (0.1°C precision)	
39	DHW off hysteresis	AV 31	456	457	1C8	Read-only	Unsigned 16-bit	Analog Value		Degrees	0°C TO 130°C (0.1°C precision)	
40	Outlet high limit setpoint	AV 32	464	465	1D0	Read-only	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
41	Stack limit setpoint	AV 33	467	468	1D3	Read-only	Unsigned 16-bit	Analog Value		Degrees	62.8°C TO 104.4°C (0.1°C precision)	
42	Delta-T delay	AV 34	473	474	1D9	Read-only	Unsigned 16-bit	Analog Value		Seconds	0 TO 64800 seconds (18 hours)	
43	T-rise delay	AV 35	483	484	1E3	Read-only	Unsigned 16-bit	Analog Value		Seconds	0 TO 64800 seconds (18 hours)	
44	CH ODR max outdoor temperature	AV 36	512	513	200	Read/Write	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
45	CH ODR min outdoor temperature	AV 37	513	514	201	Read/Write	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
46	CH ODR low water temperature	AV 38	514	515	202	Read/Write	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
47	LL CH ODR max outdoor temperature	AV 39	517	518	205	Read-only	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
48	LL CH ODR min outdoor temperature	AV 40	518	519	206	Read-only	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
49	LL CH ODR low water temperature	AV 41	519	520	207	Read-only	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
50	Lead lag CH setpoint	AV 42	546	547	222	Read/Write	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
51	Lead lag TOD CH setpoint	AV 43	547	548	223	Read-only	Unsigned 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
52	Lead lag on hysteresis	AV 44	549	550	225	Read-only	Unsigned 16-bit	Analog Value		Degrees	0°C TO 130°C (0.1°C precision)	
53	Lead lag off hysteresis	AV 45	550	551	226	Read-only	Unsigned 16-bit	Analog Value		Degrees	0°C TO 130°C (0.1°C precision)	
54	Lead lag P gain	AV 46	552	553	228	Read-only	Unsigned 16-bit	Analog Value		N/A	Model Specific; see manual	
55	Lead lag I gain	AV 47	553	554	229	Read-only	Unsigned 16-bit	Analog Value		N/A	Model Specific; see manual	
56	Base load common	AV 48	572	573	23C	Read-only	Unsigned 16-bit	Analog Value		%	25% TO 100%	
57	Warm weather shutdown setpoint	AV 49	628	629	274	Read/Write	Signed 16-bit	Analog Value		Degrees	-40°C TO 130°C (0.1°C precision)	
58	Lead lag add stage error threshold	AV 50	718	719	2CE	Read-only	Unsigned 16-bit	Analog Value		Degrees	1.7°C TO 5.6°C (0.1°C precision)	
59	Lead lag add stage interstage delay	AV 51	722	723	2D2	Read-only	Unsigned 16-bit	Analog Value		Seconds	60 (1 min.) TO 1800 (30 mins.)	
60	Lead rotation time	AV 52	733	734	2D0	Read-only	Unsigned 16-bit	Analog Value		Minutes	1 TO 57600 (960 hours)	
61	Force lead rotation time	AV 53	734	735	2DE	Read-only	Unsigned 16-bit	Analog Value		Minutes	1 TO 64800 (1080 hours)	
62	Slave 1 Address	AV 54	769	770	301	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 1st slave found on Lead Lag port
63	Slave 1 Stage Order	AV 55	771	772	303	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 1 has been added to fire
64	Slave 1 Firing Rate	AV 56	772	773	304	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
65	Slave 2 Address	AV 57	773	774	305	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 2nd slave found on Lead Lag port
66	Slave 2 Stage Order	AV 58	775	776	307	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 2 has been added to fire
67	Slave 2 Firing Rate	AV 59	776	777	308	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
68	Slave 3 Address	AV 60	777	778	309	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 3rd slave found on Lead Lag port
69	Slave 3 Stage Order	AV 61	779	780	308	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 3 has been added to fire
70	Slave 3 Firing Rate	AV 62	780	781	30C	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
71	Slave 4 Address	AV 63	781	782	30D	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 4th slave found on Lead Lag port
72	Slave 4 Stage Order	AV 64	783	784	30F	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 4 has been added to fire
73	Slave 4 Firing Rate	AV 65	784	785	310	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
74	Slave 5 Address	AV 66	785	786	311	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 5th slave found on Lead Lag port
75	Slave 5 Stage Order	AV 67	787	788	313	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 5 has been added to fire
76	Slave 5 Firing Rate	AV 68	788	789	314	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
77	Slave 6 Address	AV 69	789	790	315	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 6th slave found on Lead Lag port
78	Slave 6 Stage Order	AV 70	791	792	317	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 6 has been added to fire
79	Slave 6 Firing Rate	AV 71	792	793	318	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
80	Slave 7 Address	AV 72	793	794	319	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 7th slave found on Lead Lag port
81	Slave 7 Stage Order	AV 73	795	796	31B	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 7 has been added to fire
82	Slave 7 Firing Rate	AV 74	796	797	31C	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
83	Slave 8 Address	AV 75	797	798	31D	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	Modbus address of 8th slave found on Lead Lag port
84	Slave 8 Stage Order	AV 76	799	800	31F	Read-only	Unsigned 16-bit	Analog Value		N/A	N/A	Relative order that slave 8 has been added to fire
85	Slave 8 Firing Rate	AV 77	800	801	320	Read-only	Unsigned 16-bit	Analog Value		%	0 TO 100	
86	Lead Boiler Address	AV 78	801	802	321	Read-only	Unsigned 16-bit	Analog Value		N/A	1 TO 8	
87	CH 4 mA water temperature	AV 79	583	584	247	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
88	CH 20 mA water temperature	AV 80	584	585	248	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
89	CH ODR boost time	AV 81	515	516	203	Read-only	Unsigned 16-bit	Analog Value		Seconds	0 TO 64800 seconds (18 hours)	
90	Rate assigned to 0V/4mA (Min Mod > 80%)	AV 82	534	535	216	Read-only	Unsigned 16-bit	Analog Value		%	Model Specific; see manual	

Item	Label	BACnet Object	Modbus Register			Access	Format	Object Type	Mask	Units	Range	Notes
			Decimal	Hex	Base 0							
			Base 0	Base 1	Base 0							
91	Lead Lag CH 4mA water temperature	AV 83	560	561	230	Read-only	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
92	Lead Lag CH 20mA water temperature	AV 84	561	562	231	Read-only	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
93	Lead Lag DHW setpoint	AV 85	705	706	2C1	Read/Write	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
94	LL CH ODR boost time	AV 86	520	521	208	Read-only	Unsigned 16-bit	Analog Value		Seconds	0 TO 64800 seconds (18 hours)	
95	Preferred outlet high limit	AV 87	597	598	255	Read-only	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
96	Preferred stack limit	AV 88	598	599	256	Read-only	Unsigned 16-bit	Analog Value		Degrees	Model Specific; see manual	
97	Preferred lightoff rate	AV 89	666	667	29A	Read-only	Unsigned 16-bit	Analog Value		RPM	Model Specific; see manual	
98	Interlock/ILK	BI 1	2	3	2	Read-only	Unsigned 16-bit	Binary Input	0x0100	N/A	N/A	Bitmask; See Sola Software Interface Specification
99	LCI	BI 2	2	3	2	Read-only	Unsigned 16-bit	Binary Input	0x0400	N/A	N/A	Bitmask; See Sola Software Interface Specification
100	STAT	BI 3	2	3	2	Read-only	Unsigned 16-bit	Binary Input	0x2000	N/A	N/A	Bitmask; See Sola Software Interface Specification
101	Time of Day (TOD)	BI 4	2	3	2	Read-only	Unsigned 16-bit	Binary Input	0x4000	N/A	N/A	Bitmask; See Sola Software Interface Specification
102	Safety Relay	BI 5	2	3	2	Read-only	Unsigned 16-bit	Binary Input	0x8000	N/A	N/A	Bitmask; See Sola Software Interface Specification
103	Annunciator 1/IAS	BI 6	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0001	N/A	N/A	Bitmask; See Sola Software Interface Specification
104	Annunciator 2	BI 7	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0002	N/A	N/A	Bitmask; See Sola Software Interface Specification
105	Annunciator 3	BI 8	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0004	N/A	N/A	Bitmask; See Sola Software Interface Specification
106	Annunciator 4	BI 9	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0008	N/A	N/A	Bitmask; See Sola Software Interface Specification
107	Annunciator 5	BI 10	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0010	N/A	N/A	Bitmask; See Sola Software Interface Specification
108	Annunciator 6	BI 11	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0020	N/A	N/A	Bitmask; See Sola Software Interface Specification
109	Annunciator 7	BI 12	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0040	N/A	N/A	Bitmask; See Sola Software Interface Specification
110	Annunciator 8	BI 13	3	4	3	Read-only	Unsigned 16-bit	Binary Input	0x0080	N/A	N/A	Bitmask; See Sola Software Interface Specification
111	Pump A	BV 1	2	3	2	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	N/A	Bitmask; See Sola Software Interface Specification
112	Pump B	BV 2	2	3	2	Read-only	Unsigned 16-bit	Binary Value	0x0002	N/A	N/A	Bitmask; See Sola Software Interface Specification
113	Pump C	BV 3	2	3	2	Read-only	Unsigned 16-bit	Binary Value	0x0004	N/A	N/A	Bitmask; See Sola Software Interface Specification
114	Spark Ignition	BV 4	2	3	2	Read-only	Unsigned 16-bit	Binary Value	0x0008	N/A	N/A	Bitmask; See Sola Software Interface Specification
115	Pilot Valve	BV 5	2	3	2	Read-only	Unsigned 16-bit	Binary Value	0x0020	N/A	N/A	Bitmask; See Sola Software Interface Specification
116	Alarm	BV 6	2	3	2	Read-only	Unsigned 16-bit	Binary Value	0x0080	N/A	N/A	Bitmask; See Sola Software Interface Specification
117	Outlet High Limit	BV 7	4	5	4	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	N/A	Bitmask; See Sola Software Interface Specification
118	Stack Limit	BV 8	4	5	4	Read-only	Unsigned 16-bit	Binary Value	0x0004	N/A	N/A	Bitmask; See Sola Software Interface Specification
119	Delta-T Limit	BV 9	4	5	4	Read-only	Unsigned 16-bit	Binary Value	0x0008	N/A	N/A	Bitmask; See Sola Software Interface Specification
120	Inversion Limit	BV 10	4	5	4	Read-only	Unsigned 16-bit	Binary Value	0x0040	N/A	N/A	Bitmask; See Sola Software Interface Specification
121	T-rise Limit	BV 11	4	5	4	Read-only	Unsigned 16-bit	Binary Value	0x0200	N/A	N/A	Bitmask; See Sola Software Interface Specification
122	Burner Switch	BV 12	203	204	CB	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Off(0)/On(1)	
123	CH outdoor reset enable	BV 13	215	216	D7	Read/Write	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
124	CH Pump Control (Pump C)	BV 14	273	274	111	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Auto(0)/On(1)	
125	DHW Pump Control (Pump A)	BV 15	277	278	115	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Auto(0)/On(1)	
126	Boiler Pump Control (Pump B)	BV 16	282	283	11A	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Auto(0)/On(1)	
127	CH frost protection enable	BV 17	528	529	210	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
128	DHW frost protection enable	BV 18	529	530	211	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
129	LL frost protection enable	BV 19	532	533	214	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
130	Lead lag master enable	BV 20	545	546	221	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
131	Lead lag CH outdoor reset enable	BV 21	548	549	224	Read-only	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
132	CH enable	BV 22	208	209	DO	Read/Write	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
133	DHW enable	BV 23	448	449	1C0	Read/Write	Unsigned 16-bit	Binary Value	0x0001	N/A	Disabled(0)/Enabled(1)	
134	Demand Source	MV 1	6	7	6	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Unknown 1=No source demand 2=CH 3=DHW 4=Lead Lag slave 5=Lead Lag master 6=CH frost protection 7=DHW frost protection 8=No demand due to burner switch (register 199) turned off 9=DHW storage 10=Reserved 11=Warm weather shutdown	
135	Burner Control Status	MV 2	32	33	20	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Disabled 1=Locked out 2-3=Reserved 4=Anti-short cycle 5=Unconfigured safety data 6-33=Reserved 34=Standby Hold 35=Standby Delay 36-47=Reserved 48=Normal Standby 49=Preparing 50=Ignition 51=Firing 52=Postpurge 53-65535=Reserved	
136	Burner Control State	MV 3	33	34	21	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Sola Software Interface Specification Table 12	
137	Lockout Code	MV 4	34	35	22	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Sola Software Interface Specification Table 9	
138	Hold Code	MV 5	40	41	28	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Sola Software Interface Specification Table 9	
139	Firing Rate Control	MV 6	204	205	CC	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Auto 1=Manual in Run 2=Manual in Run&Standby	
140	CH Demand Switch	MV 7	209	210	D1	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Modulation sensor only 3=LCI	
141	CH Modulation Sensor	MV 8	210	211	D2	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Outlet sensor 2=Inlet sensor 3=SS sensor 4=S10 sensor 5=No sensor (Model dependent)	
142	DHW Demand Switch	MV 9	449	450	1C1	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Modulation sensor only 2=DHW switch	
143	DHW Modulation Sensor	MV 10	461	462	1CD	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=DHW sensor 1=Outlet sensor 2=Inlet sensor	
144	Lead lag CH setpoint source	MV 11	557	558	22D	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Local setpoint (register 546) 2=4-20mA setpoint (register 15)	
145	Lead Lag Modulation Sensor	MV 12	558	559	22E	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=SS sensor 1=S10 sensor (Model dependent)	

Item	Label	BACnet Object	Modbus Register			Access	Format	Object Type	Mask	Units	Range	Notes
			Decimal	Hex								
			Base 0	Base 1	Base 0							
146	Slave mode	MV 13	564	565	23A	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Use first according to priority 1=Equalize run-time 2=Use last according to priority	
147	Lead selection method	MV 14	574	575	23E	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Sequence order rotation 1=Lowest measured run time	
148	Lag selection method	MV 15	575	576	23F	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Sequence order rotation 1=Lowest measured run time	
149	CH setpoint source	MV 16	578	579	242	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Local setpoint (registers 211,212,etc.) 2=4-20mA remote control (register 15)	
150	CH modulation rate source	MV 17	580	581	244	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Local modulation (sensor) 3=4-20mA modulation (register 15) with sensor on/off	
151	Outdoor temperature source	MV 18	626	627	272	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Unconfigured 1=Sensor on S5 connector 2=Sensor on S10 connector (Model dependent)	
152	Slave 1 State	MV 19	770	771	302	Read-only	Unsigned 16-bit	Multi State Value		N/A	0=Slave is unknown 1=Available 2=Add stage 3=Suspend stage 4=Firing 5=On leave 6=Disabled 7=Recovering	
153	Slave 2 State	MV 20	774	775	306	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
154	Slave 3 State	MV 21	778	779	30A	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
155	Slave 4 State	MV 22	782	783	30E	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
156	Slave 5 State	MV 23	786	787	312	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
157	Slave 6 State	MV 24	790	791	316	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
158	Slave 7 State	MV 25	794	795	31A	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
159	Slave 8 State	MV 26	798	799	31E	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Slave 1 State above	
160	Most Recent Alert	MV 27	1120	1121	460	Read-only	Unsigned 16-bit	Multi State Value		N/A	See Sola Software Interface Specification Table 11	
161	Warm weather shutdown enable	MV 28	627	628	273	Read/Write	Unsigned 16-bit	Multi State Value		N/A	0=Disabled 1=Enabled 2=Shutdown immediately	
162	Lead Lag CH demand switch	MV 29	556	557	22C	Read/Write	Unsigned 16-bit	Multi State Value		N/A	0=Disabled 1=STAT terminal 7=Modulation sensor	
163	Lead Lag DHW demand switch	MV 30	704	705	2C0	Read/Write	Unsigned 16-bit	Multi State Value		N/A	0=Disabled 7=DHW (S6) sensor shorted	

Notes



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