CAMUS Hydronics Ltd.

ProtoNode FPC-N34 and ProtoNode FPC-N35 Start-up Guide

For Interfacing Camus Products:

Sola, DynaFLO, Valiant

To Building Automation Systems:

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

APPLICABILITY & EFFECTIVITY

Explains ProtoNode hardware and how to install it.

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

Document Revision: 5.A
Web Configurator
Template Revision: 72

Technical Support

Thank you for purchasing the ProtoNode for Camus.

Please call Camus for technical support of the ProtoNode product.

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

Support Contact Information:

Camus Hydronic Ltd.
6226 Netherhart Rd.
Mississauga, Ontario

Customer Service:

905·696·7800

Email: camus@bellnet.ca

Website: camus-hydronics.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. FPC-N34: Select the protocol configuration on the S Bank DIP switches. (**Section** 3.4)
4. BACnet MS/TP (FPC-N34): Set the MAC Address on the A Bank DIP switches. (**Section** 3.5.1)
5. BACnet MS/TP (FPC-N34): Set the baud rate of the BACnet MS/TP field protocol on the B Bank DIP switches. (**Section** 3.5.2)
6. Connect the ProtoNode 6 pin RS-485 connector to the RS-485 network that is connected to each of the devices. (**Section** 4.2)
7. **If using a serial field protocol:**
   Connect the ProtoNode FPC-N34 3 pin RS-485 port to the field protocol cabling, (**Section** 4.3)
   or connect the ProtoNode FPC-N35 2 pin LonWorks port to the field protocol cabling. (**Section** 4.4)
8. Connect power to the ProtoNode 6 pin port. (**Section** 4.5)
9. Use a web browser to access the ProtoNode Web Configurator page to select the profiles of the devices attached to the ProtoNode and enter any necessary device information. Once the devices are selected, the ProtoNode automatically builds and loads the appropriate configuration. (**Section** 5)
10. Ethernet Network (FPC-N34): If using an Ethernet field protocol, use a web browser to access the ProtoNode Web Configurator page to change the IP Address. (**Section** 5.5)
11. LonWorks (FPC-N35): The ProtoNode must be commissioned on the LonWorks Network. This needs to be done by the LonWorks administrator using a LonWorks commissioning tool. (**Section** 6)

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1 CERTIFICATIONS

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.

1.2 LonMark Certification

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

[1] BACnet is a registered trademark of ASHRAE

2 INTRODUCTION

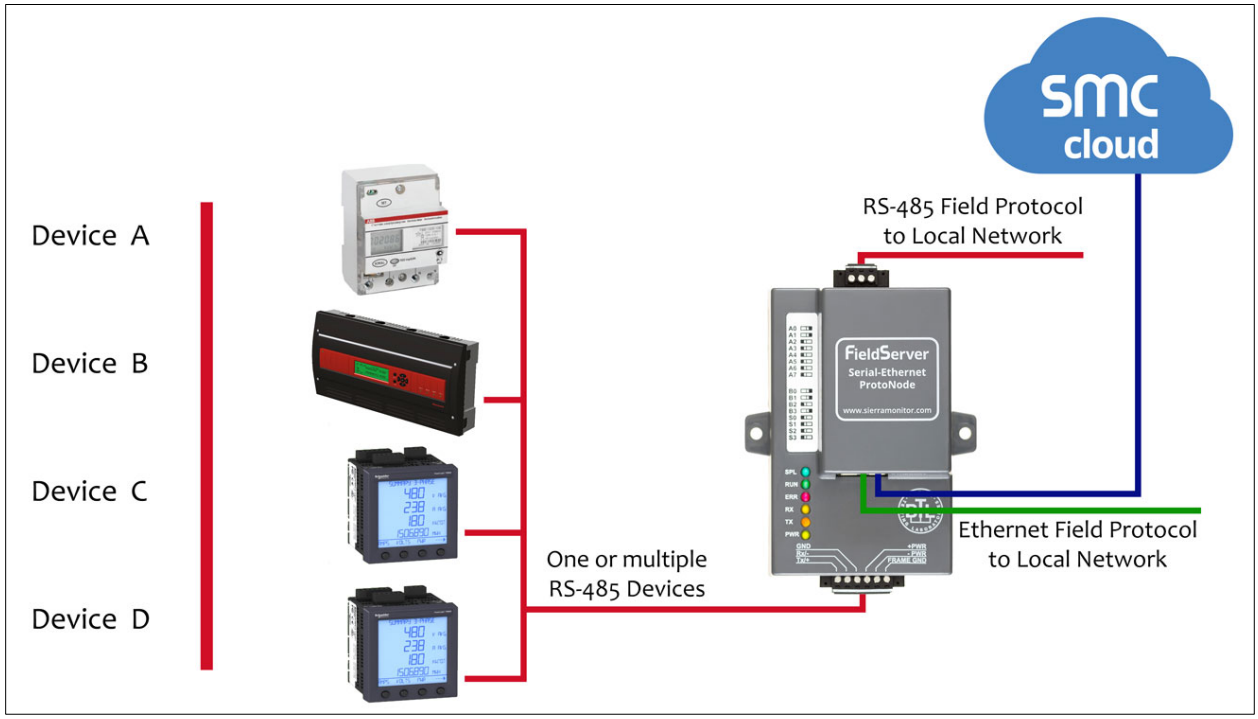
2.1 ProtoNode Gateway

The ProtoNode is an external, high performance **building automation multi-protocol gateway** that is preconfigured to communicate between Camus' products (hereafter called "device") connected to the ProtoNode and configure them for BACnet MS/TP, BACnet/IP, Metasys®[2] N2 by JCI, Modbus TCP/IP or LonWorks®[3].

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

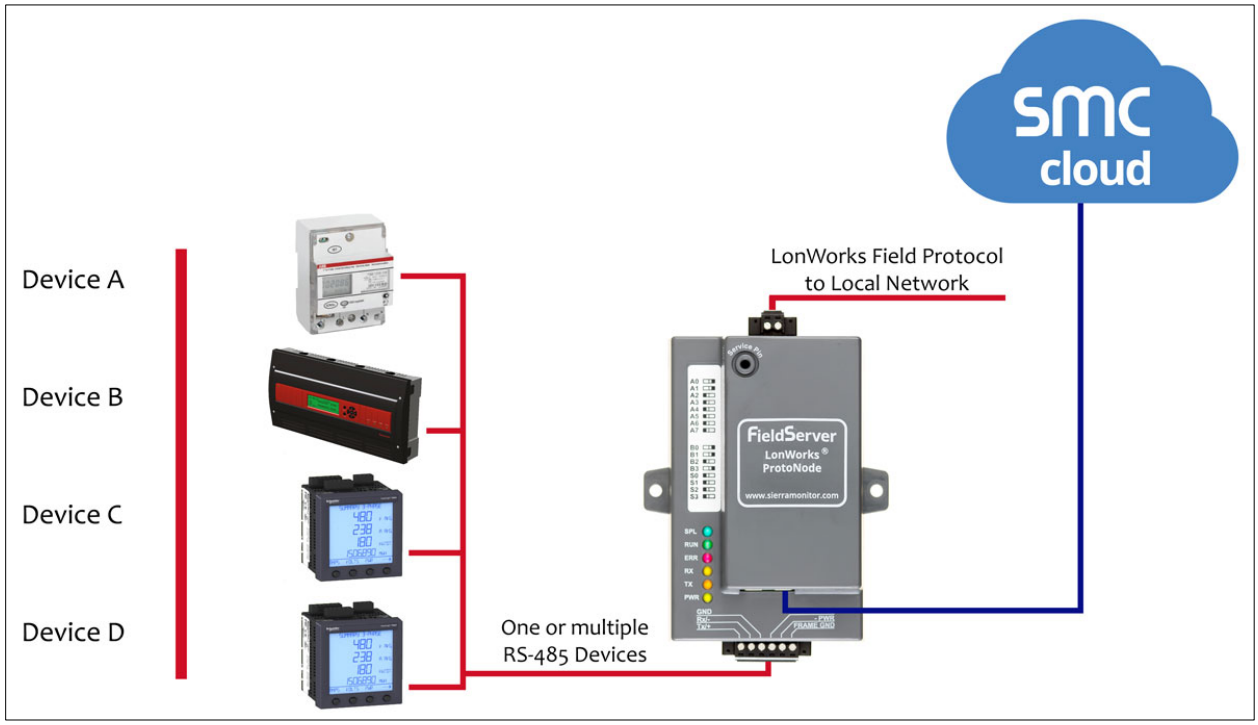
WARNING: Only use screws supplied by MSA Safety in the holes found on the back of the unit when attaching the optional DIN rail bracket. Use of any other screws may damage the unit.

FPC-N34 Connectivity Diagram:



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

FPC-N35 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.

3 SETUP FOR PROTONODE

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-N34	FPC-N34-0565
ProtoNode FPC-N35	FPC-N35-0566

Figure 1: ProtoNode Part Numbers

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

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-N34-0565	1,500
FPC-N35-0566	1,500

Figure 2: Supported Point Count Capacity

Devices	Points Per Device
Sola	37
DynaFLO	12
Valiant	200

Figure 3: Points per Device

3.3 Configuring Device Communications

3.3.1 Confirm the Device and ProtoNode COM Settings Match

- **Any connected serial device 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	Sola	Valiant	DynaFLO
Protocol	Modbus RTU	Modbus RTU	Modbus RTU
Baud Rate	38400	9600	19200
Parity	None	None	None
Data Bits	8	8	8
Stop Bits	1	2	1

Figure 4: COM Settings

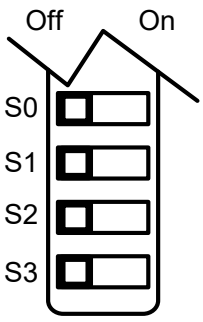
3.3.2 Set Node-ID for Any Device Attached to the ProtoNode

- 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 to any device. The Node-ID assigned is used for deriving the Device Instance for BACnet/IP and BACnet MS/TP. (**Section** 3.5.2)

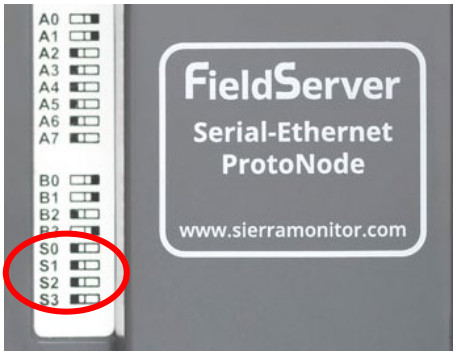
NOTE: The Metasys N2 or Modbus TCP/IP field protocol Node-ID is automatically set to be the same value as the Node-ID of the device.

3.4 Selecting the Desired Protocol Configuration

- ProtoNode FPC-N34 units use the "S" bank of DIP switches (S0 – S3) to select the protocol configuration.
  - See the table in **Figure 5** for the switch settings to select
  - The OFF position is when the DIP switches are set closest to the outside of the box
- ProtoNode FPC-N35 units do not use the "S" bank DIP switches (S0 – S3) to select a field protocol.
  - On ProtoNode FPC-N35 units, these switches are disabled; the field protocol is always LonWorks



S0 – S3 DIP Switches



S Bank DIP Switch Location

ProtoNode FPC-N34	S Bank DIP Switches			
Profile	**S0**	**S1**	**S2**	**S3**
BACnet/IP	Off	Off	Off	Off
BACnet MS/TP	On	Off	Off	Off
Metasys N2	Off	On	Off	Off
Modbus TCP/IP	On	On	Off	Off
BACnet MS/TP (single node)	Off	Off	On	Off

Profile Settings for ProtoNode

Figure 5: S Bank DIP Switches

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

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

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

- Only 1 MAC Address is set for ProtoNode regardless of how many devices are connected to ProtoNode.
- Set the BACnet MS/TP MAC Address of the ProtoNode to a value between 1 to 127 (Master MAC Address); this is so that the BMS front end can find ProtoNode via BACnet Auto-Discovery.

NOTE: Never set a BACnet MS/TP MAC Address of the ProtoNode to a value from 128 to 255. Addresses from 128 to 255 are Slave Addresses and cannot be discovered by BMS front ends that support Auto-Discovery of BACnet MS/TP devices.

- Set "A" bank DIP switches A0 – A7 to assign a MAC Address to the ProtoNode for BACnet MS/TP.
- Refer to **Appendix D.1** for the complete range of MAC Addresses and DIP switch settings.

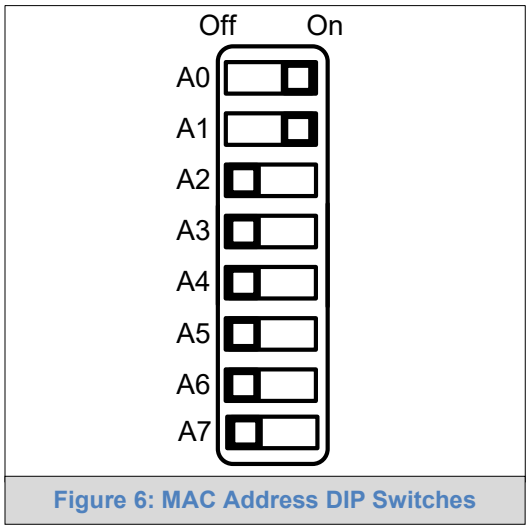


Figure 6: MAC Address DIP Switches

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

3.5.2 BACnet (FPC-N34): Calculating the Default Device Instance

- The Device Instance value is automatically generated using the following formula:

  BACnet Device Instance = (Device Node ID) + (Default Node Offset)

NOTE: The default Node Offset is 50,000.

For example, if Device A has a Node ID of 1 and Device B has a Node ID of 2, then:

BACnet Device Instance A = (1) + (50000) = 50001

BACnet Device Instance B = (2) + (50000) = 50002

NOTE: The Node ID is set in Section 3.3.2.

- To reach a specific BACnet Device Instance result, refer to **Section 5.6**.

3.5.3 FPC-N34: Setting the Baud Rate for BMS Network

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

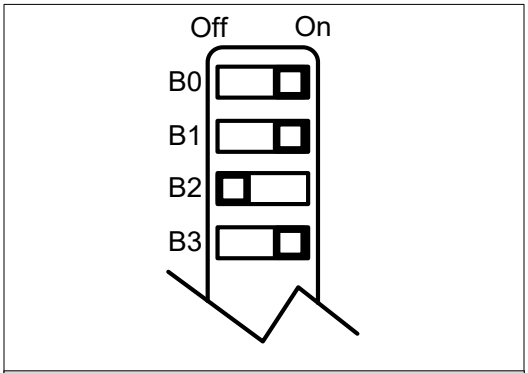


Figure 7: Baud Rate DIP Switches

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

3.5.3.1 Baud Rate DIP Switch Selection

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

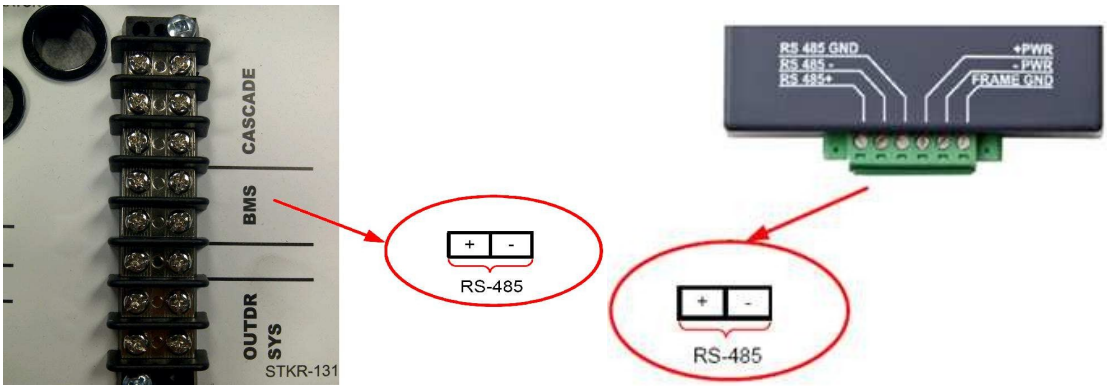
Figure 8: BMS Baud Rate

* Factory default setting = 38400

4 INTERFACING PROTONODE TO DEVICES

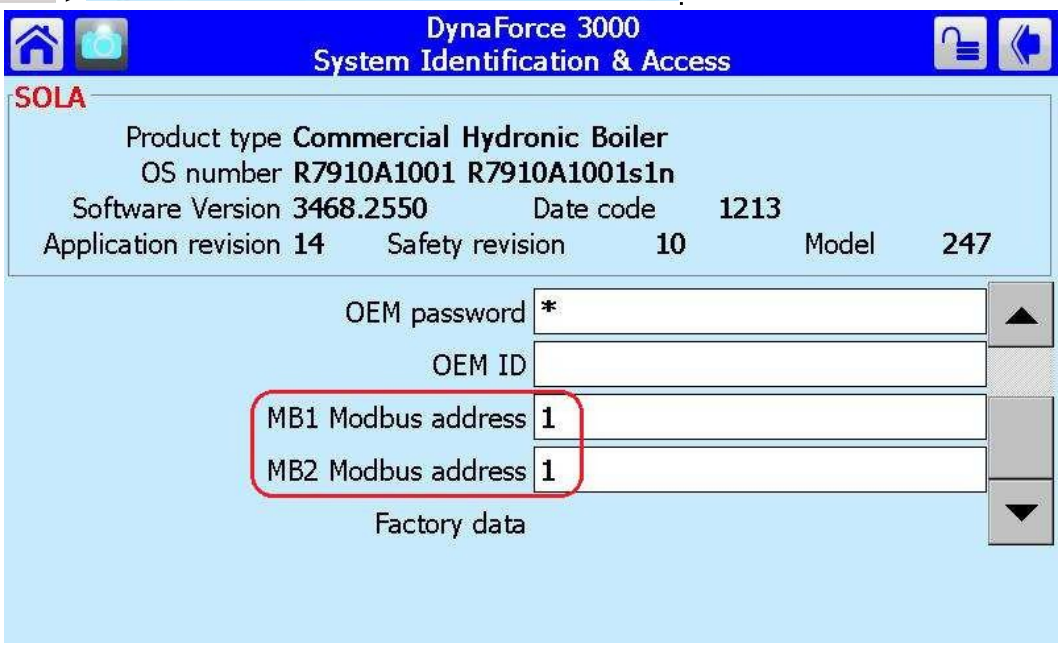
4.1 Connection from DynaFlame/Dynaforce/Advantus/Avenger to ProtoNode

The DynaFlame®/Dynaforce® terminals J3-MB2 (+, -) are connected to the Protonode as shown.



Configure > > “sola” (without the quotation

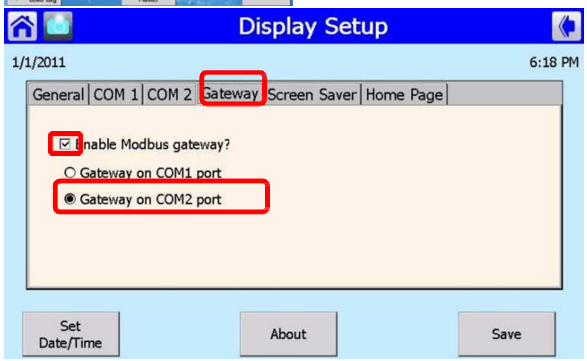
Configure > System Identification & Access:



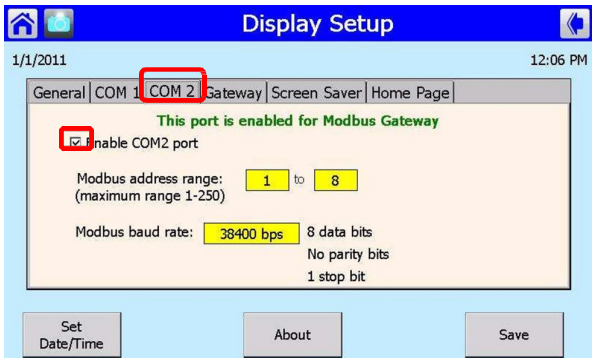
- Boiler 1: MB1 Modbus Address = MB2 Modbus Address = 1
- Boiler 2: MB2 Modbus Address = MB2 Modbus Address = 2 etc.

Activating Comm. Port 2 on Sola Display

> Setup > Display Setup > Select Gateway tab

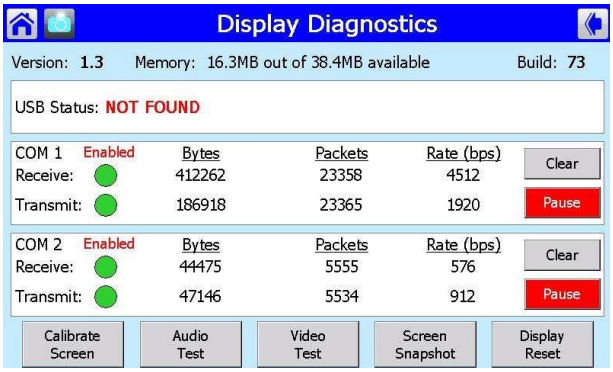


1) Select Gateway tab
2) Check Enable Modbus gateway
3) Select Gateway on COM2 port



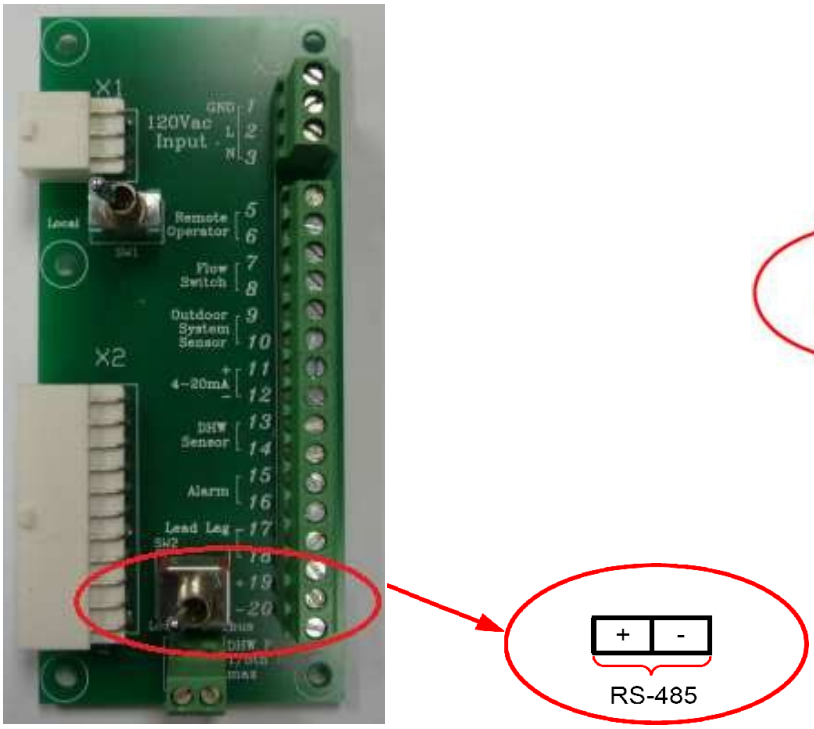
1) Select COM2 tab
2) Check Enable COM2 port

Verify activity on COM2 port



COM1: Modbus data between Diana and SOLA
COM2: Modbus data between Diana and front end (Modbus) or ProtoNode

4.2 Connection from DynaMaxHS to ProtoNode

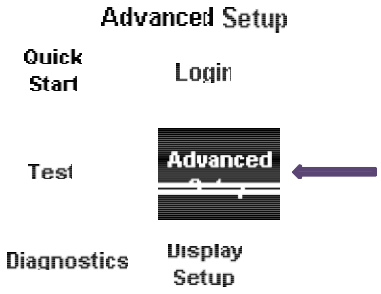


Programming DynaMax^{HS}

Place Local/Modbus toggle switch in LOCAL

Press and select Login, enter “sola”

Select Advanced Setup



Select System

Select System ID & Access

Verify MB1 Modbus address = 1. To be in sequential order.

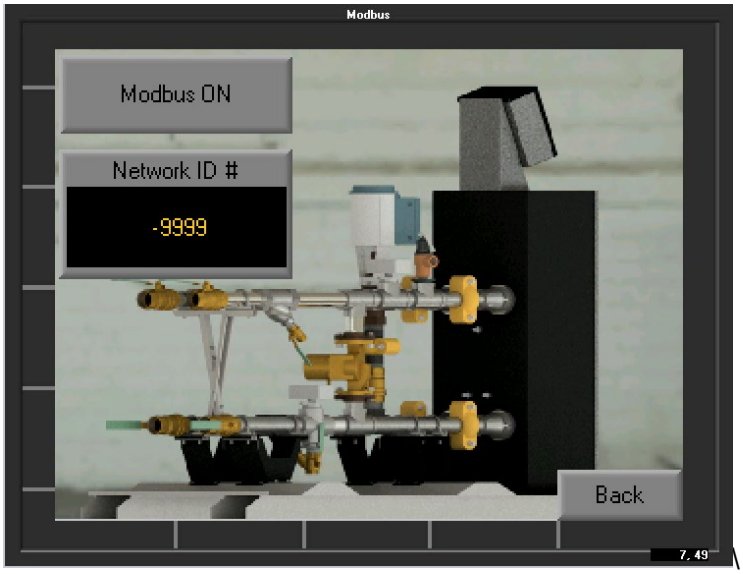
Verify MB2 Modbus address = 1. To be in sequential order.

Place Local/Modbus toggle switch in BMS

4.3 Connection from DynaFLO to ProtoNode

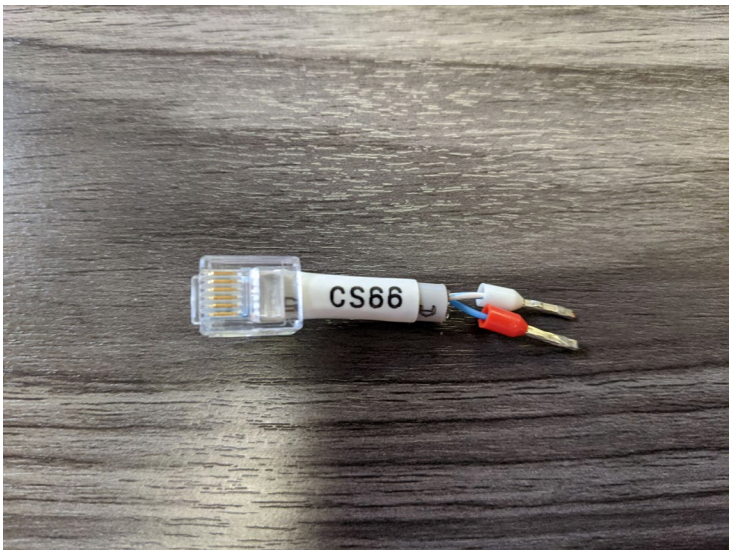
Start-up screen > Setup (password:3232) > Modbus:

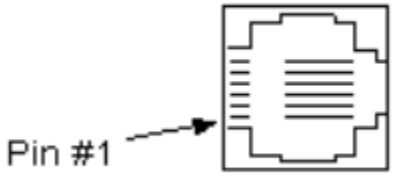
Assign a network ID or slave address to DynaFLO's controller by pressing <Network ID #> and inserting a number. Make sure the <Modbus ON> is switched to "Modbus ON".



When <Modbus ON/OFF> switch turns ON, it opens Port 2 on DynaFLO's controller and sets the controller as a Modbus Slave.

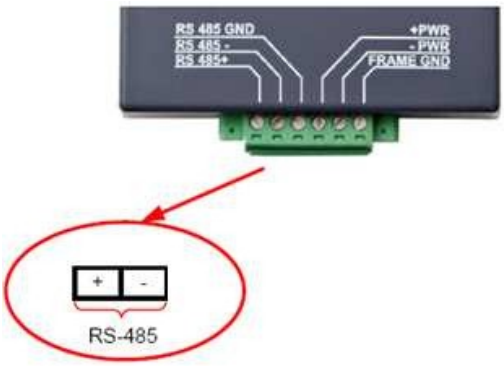
Use the RJ11 cable connector shown below (provided with your DynaFLO) or a similar RJ11 (6POS2C) cable to connect to Port 2 of your DynaFLO's PLC.





Pin Number	Function
1	A signal (+) TX+/RX+
6	B signal (-) TX-/RX-

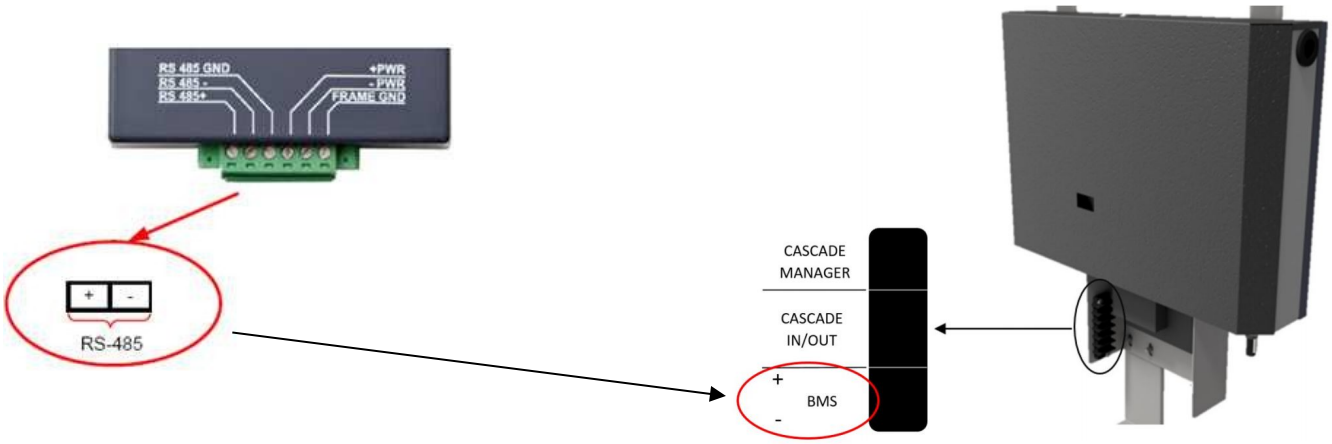
Having access to pins 1 and 6 of Port2 on DynaFLO by using the RJ11 (6POS2C) cable, make connections to the Protonode according to the above table:



Please refer to appendix C.2 for DynaFLO's Modbus mapping table. **Note that DynaFLO needs to be put into <Remote_SP> from the "Control" menu before setpoint can be changed remotely.**

4.4 Connection from Valiant to ProtoNode

The RS-485 connection is made by connecting wires from the Protonode to the terminal block located under the Valiant's control panel. The designated BMS terminals are labelled as shown in the image below for ease of identification:



The slave address can be changed from the Valiant's pushbutton screen. To change the slave address go to Menu>Settings>General Settings>Other Settings>Modbus Address

Note: Do not change "Modbus Stopbits"!

Please refer to appendix C.3 for Valiant's Modbus mapping table.

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

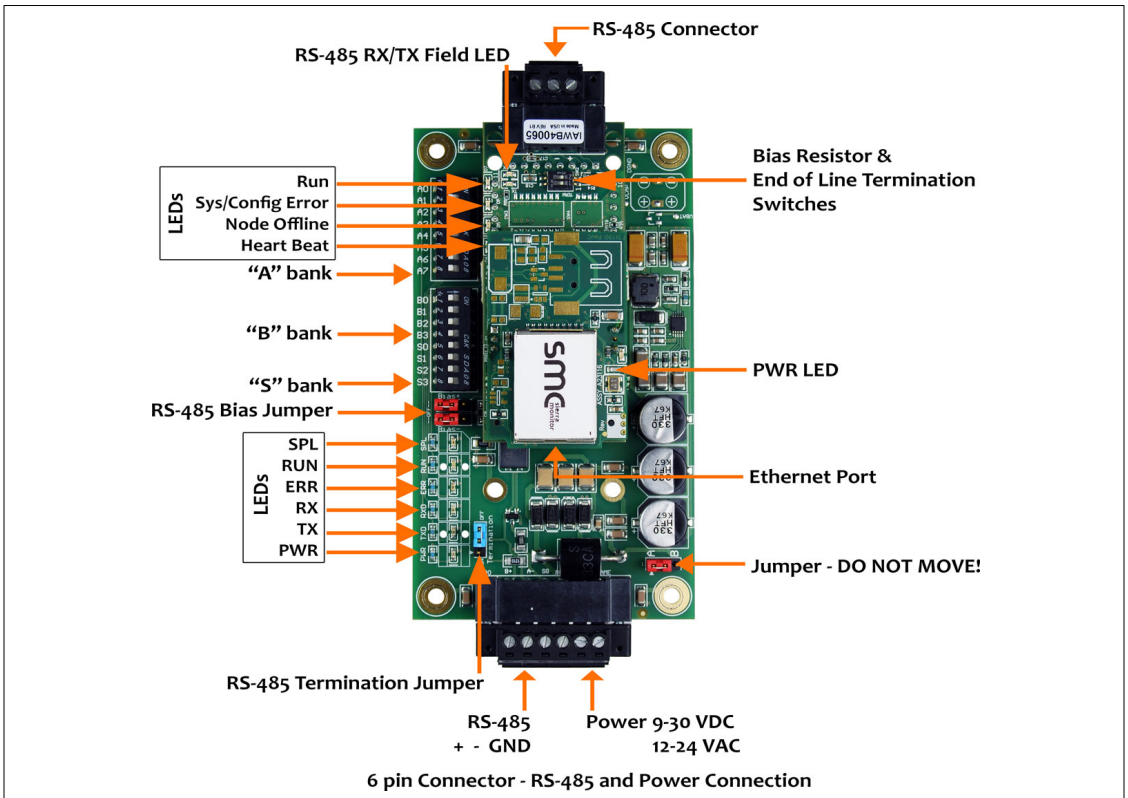


Figure 9: ProtoNode FPC-N34 (Top) and ProtoNode FPC-N35 (Bottom)

4.6 Serial Device Connections to the ProtoNode

ProtoNode 6 Pin Phoenix connector:

- The 6 pin Phoenix connector is the same for ProtoNode FPC-N34 and FPC-N35 (LonWorks).
- Pins 1 through 3 are for RS-485 devices.
  - Use standard grounding principles for RS-485 GND
- Pins 4 through 6 are for power. **Do not connect power until Section 4.5**.

Device Pins	ProtoNode Pin #	Pin Assignment
Pin RS-485 +	Pin 1	RS-485 +
Pin RS-485 -	Pin 2	RS-485 -
Pin GND	Pin 3	RS-485 GND
Power In (+)	Pin 4	V +
Power In (-)	Pin 5	V -
Frame Ground	Pin 6	FRAME GND

Figure 10: Device and Power Connections

4.6.1 Biasing the RS-485 Device Network

- An RS-485 network with more than one device needs to have biasing to ensure proper communication. The biasing only needs to be done on one device.
- The ProtoNode has 510 ohm resistors that can be used to set the biasing. The ProtoNode's default positions from the factory for the biasing jumpers are OFF.
- The OFF position is when the 2 red biasing jumpers straddle the 4 pins closest to the outside of the board of the ProtoNode. (Figure 11)
- **Only turn biasing ON:**
  - **IF the BMS cannot see more than one device connected to the ProtoNode**
  - **AND all the settings (COM settings, wiring, and DIP switches) have been checked**
- To turn biasing ON, move the 2 red biasing jumpers to straddle the 4 pins closest to the inside of the board of the ProtoNode.

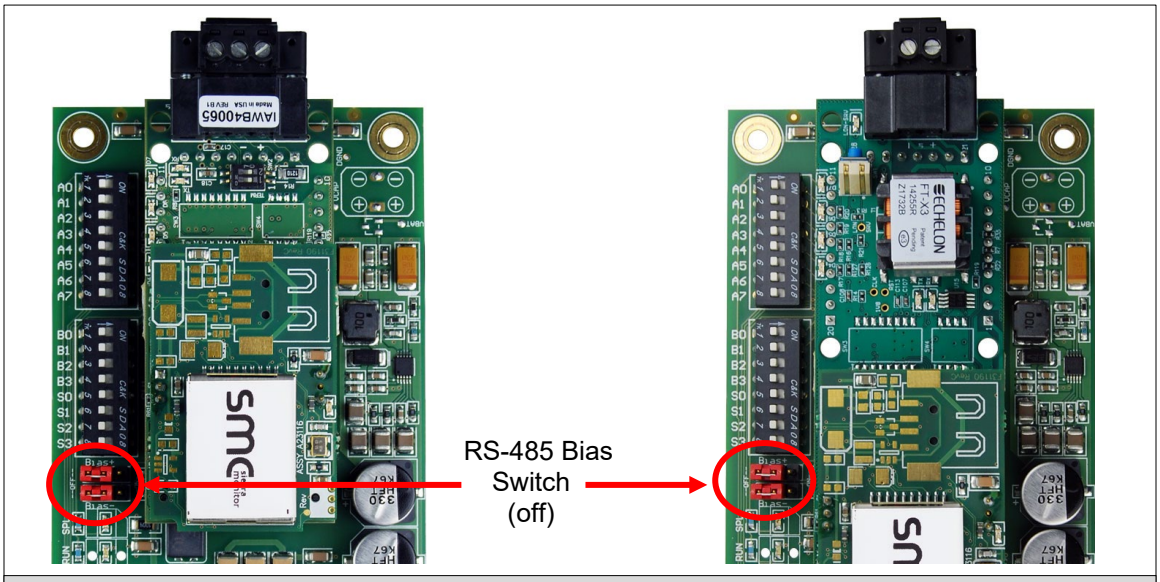


Figure 11: RS-485 Biasing Switch on the ProtoNode N34 (Left) and ProtoNode N35 (Right)

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

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

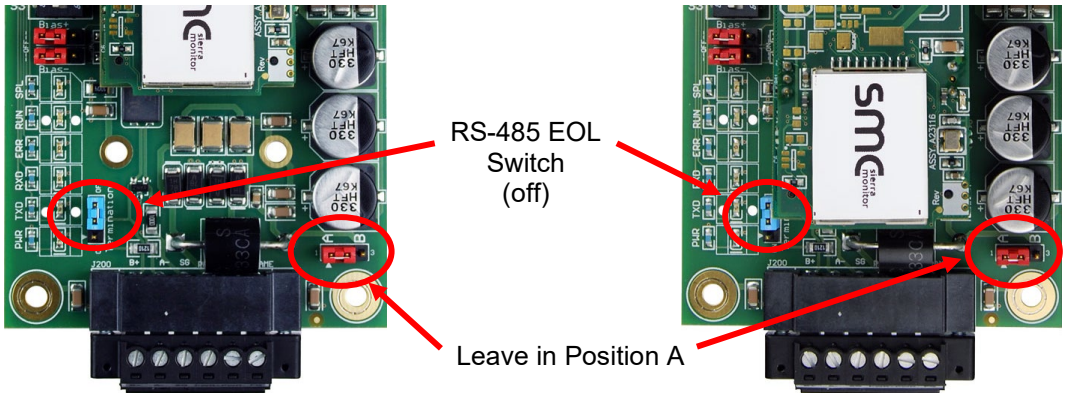


Figure 12: RS-485 End-Of-Line Termination Switch on the ProtoNode N34 (Left) and ProtoNode N35 (Right)

4.7 Serial Network (FPC-N34): Wiring Field Port to RS-485 Network

- Connect the RS-485 network wires to the 3-pin RS-485 connector on ProtoNode as shown below in Figure 13.
  - Use standard grounding principles for RS-485 GND
- See **Section** 5.5 for information on connecting to an Ethernet network.

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

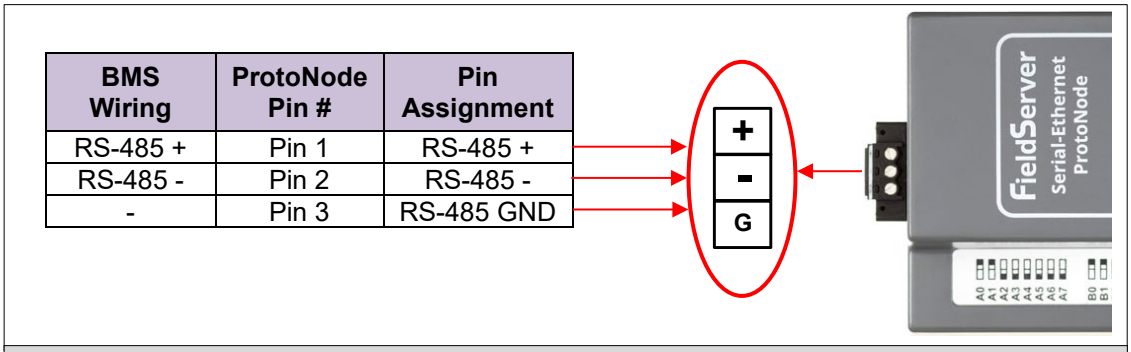


Figure 13: Connection from ProtoNode to RS-485 Field Network

- If the ProtoNode is the last device on the trunk, then the end of line (EOL) termination switch needs to be enabled. **See Figure 14 for the orientation of switch positions referenced below.**
  - The default setting from the factory is OFF (switch position = right side)
  - To enable the EOL termination, turn the EOL switch ON (switch position = left side)

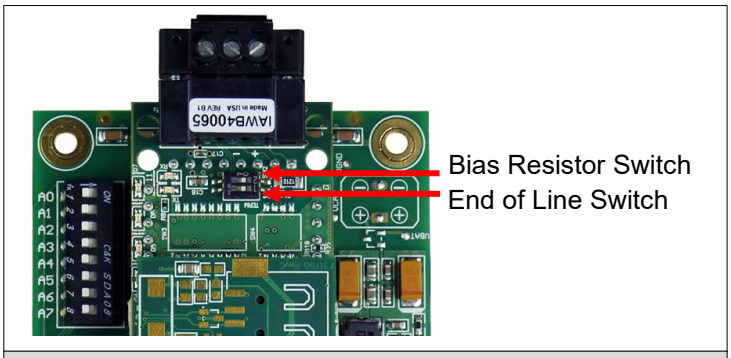


Figure 14: RS-485 EOL & Bias Resistor Switches

- If more than one RS-485 device is connected to the network, then the field bias resistor switch needs to be enabled to ensure proper communication. **See Figure 14 for the orientation of switch positions referenced below.**
  - The default factory setting is OFF (switch position = right side)
  - To enable biasing, turn the bias switch ON (switch position = left side)

NOTE: Biasing only needs to be enabled on one device. The ProtoNode has 510 ohm resistors that are used to set the biasing.

4.8 LonWorks (FPC-N35): Wiring LonWorks Devices to the LonWorks Terminal

- Wire the LonWorks device network to the ProtoNode LonWorks Terminal.
  - Use approved cable per the FT-10 installation guidelines
  - LonWorks has no polarity.

Figure 15: LonWorks Terminal

4.9 Power-Up ProtoNode

Check power requirements in the table below:

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

Figure 16: Required Current Draw for the ProtoNode

Apply power to the ProtoNode as shown below in Figure 17. Ensure that the power supply used complies with the specifications provided in Appendix E.1.

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

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

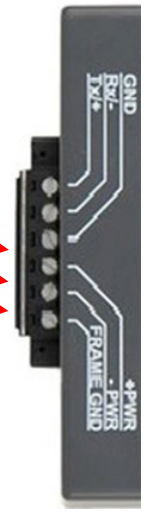


Figure 17: Power Connections

5 USE THE PROTONODE WEB CONFIGURATOR TO SETUP THE GATEWAY

5.1 Connect the PC to the ProtoNode via the Ethernet Port

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

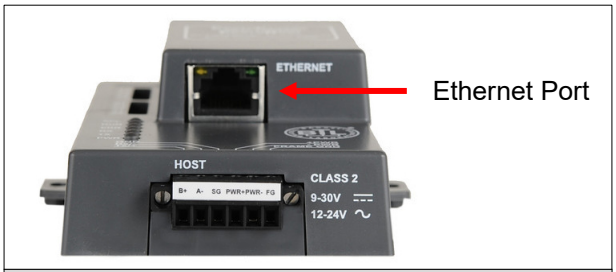


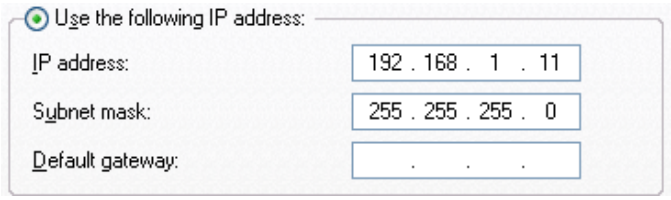
Figure 18: Ethernet Port Location

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.

5.2 Connecting to the ProtoNode Web Configurator

After setting a local PC on the same subnet as the ProtoNode (**Section 5.1**), open a web browser on the PC and enter the IP Address of the ProtoNode; the default address is 192.168.1.24.

NOTE: If the IP Address of the ProtoNode was changed, the assigned IP Address can be discovered using the FS Toolbox utility. See Appendix A.1 for instructions.

5.3 Selecting Profiles for Devices Connected to ProtoNode

NOTE: If Modbus TCP/IP was selected in Section 3.4 for the Field/BMS protocol, skip this section. Device profiles are NOT used for Modbus TCP/IP.

- 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 19**)

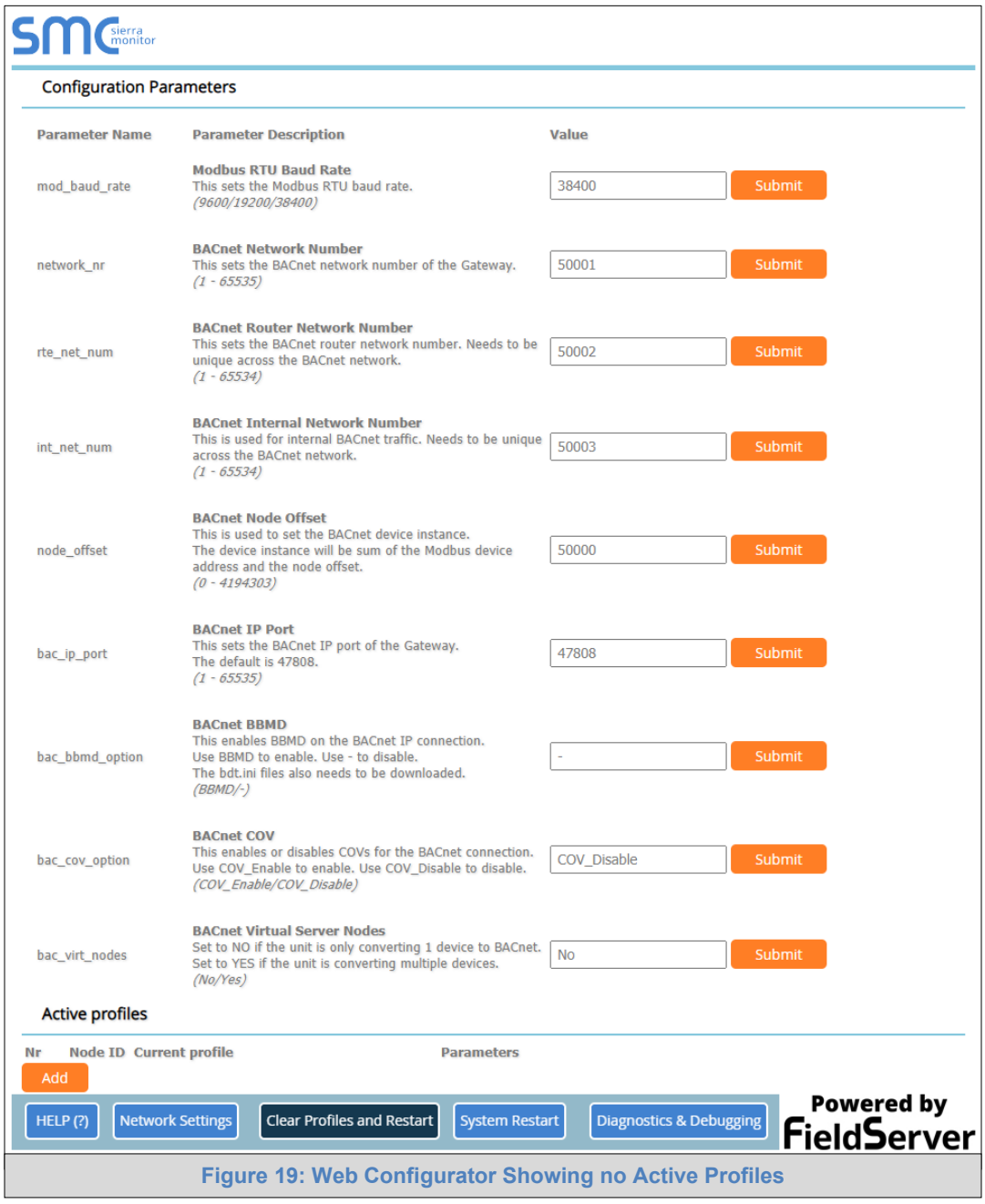


Figure 19: Web Configurator Showing no Active Profiles

- To add an active profile to support a device, click the Add button under the Active Profiles heading. Select a profile from the drop-down menu field that appears underneath the Current profile column.

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.

- 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.

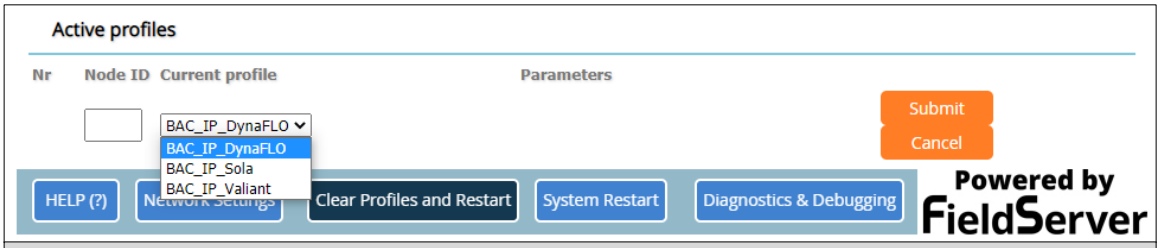


Figure 20: Web Configurator Showing Available Profile Selection

- 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 21.

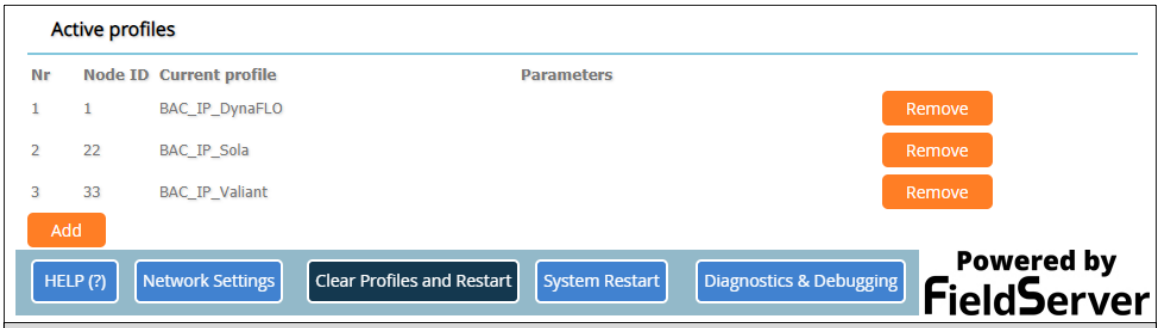


Figure 21: Web Configurator Showing Active Profile Additions

5.4 Verify Device Communications

- **Check that TX and RX LEDs** are rapidly flashing. See Appendix A.4 for information and images.
- Confirm the software shows communication without errors (Appendix A.2).

5.5 Ethernet Network: Setting IP Address for the Field Network

- Follow the steps outlined in **Section** 5.1 to access the ProtoNode Web Configurator.
- To access the FS-GUI, click on the "Diagnostics & Debugging" button in the bottom right corner of the page.

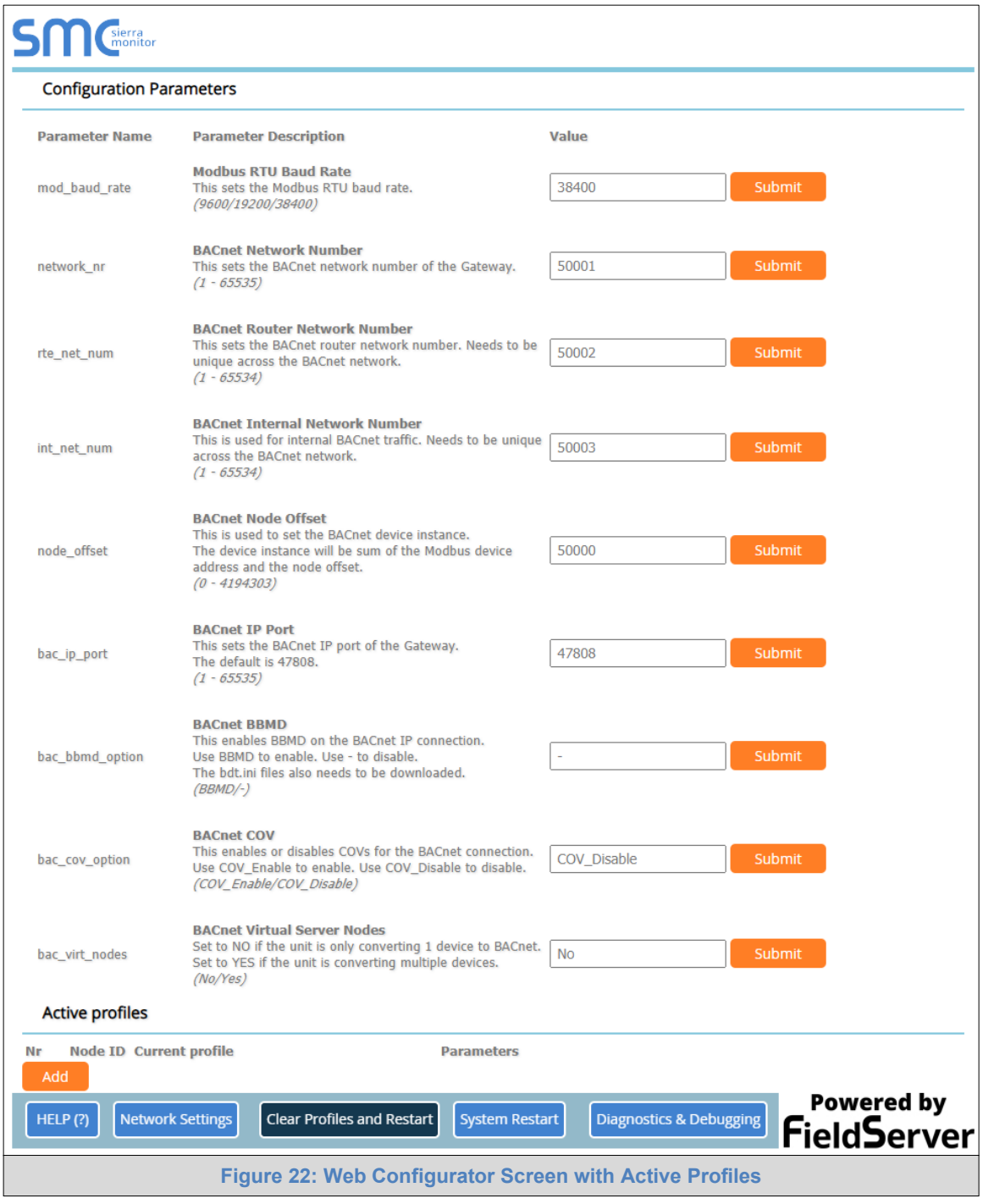


Figure 22: Web Configurator Screen with Active Profiles

- 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 23)

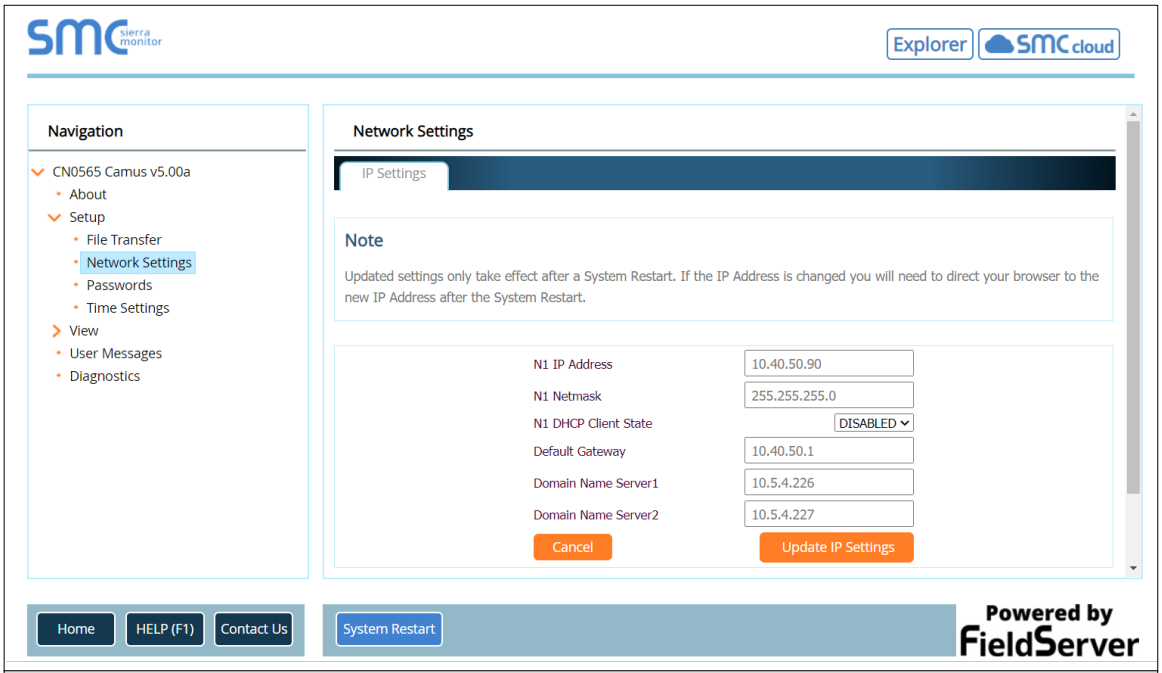


Figure 23: Changing IP Address via FS-GUI

- 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 23) 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.

5.6 BACnet: Setting Node_Offset to Assign Specific Device Instances

- Follow the steps outlined in **Section** 5.1 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.

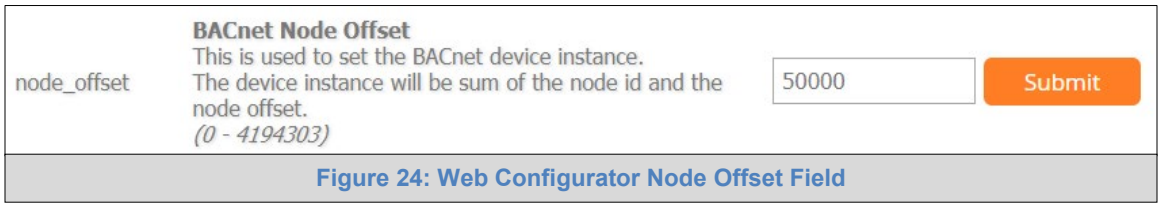


Figure 24: Web Configurator Node Offset Field

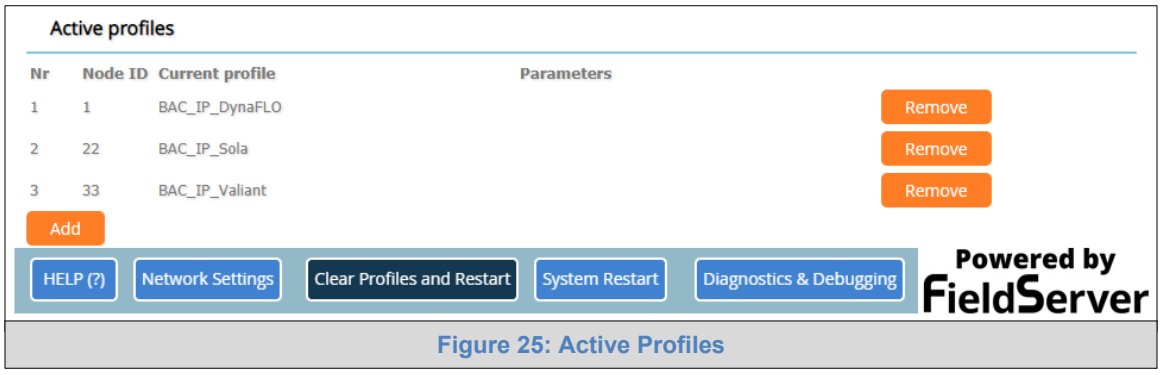


Figure 25: Active Profiles

5.7 How to Start the Installation Over: Clearing Profiles

- Follow the steps outlined in **Section** 5.1 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.

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

Commissioning may only be performed by the LonWorks administrator.

6.1 Commissioning ProtoNode FPC-N35 on a LonWorks Network

During the commissioning process, the LonWorks administrator may prompt the user to hit the service pin on the ProtoNode FPC-N35 at a specific point (this step occurs at different points of the commissioning process for each LonWorks network management tool).

- If an XIF file is required, see steps in **Section** 6.1.1 to generate XIF.

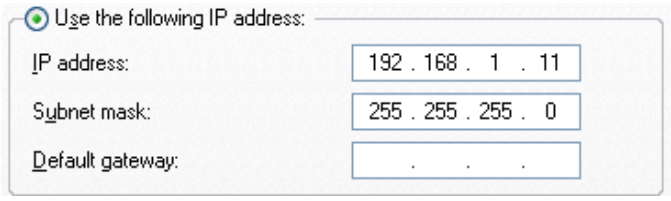
Figure 26: LonWorks Service Pin Location

6.1.1 Instructions to Upload XIF File from ProtoNode FPC-N35 Using Browser

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

- Open a web browser and go to the following address: [IP Address of ProtoNode]/fserver.xif
  - Example: 192.168.1.24/fserver.xif
- If the web browser prompts to save the file, save the file onto the PC. If the web browser displays the xif file as a web page, save the file onto the local PC as “fserver.xif”.

```
File: fserver.xif generated by LonDriver Revision 1.30(d), XIF Version 4.0
Copyright (c) 2000-2012 by FieldServer Technologies
All Rights Reserved.  Run on Thu Jan  1 00:00:00 1970

90:00:95:47:1E:02:04:7C
2 15 1 4 0 14 11 3 3 12 14 11 11 11 11 3 0 16 63 0 1 11 4
32 5 19 13 28 0 0 15 5 3 109 63
1 7 1 0 4 4 4 15 200 0
78125 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 5 8 5 12 14 15
*
"FFP-Lon Demo

VAR nviAnalog_01 0 0 0 0
0 1 63 0 0 0 0 0 0 0 0 0 0
*
51 * 1
4 0 4 0 0
VAR nvoAnalog_01 1 0 0 0
0 1 63 1 0 0 0 0 0 0 0 0 0
*
51 * 1
4 0 4 0 0
VAR nviBinary_01 2 0 0 0
0 1 63 0 0 0 0 0 0 0 0 0 0
*
95 * 2
1 0 0 0 0
1 0 0 1 0
VAR nvoBinary_01 3 0 0 0
0 1 63 1 0 0 0 0 0 0 0 0 0
*
95 * 2
1 0 0 0 0
1 0 0 1 0
```

Figure 27: Sample of Fserver.XIF File Generated

7 USING THE EMBEDDED BACNET EXPLORER

The embedded BACnet Explorer allows installers of the OEM product to validate that their equipment is working on BACnet without having to ask the BMS integrator to test the unit.

- To access the embedded BACnet Explorer, go to the FS-GUI page and click the Explorer button.

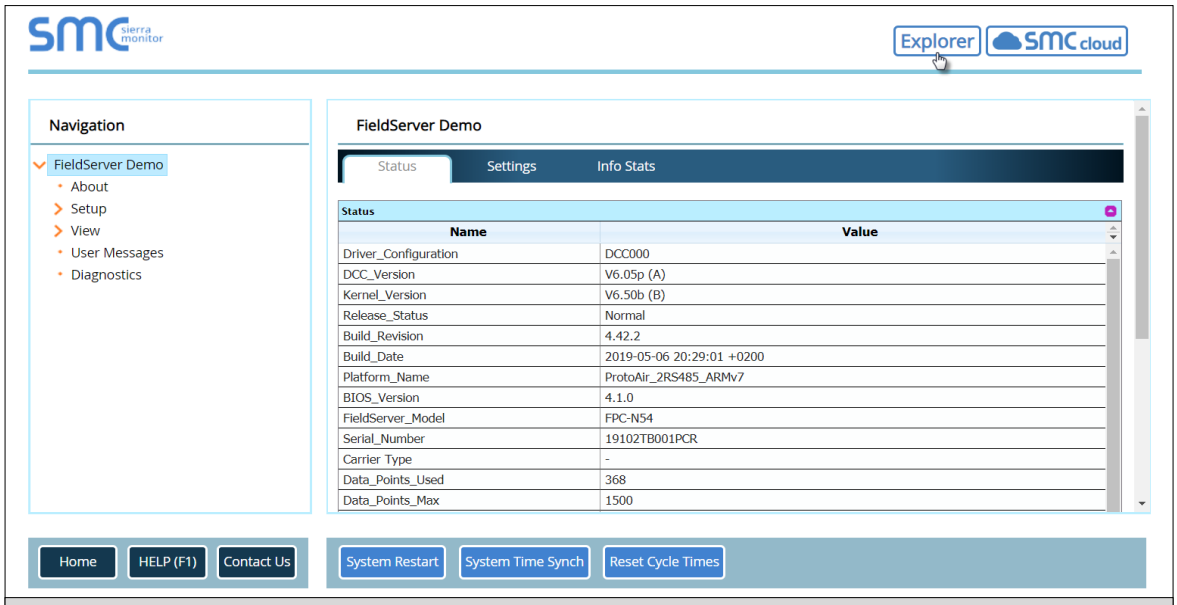


Figure 28: FS-GUI BACnet Explorer Button

- Then login to the BACnet Explorer page using the supplied username and password.

NOTE: The default user name is "admin" and the default password is "admin".

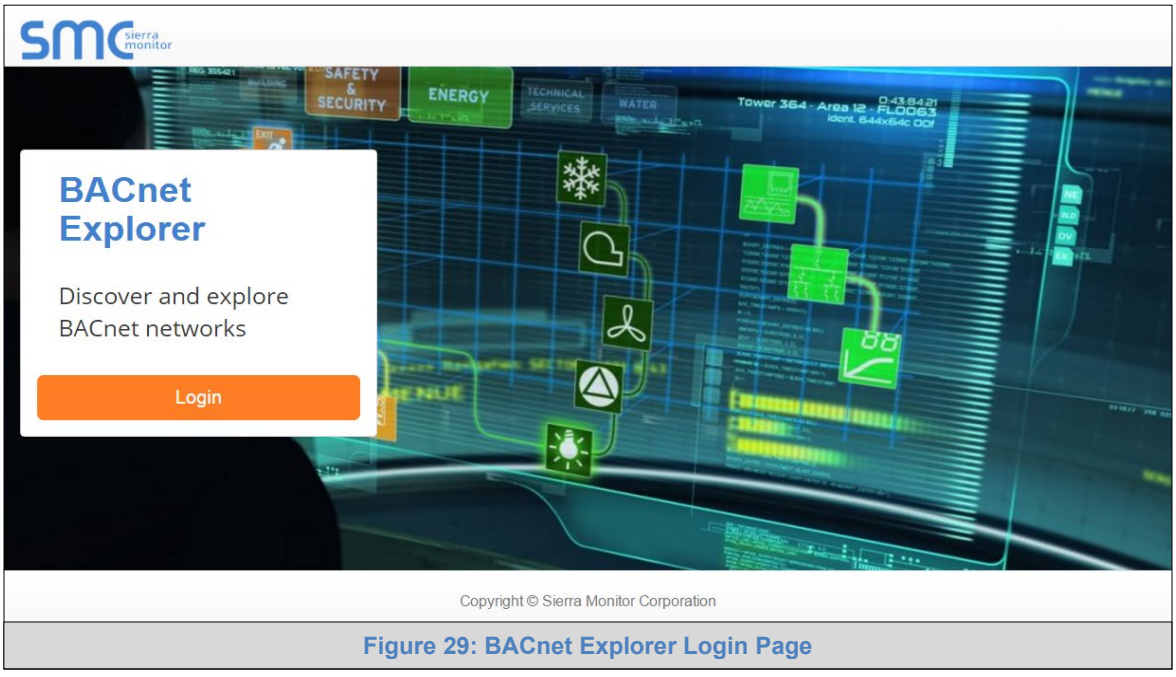


Figure 29: BACnet Explorer Login Page

NOTE: For BACnet/IP, click on the Settings button on the left side of the landing page to ensure the ProtoNode is on the BACnet/IP network subnet or to configure BBMD.

7.1 Discover Device List

- From the BACnet Explorer landing page, click on the BACnet Explorer button on the left side of the screen to go to the BACnet Explorer page.

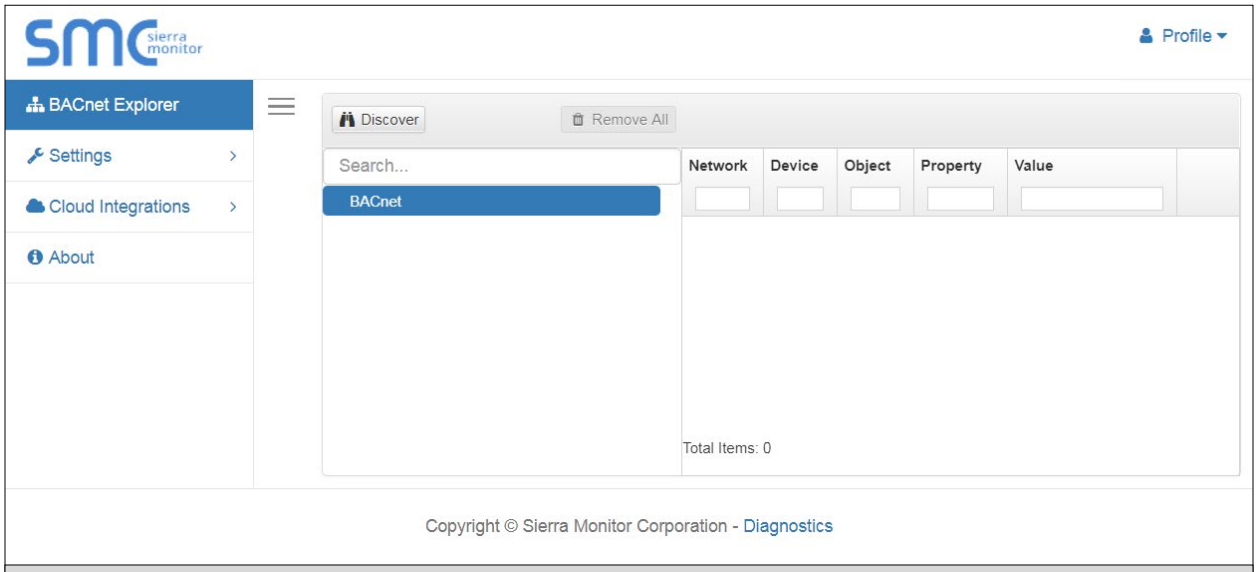


Figure 30: BACnet Explorer Page

- To discover the devices connected to the same subnet as the BACnet Explorer, click the Discover button (binocular icon).
- This will open the Discover window, click the checkboxes next to the desired search settings and click Discover to start the search.

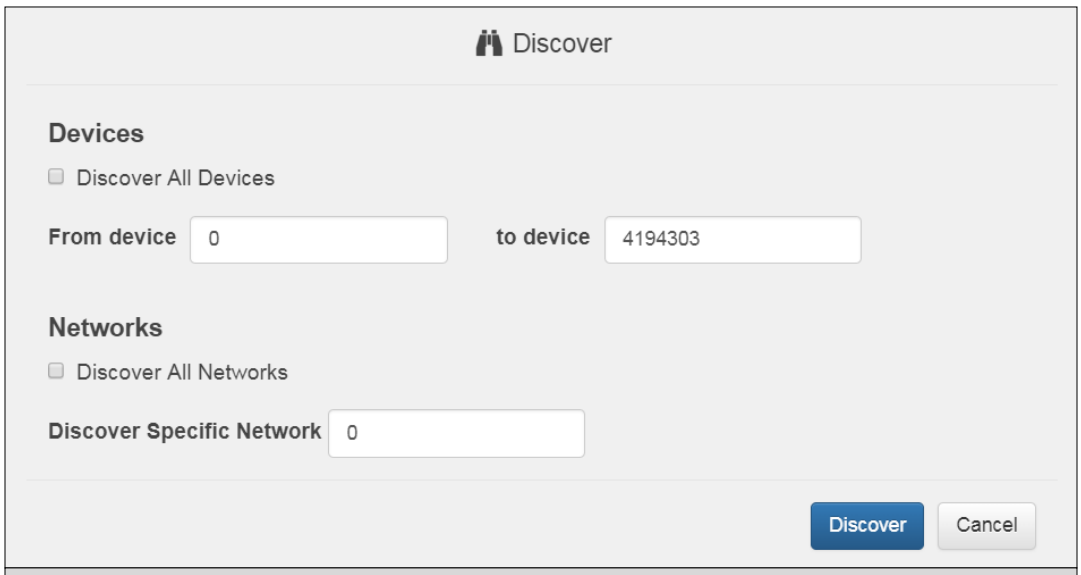


Figure 31: Discover Window

NOTE: The "Discover All Devices" or "Discover All Networks" checkboxes must be unchecked to search for a specific device range or network.

NOTE: Allow the devices to populate before interacting with the device list for optimal performance. Any discovery or explore process will cause a green message to appear in the upper right corner of the browser to confirm that the action is complete.

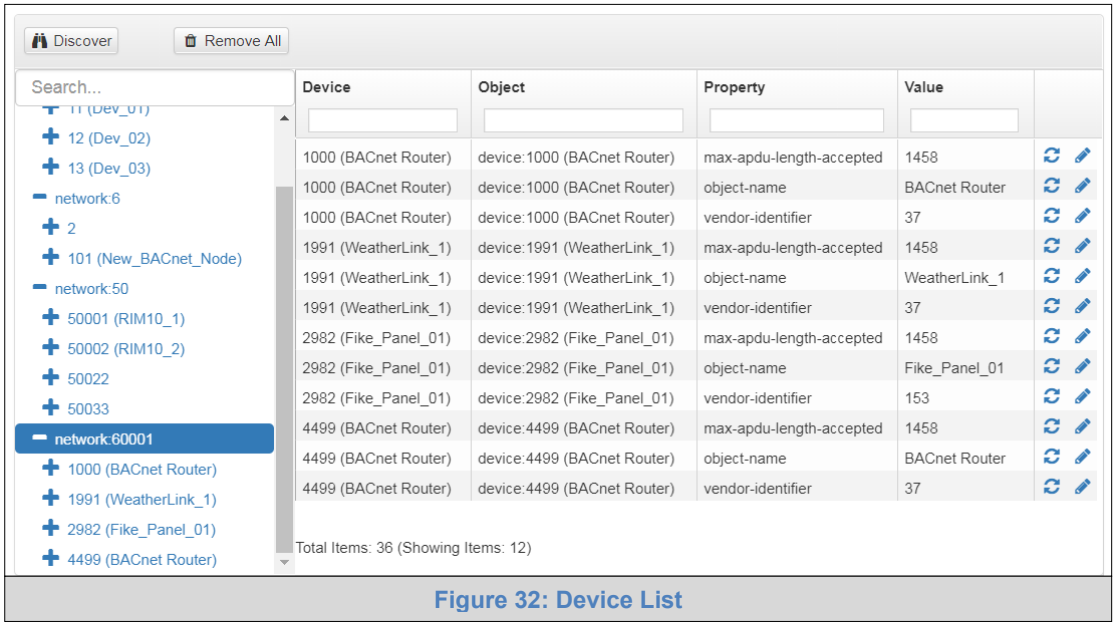


Figure 32: Device List

7.2 View Device Details and Explore Points/Parameters

- To view the device details, click the blue plus sign (+) next to the desired device in the list.
  - This will show only some of the device properties for the selected aspect of a device

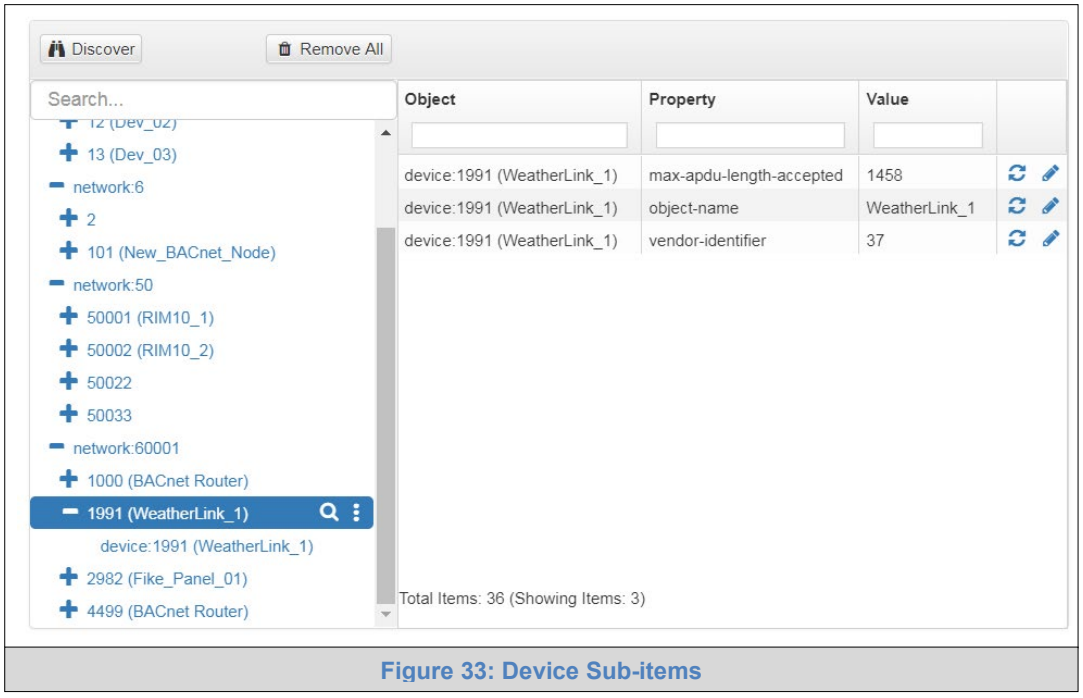


Figure 33: Device Sub-items

- To view the full details of a device, highlighting the device directly (in Figure 34 "1991 WeatherLink_1") and click the Explore button ( ) that appears to the right of the highlighted device as a magnifying glass icon or double-click the highlighted device.

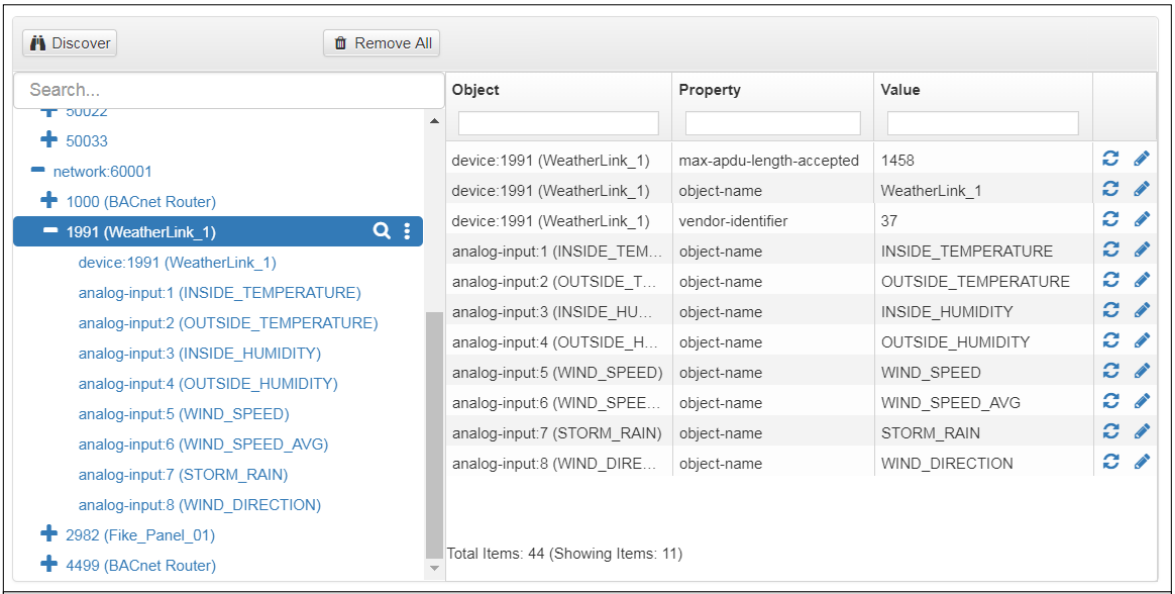


Figure 34: Full Device Sub-items

  - Now additional device details are viewable; however, the device can be explored even further

- Click on one of the device details.

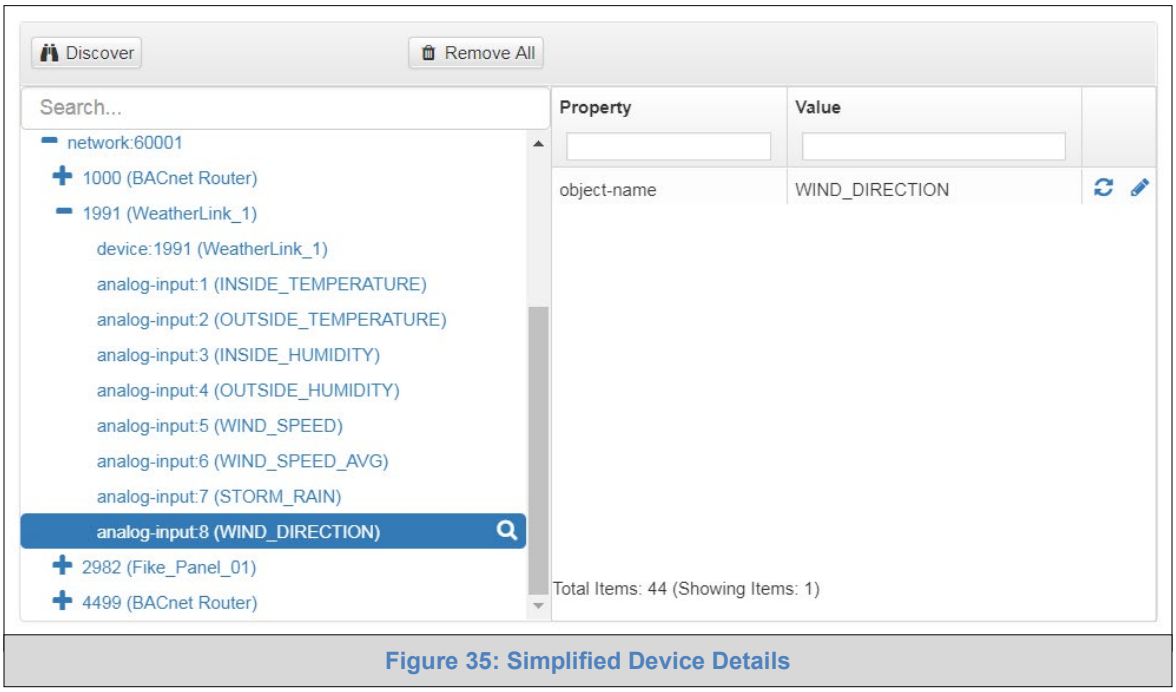


Figure 35: Simplified Device Details

- Then click on the Explore button or double-click the device object.

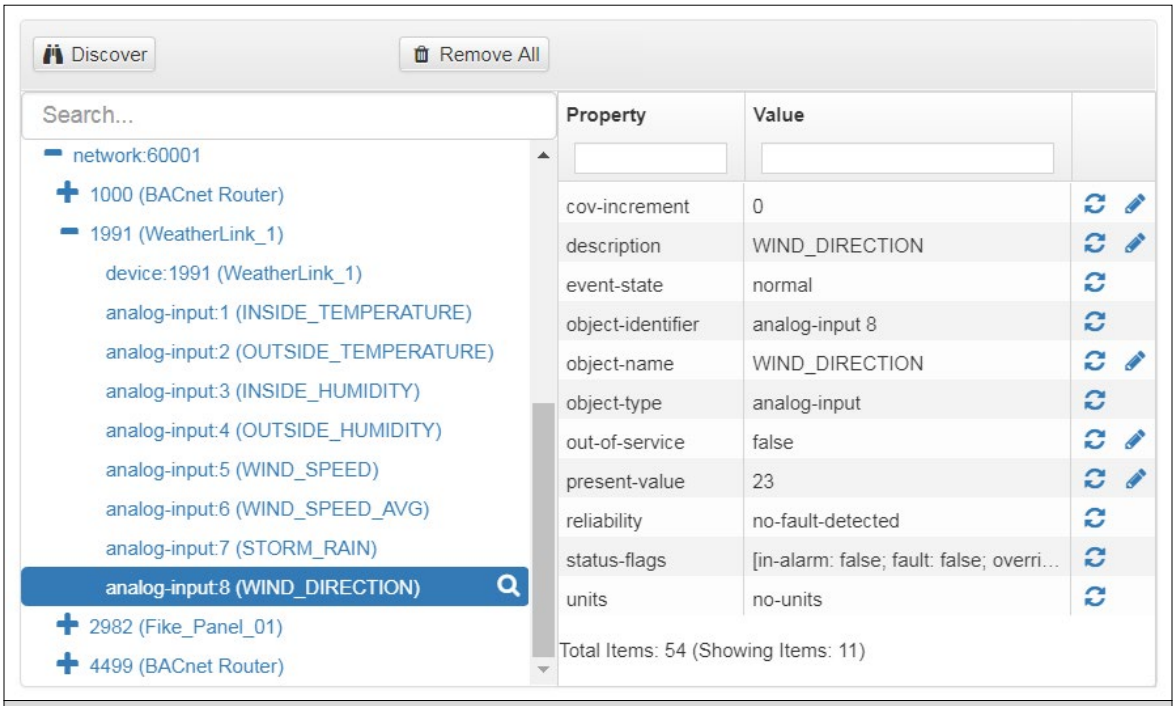


Figure 36: Additional Device Details

A full list of the device details will appear on the right side window. If changes are expected since the last explore, simply press the Refresh button ( ) that appears to right of individual properties to refresh the value.

NOTE: The Explorer Search Bar will find devices based on their Device ID.

NOTE: The Explorer Discovery Tree has 3 levels that correspond to the following.

- **Network number**
  - **Device**
    - **Device object**

7.2.1 Edit the Present Value Field

The only recommended field to edit via BACnet Explorer is the device's present value field.

NOTE: Other BACnet properties are editable (such as object name, object description, etc.); however, this is not recommended because the BACnet Explorer is a discovery tool not a Building Management System (BMS).

- To edit the present value, select it in the property listings.

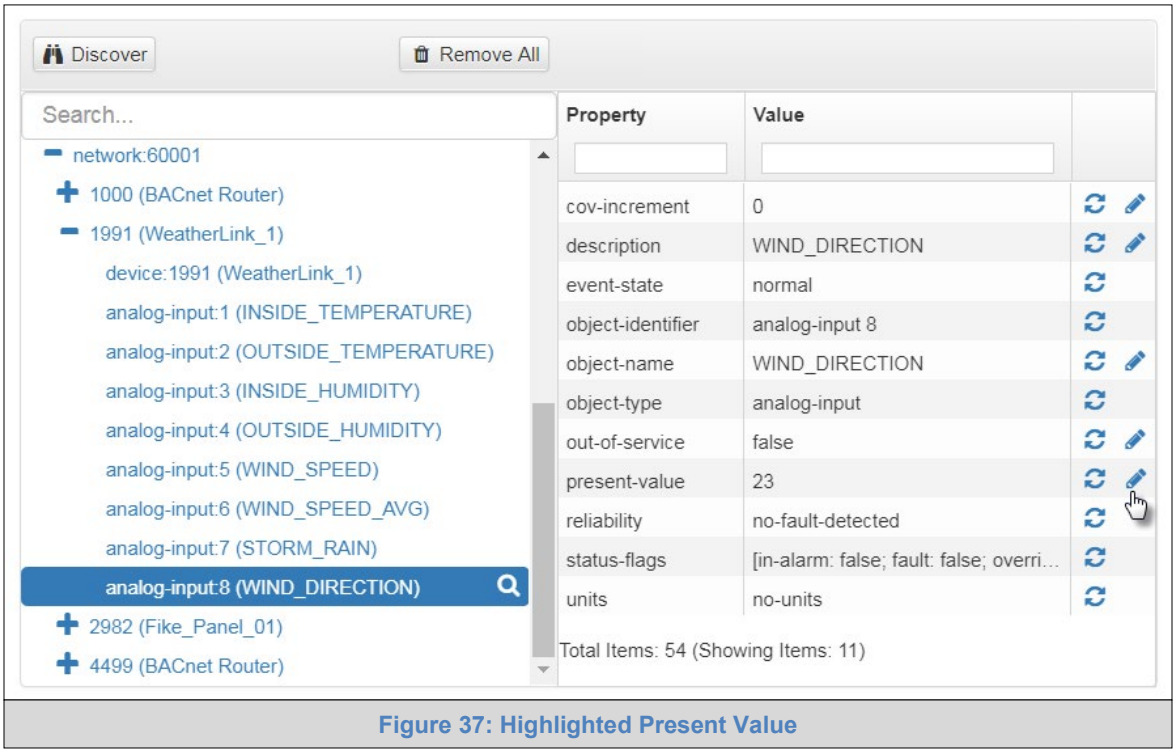


Figure 37: Highlighted Present Value

- Then click the Write button ( ) on the right of the property to bring up the Write Property window.

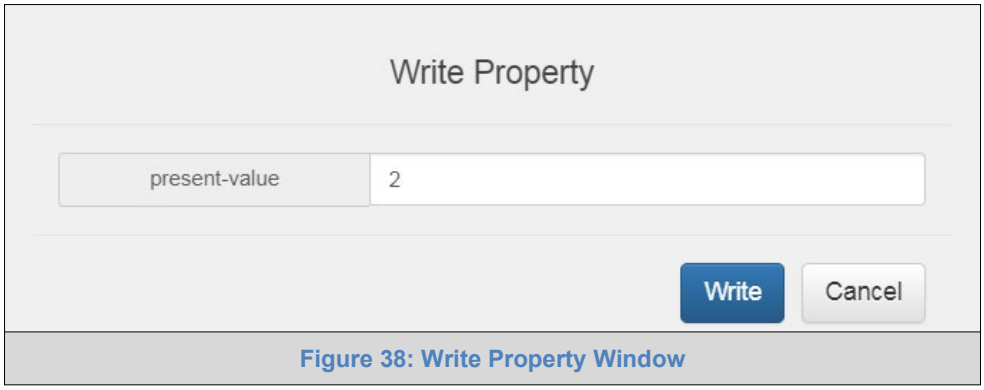


Figure 38: Write Property Window

- Enter the appropriate change and click the Write button.

  The window will close. When the BACnet Explorer page appears, the present value will be changed as specified.

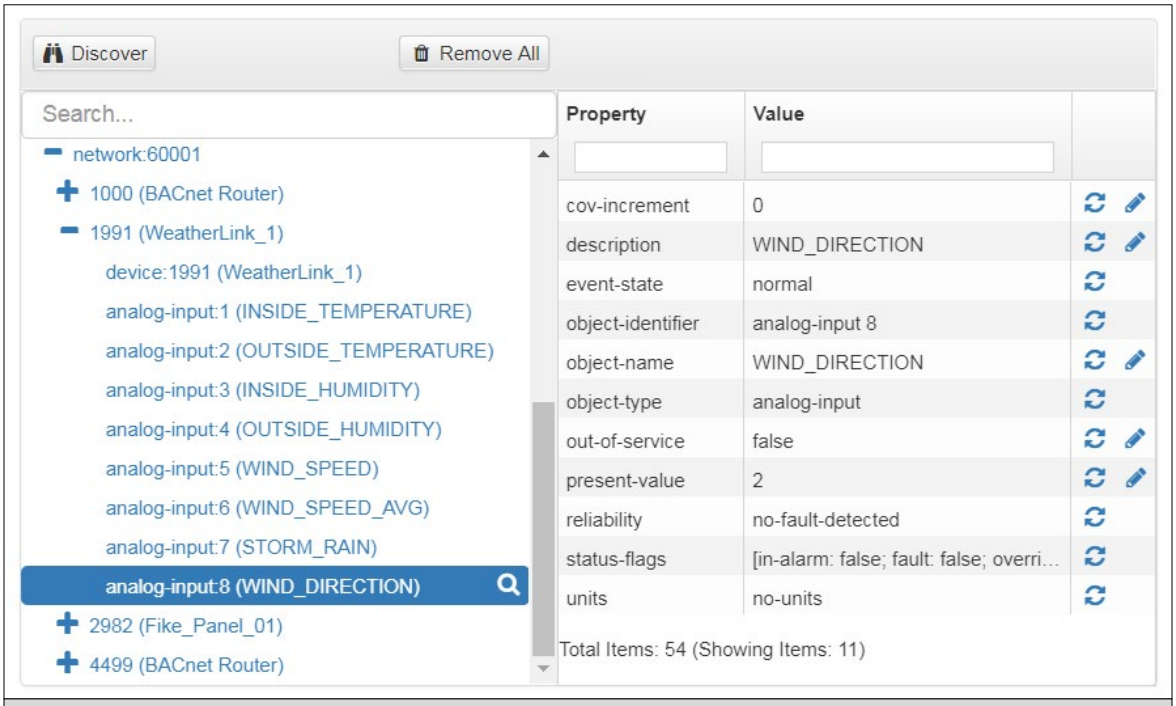


Figure 39: Updated Present Value

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.

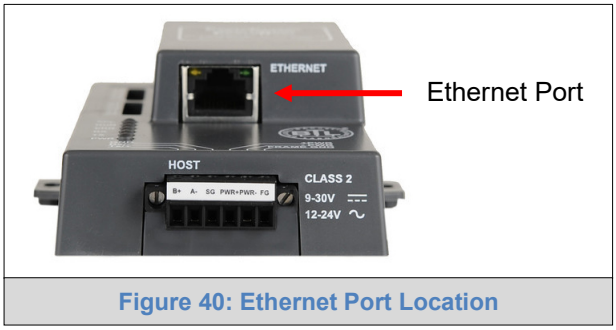
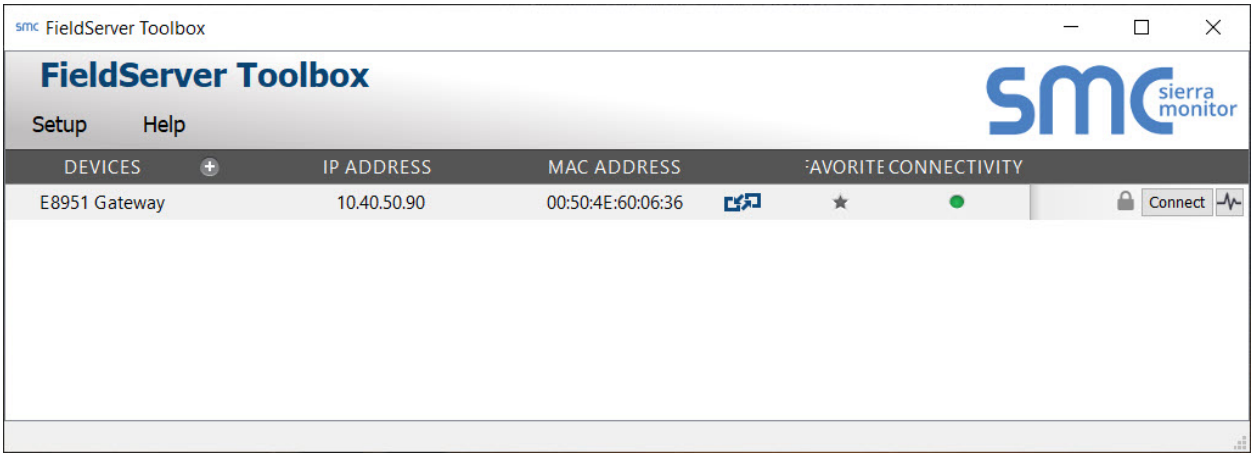


Figure 40: Ethernet Port Location

- 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 and Debugging Button, then click on view, and then on connections.
- If there are any errors showing on the Connection page, refer to **Appendix A.3** for the relevant wiring and settings.

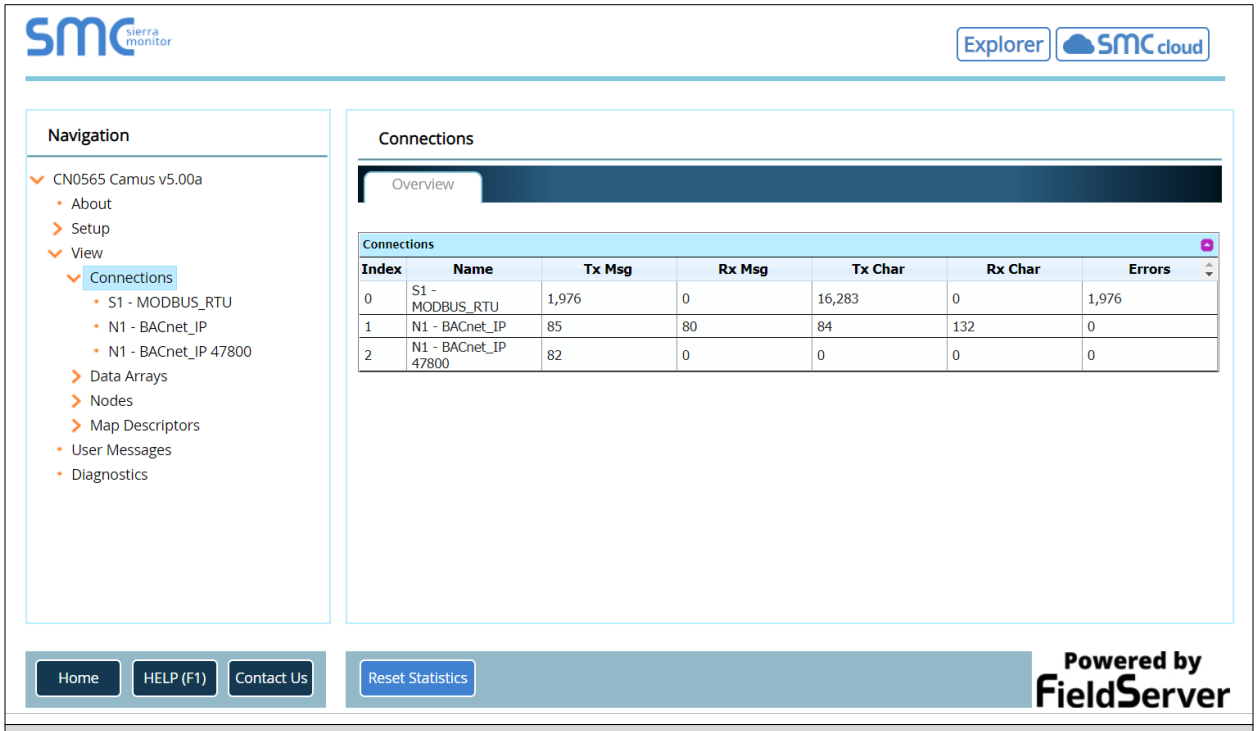


Figure 41: Error Messages Screen

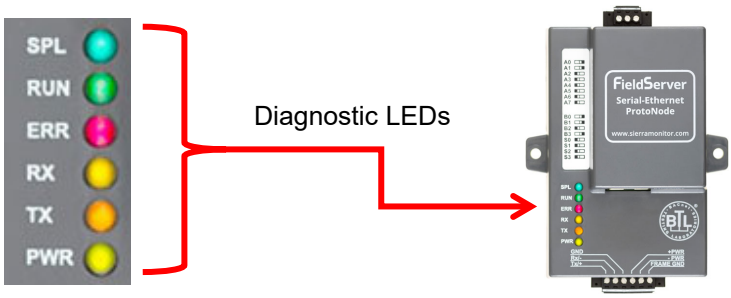
Appendix A.3. Check Wiring and Settings

- 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 the ProtoNode (**Appendix A.4**)
  - Check baud rate, parity, data bits, stop bits
  - Check device address
  - Verify wiring
  - Verify the Modbus device(s) were listed in the Web Configurator (**Section 5.3**)
- Field COM problems:
  - If Ethernet protocols are used, observe Ethernet LEDs on the ProtoNode (**Appendix A.4**)
  - Check dipswitch settings (using correct baud rate and device instance)
  - Verify IP Address setting
  - Verify wiring

NOTE: If the problem persists, a Diagnostic Capture needs to be taken and sent to support. (Appendix A.5)

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

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



Tag	Description
SPL	The SPL LED will light if the unit is not getting a response from one or more of the configured devices. **For LonWorks units**, LED will light until the unit is commissioned on the LonWorks network.
RUN	The RUN LED will start flashing 20 seconds after power indicating normal operation.
ERR	A steady red light will indicate there is a system error on the unit. If this occurs, immediately report the related “system error” shown in the error screen of the FS-GUI interface to support for evaluation.
RX	The RX LED will flash when a message is received on the serial port on the 6-pin connector. **If the serial port is not used,** this LED is non-operational.
TX	The TX LED will flash when a message is sent on the serial port on the 6-pin connector. **If the serial port is not used,** this LED is non-operational.
PWR	The power light should always show steady green when connected to a functioning power source.

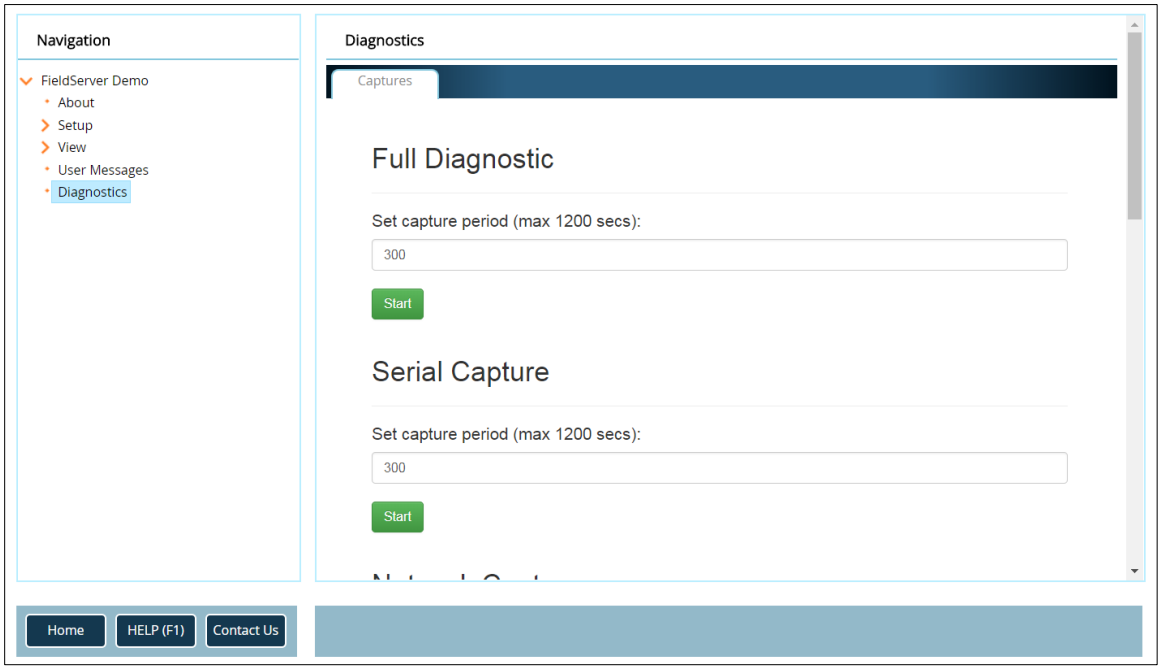
Figure 42: Diagnostic LEDs

Appendix A.5. Take a FieldServer Diagnostic Capture

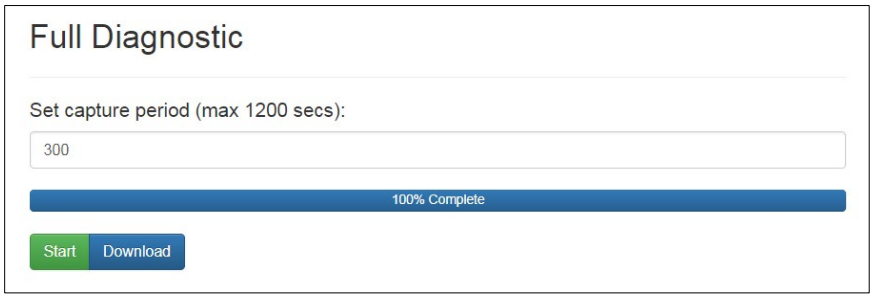
When there is a problem on-site that cannot easily be resolved, perform a Diagnostic Capture before contacting support. Once the Diagnostic Capture is complete, email it to technical support. The Diagnostic Capture will accelerate diagnosis of the problem.

If the FieldServer bios is updated/released on November 2017 or later then the Diagnostic Capture is performed via the gateway's on-board system.

- 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.
- 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.

- Send 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 A.5.1. Taking a Capture with Older Firmware

If the FieldServer firmware is from before November 2017, the Diagnostic Capture can be done by downloading the FieldServer Toolbox software but network connections (such as Ethernet and Wi-Fi) cannot be captured (if a network diagnostic is needed take a Wire Shark capture).

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.

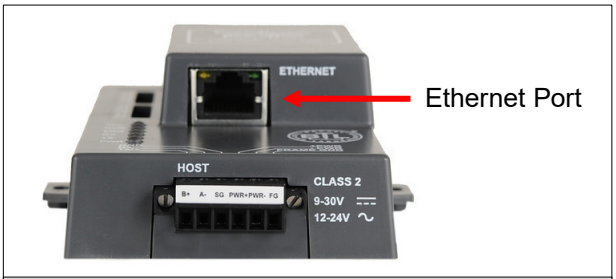
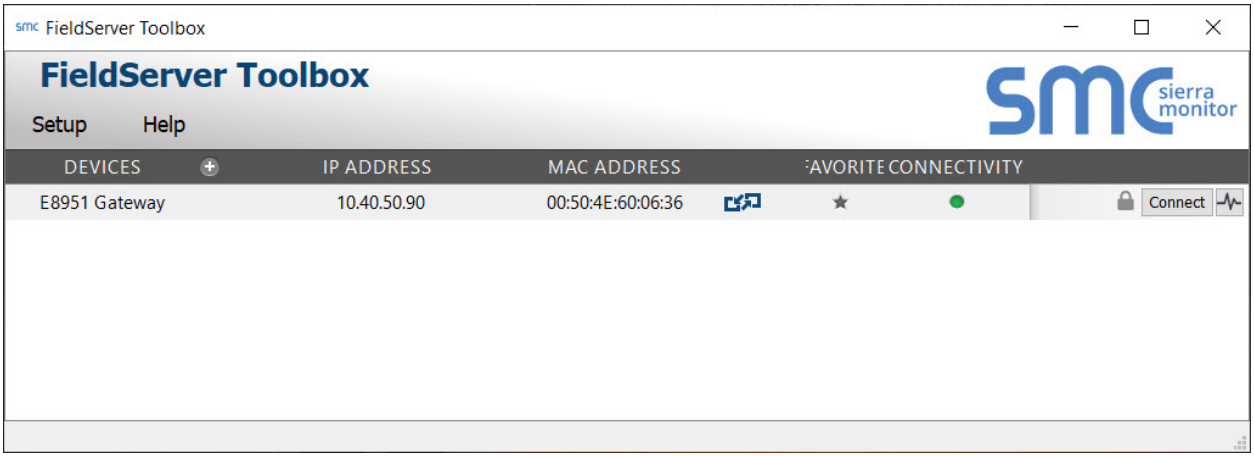


Figure 43: Ethernet Port Location

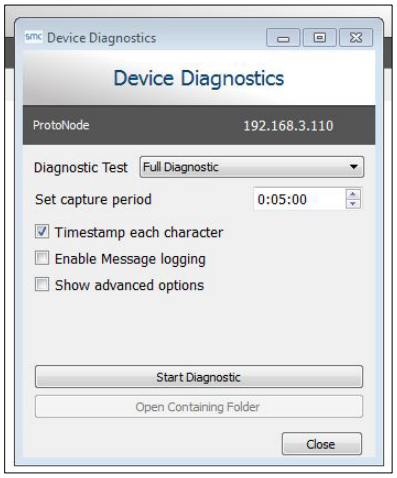
- Connect a standard Cat-5 Ethernet cable between the PC and ProtoNode.
- Double click on the FS Toolbox Utility.
- **Step 1:** Take a Log
  - Click on the diagnose icon for the desired device



- Select “Full Diagnostic" from the drop down menu

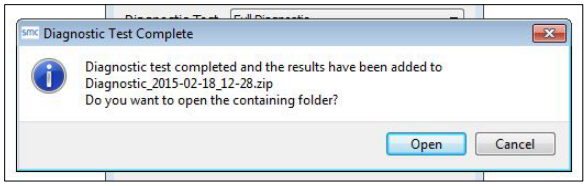
NOTE: If desired, the default capture period can be changed.

- Click on the Start Diagnostic button



- Wait for the capture period to finish and 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
  - Send the Diagnostic zip file to technical support

Appendix B. Additional Information

Appendix B.1. Update Firmware

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

1. Extract and save the new file onto the local PC.
2. Open a web browser and type the IP Address of the FieldServer in the address bar.
   - 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 50001.

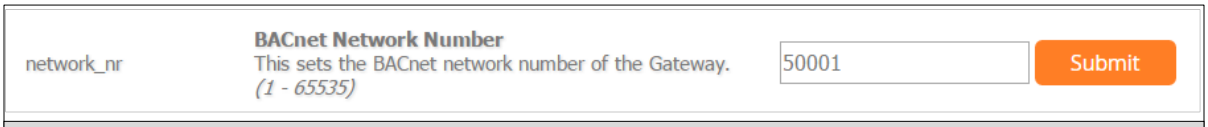


Figure 44: Web Configurator – Network Number Field

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 support team. Access the ProtoNode to set a new password.

NOTE: If a gateway in the field is updated to a secure gateway, the password will change to "admin". This change will still occur if the gateway was already setup with a unique password that was loaded in the factory and printed on the label.

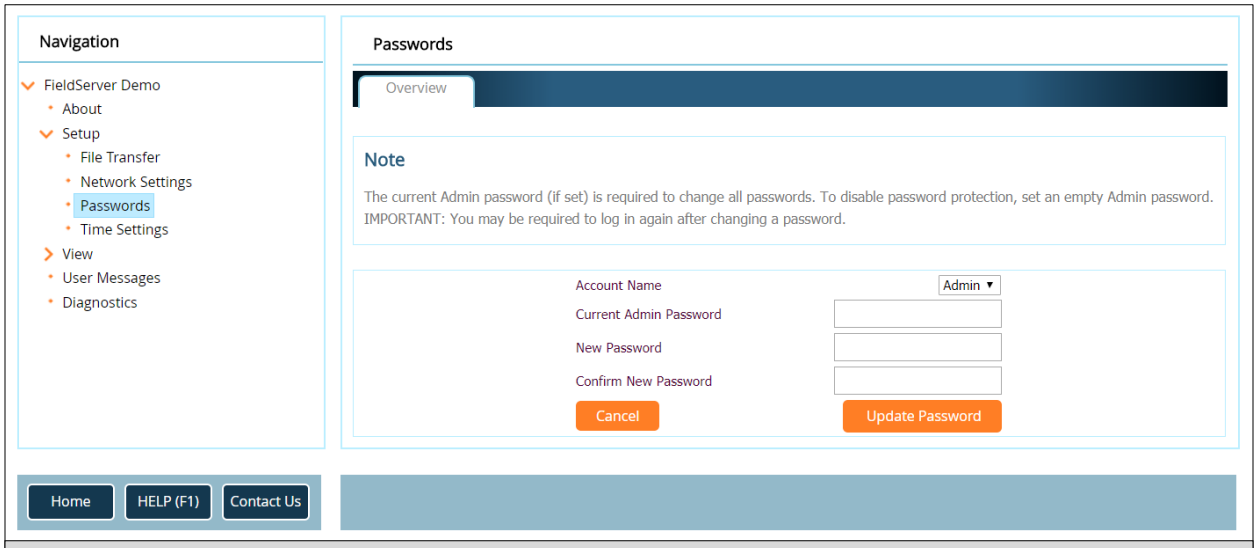


Figure 45: FS-GUI Passwords Page

Figure 46: Password Recovery Page

Appendix B.4. 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 C. Vendor Information – Camus

NOTE: All Modbus TCP/IP registers are the same as the Modbus RTU registers for the serial device. The Modbus TCP/IP node address of the device is also the same as the Modbus RTU node address.

Appendix C.1. Sola Modbus RTU Mappings to BACnet, Metasys N2, Modbus TCP/IP & LonWorks

Point Name	R/W	Modbus Address (hex)	Modbus Register (dec)	BACnet Object Type	BACnet Object ID / N2 Point Address	N2 Data Type	Lon Name	Lon SNVT	Note
Demand source	R	0006	0006	AI	2	AI	nvoXDemandSource	SNVT_count_f	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 turned off 9 = DHW storage 10 = Reserved 11 = Warm weather shutdown
Outlet sensor	R	0007	0007	AI	3	AI	nvoXOutletSensor	SNVT_temp_p	-40 – 130°C (0.1°C precision)[1]
Firing rate	R	0008	0008	AI	4	AI	nvoXFiringRate	SNVT_count_f	Actual Fire Rate (%[2] or RPM[3])
Fan speed	R	0009	0009	AI	5	AI	nvoXFanSpeed	SNVT_count_f	RPM Used on all DynaMax, Dynaforce® 300 – 1000, Advantus™ 500 - 600
Flame signal	R	0010	0010	AI	6	AI	nvoXFlameSignal	SNVT_count_f	0.01V (0.00 – 50.00V)
Inlet sensor	R	000B	0011	AI	7	AI	nvoXInletSensor	SNVT_temp_p	40 – 200°F[1]
DHW sensor	R	000C	0012	AI	8	AI	nvoXDHWSensor	SNVT_temp_p	40 – 200°F[1]
S5 sensor	R	000D	0013	AI	9	AI	nvoXS5Sensor	SNVT_temp_p	40 – 200°F[1]
Stack sensor	R	000E	0014	AI	10	AI	nvoXStackSensor	SNVT_temp_p	40 – 200°F[1]
4 - 20 mA remote ctl input	R	000F	0015	AI	11	AI	nvoX420mARmCtlIn	SNVT_count_f	4-20mA (0.1mA precision)
Active CH setpoint	R	0010	0016	AI	12	AI	nvoXActiveCHSP	SNVT_temp_p	40 – 200°F[1]
Active DHW setpoint	R	0011	0017	AI	13	AI	nvoXActiveDHWSP	SNVT_temp_p	40 – 200°F[1]

Active LL setpoint	R	0012	0018	AI	14	AI	nvoXActiveLLSP	SNVT_temp_p	40 – 200°F[1]
Burner control status	R	0020	0032	AI	16	AI	nvoXBrnCtrlStatus	SNVT_count_f	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
Lockout Code	R	0022	0034	AI	17	AI	nvoXLockoutCode	SNVT_count_f	0 = No lockout 1 – 4096. See Appendix D.1
Alarm reason	R	0023	0035	AI	18	AI	nvoXAlarmReason	SNVT_count_f	0 = None 1 = Lockout, see register (hex) 0015 for lockout code 2 = Alert. Refer to Appendix D.2
Annunciator first out	R	0024	0036	AI	19	AI	nvoXAnnunFirstOut	SNVT_count_f	0 = None 1 = ILK 11 = Air Proving Switch 12 = Flow Switch 13 = High Limit 14 = Gas Pressure Switch 15 = Blocked Flue Switch
Annunciator Hold	R	0025	0037	AI	20	AI	nvoXAnnunHold	SNVT_count_f	0 = None 1 = ILK 3 = LCI 11 = Air Proving Switch 12 = Flow Switch 13 = High Limit 14 = Gas Pressure Switch 15 = Blocked Flue Switch
CH pump status	R	0060	0096	AI/AI	34	AI	nvoXCHPmpStatus	SNVT_count_f	Refer to Appendix D.3 Equivalent to Pump B on Dynaforce®, Dynaflame®, Advantus™
Boiler pump status	R	006C	0108	AI/AI	37	AI	nvoXBlrPmpStatus	SNVT_count_f	Refer to Appendix D.3 Equivalent to Pump A on DynaMax

Outdoor temperature	R	00AA	0170	AI	41	AI	nvoXOutdoorTmp	SNVT_temp_p	40 – 200°F[1]
Burner switch	R/W	00CB	0203	AV	47	AO	nvi/nvoXBrnSwitch	SNVT_count_f	Used to enable/disable burner control. 0 = Off 1 = On NOTE: Writing to this point will result in an alert appearing on screen
CH enable	R/W	00D0	0208	AV	48	AO	nvi/nvoXEnable	N/A	0 = Disable Central Heating 1 = Enable Central Heating
CH setpoint	R/W	00D3	0211	AV	49	AO	nvi/nvoXCHSP	SNVT_temp_p	40 – 200°F[1]
DHW Enable	R/W	01C1	0448	AV	54	AO	nvi/nvoXDHWEnable	SNVT_count_f	0 = DHW Disabled 1 = DHW Enabled
DHW Setpoint	R/W	01C5	0453	AV	55	AO	nvi/nvoXDHWSP	SNVT_temp_p	40 – 200°F[1]
Lead Lag Master Enable	R/w	0221	0545	AV	64	AO	nvoXLdLgMstrEnbl	SNVT_count_f	0 = Not a Lead/Lag master 1 = Lead/Lag master
Lead Lag setpoint	R/W	0222	0546	AV	65	AO	nvi/nvoXLdLgSetpoint	SNVT_temp_p	40 – 200°F[1]
Burner cycle count	R	0080-0081	0128-0129	AV	89	AO	N/A	N/A	0-999,999
Burner run time	R	0082-0083	0130-0131	AV	90	AO	N/A	N/A	0-999,999 hours
CH pump cycle count	R	0084-0085	0132-0133	AV	91	AO	nvi/nvoXCHPmpCycCnt	SNVT_count_f	0-999,999
Lead Boiler Address	R	0321	0801	AI	97	AI	nvoXLdBlrAddr	SNVT_count_f	Modbus address of the first boiler that will be or was added to service Lead Lag demand (slave must be available for firing)
Lead Lag Operation Switch	R/W	022B	0555	BV	104	DO	nvi/nvoXLdLgOpSwitch	SNVT_switch	To enable/disable the Lead Lag boiler plant
Active System Setpoint	R	001D	0029	AI	108	AI	nvoXActSysSP	SNVT_count_p	40 – 200°F[1]
Modulation Output	R	00C0	0192	AI	105	AI	nvoXModOutput	SNVT_count_f	0 = Fan PWM 1 = 0-10Vdc 2 = 4-20mA
Max Firing Rate	R	00C1	0193	AI	106	AI	nvoXMaxFirRate	SNVT_count_f	(%[2] or RPM[3])
Min Firing Rate	R	00C3	0195	AI	107	AI	nvoXMinFirRate	SNVT_count_f	(%[2] or RPM[3])

[1] All temperature registers are expressed in °C regardless of what temperature units are set to on the boiler, ex. 32.0°C = 320. A temperature that is NOT applicable has a value of 0x8FFF.
[2] All percentage values are given in 0.1% granularity, ie. 0-1000 is the range from 0.0 – 100.0%
[3] Most significant bit in value determines which units type the parameter has: 0 = RPM, 1 = %. If modulation output parameter doesn't match with the setting of this bit, then the parameter setting is invalid
[4] For binary fraction % format commanded rate is a binary fraction between .00000000 (0% = no heat at all) and .11111111 (99.98% = maximum fire). For a 0.5% step format commanded rate is a value between 0 (minimum fire) and 200 (maximum fire) that is a multiple of 0.5% (200 x 0.5% = 100%)
[5] Commanded rate in least significant byte of this register can be expressed in two formats: binary fraction % or multiple of 035% steps. Bit 8 of this register indicates which format the commanded rate is expressed in; when bit 8 is set, the commanded rate is in binary fraction % format when bit 8 is cleared, the commanded rate is in 0.5% steps.

Appendix C.2. DynaFLO Modbus RTU Mappings to BACnet, Metasys N2, Modbus TCP/IP & LonWorks

Point Name	R/W	Modbus Address (hex)	Modbus Register (dec)	BACnet Object Type	BACnet Object ID / N2 Point Address	N2 Data Type	Lon Name	Lon SNVT	Note
DHW Outlet Temp	R	000A	0010	AI	1	Ana_Input	nvoX DHW Outlet Temp	SNVT_temp_p	
Setpoint Read	R	0062	0098	AI	2	Ana_Input	nvoX Setpoint Read	SNVT_temp_p	
Actuator Position Read	R	0060	0096	AI	3	Ana_Input	nvoX Actuator Position Read	SNVT_count_f	
Setpoint Write	W	0058	0088	AV	4	Ana_Output	nviX Setpoint Write	SNVT_temp_p	Only Possible when the control is set to Remote Setpoint
Actuator Position Write	W	0061	0097	AV	5	Ana_Output	nviX Actuator Position Write	SNVT_count_f	Only Possible when the control is set to Remote Direct.
Clear Alarms	W	0014	0020	BV	1/2	Dig_Output	nviX Clear Alarms Write	SNVT_switch	If all conditions for all alarms have been satisfied, this can ACK any pending alarm that is not active anymore. However, this also clears such alarms from alarm history.
General Alarm	R	0015	0021	BI	1/2	Dig_Input	nvoX General Alarm	SNVT_switch	
Low Temp Alarm	R	0018	0024	BI	2/3	Dig_Input	nvoX Low Temp Alarm	SNVT_switch	
High Temp Alarm	R	001B	0027	BI	3/4	Dig_Input	nvoX High Temp Alarm	SNVT_switch	
RTD1 Failure Alarm	R	001E	0030	BI	4/5	Dig_Input	nvoX RTD1 Failure Alarm	SNVT_switch	
AI1 Failure Alarm	R	0024	0036	BI	5/6	Dig_Input	nvoX AI1 Failure Alarm	SNVT_switch	
Low Battery	R	0027	0039	BI	6/7	Dig_Input	nvoX Low Battery	SNVT_switch	

Appendix C.3. Valiant Modbus RTU Mappings to BACnet, Metasys N2, Modbus TCP/IP & LonWorks

Point Name	R/W	BACnet Object Type	BACnet Object ID/ N2 Address	N2 Data Type	Modbus Register (dec)	LonWorks Name	LonWorks SNVT	Notes
Outdoor_temp	R	AI	1	AI	126	nvoOutdrTmp_XXX	SNVT_temp_p	
BM_TotalSystemSetpoint	W	AV	2	AO	503	nvoBMTotSySP_XXX	SNVT_temp_p	
BM_CM_PowerLevel	R	AI	3	AI	20001	nvoBMCMPwLvl_XXX	SNVT_count_f	
BM_CM_Setpoint	R	AI	4	AI	20002	nvoBMCMSP_XXX	SNVT_temp_p	
BM_CM_SystemTempSensor	R	AI	5	AI	20021	nvoBMCMSyTSn_XXX	SNVT_temp_p	In Cascade mode only
BM_CM_OutdoorTempSensor	R	AI	6	AI	20022	nvoBMCMOtTSn_XXX	SNVT_temp_p	
BM_CM_PumpStatus	R	AI	7	AI	20061	nvoBMCMPmpSt_XXX	SNVT_count_f	
BM_Boiler_1_Available	R	AI	8	AI	20101	nvoBM1Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_2_Available	R	AI	9	AI	20102	nvoBM2Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_3_Available	R	AI	10	AI	20103	nvoBM3Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_4_Available	R	AI	11	AI	20104	nvoBM4Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_5_Available	R	AI	12	AI	20105	nvoBM5Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_6_Available	R	AI	13	AI	20106	nvoBM6Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_7_Available	R	AI	14	AI	20107	nvoBM7Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_8_Available	R	AI	15	AI	20108	nvoBM8Avail_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_1_Active	R	AI	16	AI	20133	nvoBM1Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_2_Active	R	AI	17	AI	20134	nvoBM2Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_3_Active	R	AI	18	AI	20135	nvoBM3Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_4_Active	R	AI	19	AI	20136	nvoBM4Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_5_Active	R	AI	20	AI	20137	nvoBM5Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_6_Active	R	AI	21	AI	20138	nvoBM6Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_7_Active	R	AI	22	AI	20139	nvoBM7Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_8_Active	R	AI	23	AI	20140	nvoBM8Act_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_1_HasError	R	AI	24	AI	20165	nvoBM1Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_2_HasError	R	AI	25	AI	20166	nvoBM2Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_3_HasError	R	AI	26	AI	20167	nvoBM3Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_4_HasError	R	AI	27	AI	20168	nvoBM4Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_5_HasError	R	AI	28	AI	20169	nvoBM5Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_6_HasError	R	AI	29	AI	20170	nvoBM6Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_7_HasError	R	AI	30	AI	20171	nvoBM7Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_8_HasError	R	AI	31	AI	20172	nvoBM8Error_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_1_ReqService	R	AI	32	AI	20197	nvoBM1ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_2_ReqService	R	AI	33	AI	20198	nvoBM2ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_3_ReqService	R	AI	34	AI	20199	nvoBM3ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_4_ReqService	R	AI	35	AI	20200	nvoBM4ReqSr_XXX	SNVT_count_f	In Cascade mode only

BM_Boiler_5_ReqService	R	AI	36	AI	20201	nvoBM5ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_6_ReqService	R	AI	37	AI	20202	nvoBM6ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_7_ReqService	R	AI	38	AI	20203	nvoBM7ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_8_ReqService	R	AI	39	AI	20204	nvoBM8ReqSr_XXX	SNVT_count_f	In Cascade mode only
BM_ResetCurveBoilerDesign	W	AV	40	AO	21001	nvoBMRsCvBDs_XXX	SNVT_temp_p	
BM_ResetCurveBoilerMildWeather	W	AV	41	AO	21002	nvoBMRsCvBWt_XXX	SNVT_temp_p	
BM_ResetCurveDesignMildWeather	W	AV	42	AO	21003	nvoBMRsCvDWt_XXX	SNVT_temp_p	
BM_ResetCurveOutdoorDesign	W	AV	43	AO	21004	nvoBMRsCvODs_XXX	SNVT_temp_p	
BM_WarmWeatherShutdown	W	AV	44	AO	21005	nvoBMWmWtSht_XXX	SNVT_temp_p	
BM_ResetCurveBoilerMaximum	W	AV	45	AO	21006	nvoBMRsCvBMx_XXX	SNVT_temp_p	
BM_ResetCurveBoilerMinimum	W	AV	46	AO	21007	nvoBMRsCvBMn_XXX	SNVT_temp_p	
BM_NightSetBack	W	AV	47	AO	21008	nvoBMNtStBck_XXX	SNVT_temp_p	
BM_Boiler_PowerLevel	R	AI	48	AI	30001	nvoBMBlPwLvl_XXX	SNVT_count_f	
BM_Boiler_CalcSetpoint	R	AI	49	AI	30002	nvoBMBlClcSP_XXX	SNVT_temp_p	
BM_Boiler_SystemTempSensor	R	AI	50	AI	30021	nvoBMBlSyTpS_XXX	SNVT_temp_p	In Cascade mode only
BM_Boiler_DHWSensor	R	AI	51	AI	30022	nvoBMBlDHWSn_XXX	SNVT_temp_p	
BM_Boiler_SystemCHPumpStatus	R	AI	52	AI	30061	nvoBMBlSCHPp_XXX	SNVT_count_f	0 = off 1 = on
BM_Boiler_DHWPumpStatus	R	AI	53	AI	30062	nvoBMBlDHWPp_XXX	SNVT_count_f	
BM_Boiler_BurnHours	R	AI	54	AI	30081	nvoBMBlBrnHr_XXX	SNVT_time_hour	
BM_Unit_11_available	R	AI	55	AI	30101	nvoBMUn11Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_available	R	AI	56	AI	30102	nvoBMUn12Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_13_available	R	AI	57	AI	30103	nvoBMUn13Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_available	R	AI	58	AI	30104	nvoBMUn14Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_available	R	AI	59	AI	30105	nvoBMUn15Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_available	R	AI	60	AI	30106	nvoBMUn16Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_17_available	R	AI	61	AI	30107	nvoBMUn17Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_available	R	AI	62	AI	30108	nvoBMUn18Avl_XXX	SNVT_count_f	In Cascade mode only
BM_Boiler_Address	R	AI	63	AI	31001	nvoBMBlrAddr_XXX	SNVT_count_f	
BM_HoursSinceLastService	R	AI	64	AI	33001	nvoBMHrLstSv_XXX	SNVT_time_hour	
BM_HoursTillServiceIsRequired	R	AI	65	AI	33002	nvoBMHrTlSrv_XXX	SNVT_time_hour	
BM_OverdueCounter0	R	AI	66	AI	33006	nvoBMOvrCt0_XXX	SNVT_time_hour	
BM_OverdueCounter1	R	AI	67	AI	33007	nvoBMOvrCt1_XXX	SNVT_time_hour	
BM_OverdueCounter2	R	AI	68	AI	33008	nvoBMOvrCt2_XXX	SNVT_time_hour	
BM_OverdueCounter3	R	AI	69	AI	33009	nvoBMOvrCt3_XXX	SNVT_time_hour	
BM_OverdueCounter4	R	AI	70	AI	33010	nvoBMOvrCt4_XXX	SNVT_time_hour	
BM_OverdueCounter5	R	AI	71	AI	33011	nvoBMOvrCt5_XXX	SNVT_time_hour	
BM_OverdueCounter6	R	AI	72	AI	33012	nvoBMOvrCt6_XXX	SNVT_time_hour	
BM_OverdueCounter7	R	AI	73	AI	33013	nvoBMOvrCt7_XXX	SNVT_time_hour	
BM_OverdueCounter8	R	AI	74	AI	33014	nvoBMOvrCt8_XXX	SNVT_time_hour	
BM_OverdueCounter9	R	AI	75	AI	33015	nvoBMOvrCt9_XXX	SNVT_time_hour	
BM_OverdueCounter10	R	AI	76	AI	33016	nvoBMOvrCt10_XXX	SNVT_time_hour	
BM_OverdueCounter11	R	AI	77	AI	33017	nvoBMOvrCt11_XXX	SNVT_time_hour	
BM_OverdueCounter12	R	AI	78	AI	33018	nvoBMOvrCt12_XXX	SNVT_time_hour	
BM_OverdueCounter13	R	AI	79	AI	33019	nvoBMOvrCt13_XXX	SNVT_time_hour	

BM_OverdueCounter14	R	AI	80	AI	33020	nvoBMOvrCt14_XXX	SNVT_time_hour	
BM_ServiceInterval	R	AI	81	AI	33043	nvoBMSrvInt_XXX	SNVT_time_hour	
Error_0	R	AI	82	AI	34008	nvoError0_XXX	SNVT_time_hour	
Error_0_ID	R	AI	83	AI	34009	nvoError0ID_XXX	SNVT_time_hour	
Error_0_DoW	R	AI	84	AI	34010	nvoError0DoW_XXX	SNVT_count_f	
Error_0_DoM	R	AI	85	AI	34011	nvoError0DoM_XXX	SNVT_count_f	
Error_0_M	R	AI	86	AI	34012	nvoError0M_XXX	SNVT_count_f	
Error_0_Y	R	AI	87	AI	34013	nvoError0Y_XXX	SNVT_count_f	
Error_0_HH	R	AI	88	AI	34014	nvoError0HH_XXX	SNVT_time_hour	
Error_0_MM	R	AI	89	AI	34015	nvoError0MM_XXX	SNVT_count_f	
Error_1	R	AI	90	AI	34016	nvoError1_XXX	SNVT_count_f	
Error_1_ID	R	AI	91	AI	34017	nvoError1ID_XXX	SNVT_count_f	
Error_1_DoW	R	AI	92	AI	34018	nvoError1DoW_XXX	SNVT_count_f	
Error_1_DoM	R	AI	93	AI	34019	nvoError1DoM_XXX	SNVT_count_f	
Error_1_M	R	AI	94	AI	34020	nvoError1M_XXX	SNVT_count_f	
Error_1_Y	R	AI	95	AI	34021	nvoError1Y_XXX	SNVT_count_f	
Error_1_HH	R	AI	96	AI	34022	nvoError1HH_XXX	SNVT_time_hour	
Error_1_MM	R	AI	97	AI	34023	nvoError1MM_XXX	SNVT_count_f	
Error_2	R	AI	98	AI	34024	nvoError2_XXX	SNVT_count_f	
Error_2_ID	R	AI	99	AI	34025	nvoError2ID_XXX	SNVT_count_f	
Error_2_DoW	R	AI	100	AI	34026	nvoError2DoW_XXX	SNVT_count_f	
Error_2_DoM	R	AI	101	AI	34027	nvoError2DoM_XXX	SNVT_count_f	
Error_2_M	R	AI	102	AI	34028	nvoError2M_XXX	SNVT_count_f	
Error_2_Y	R	AI	103	AI	34029	nvoError2Y_XXX	SNVT_count_f	
Error_2_HH	R	AI	104	AI	34030	nvoError2HH_XXX	SNVT_time_hour	
Error_2_MM	R	AI	105	AI	34031	nvoError2MM_XXX	SNVT_count_f	
Error_3	R	AI	106	AI	34032	nvoError3_XXX	SNVT_count_f	
Error_3_ID	R	AI	107	AI	34033	nvoError3ID_XXX	SNVT_count_f	
Error_3_DoW	R	AI	108	AI	34034	nvoError3DoW_XXX	SNVT_count_f	
Error_3_DoM	R	AI	109	AI	34035	nvoError3DoM_XXX	SNVT_count_f	
Error_3_M	R	AI	110	AI	34036	nvoError3M_XXX	SNVT_count_f	
Error_3_Y	R	AI	111	AI	34037	nvoError3Y_XXX	SNVT_count_f	
Error_3_HH	R	AI	112	AI	34038	nvoError3HH_XXX	SNVT_time_hour	
Error_3_MM	R	AI	113	AI	34039	nvoError3MM_XXX	SNVT_count_f	
Error_4	R	AI	114	AI	34040	nvoError4_XXX	SNVT_count_f	
Error_4_ID	R	AI	115	AI	34041	nvoError4ID_XXX	SNVT_count_f	
Error_4_DoW	R	AI	116	AI	34042	nvoError4DoW_XXX	SNVT_count_f	
Error_4_DoM	R	AI	117	AI	34043	nvoError4DoM_XXX	SNVT_count_f	
Error_4_M	R	AI	118	AI	34044	nvoError4M_XXX	SNVT_count_f	
Error_4_Y	R	AI	119	AI	34045	nvoError4Y_XXX	SNVT_count_f	
Error_4_HH	R	AI	120	AI	34046	nvoError4HH_XXX	SNVT_time_hour	
Error_4_MM	R	AI	121	AI	34047	nvoError4MM_XXX	SNVT_count_f	
BM_Unit_11_CurrentState	R	AI	122	AI	40001	nvoU11CrSt_XXX	SNVT_count_f	Please check the Valiant manual for more detailed information on each state.

								0: Initializing 1: Reset 2: Standby 3: Pre-purge 0 4: Pre-purge 1 5: Pre-ignit 6: Ignit 7: Flame proving 8: Burn 9: Post-burn 10: Post-purge 0 11: Post-purge 1 12: Error check 13: Alarm 14: Burner boot
BM_Unit_11_Error	R	AI	123	AI	40002	nvoU11Err_XXX	SNVT_count_f	Please check the Valiant manual for more detailed information on each state. 0 – 99 = Locking errors 100 – 199 = Blocking errors 200 – 255 = Warnings 255 = No error / warning
BM_Unit_11_CalcSetpoint	R	AI	124	AI	40003	nvoU11ClSP_XXX	SNVT_temp_p	
BM_Unit_11_PowerLevel	R	AI	125	AI	40004	nvoU11PwLv_XXX	SNVT_count_f	
BM_Unit_11_GenPumpStatus	R	AI	126	AI	40007	nvoU11GnPmSt_XXX	SNVT_count_f	
BM_Unit_11_ChFlowRate	R	AI	127	AI	40010	nvoU11ChFlRt_XXX	SNVT_count_f	
BM_Unit_11_ActualFanSpeed	R	AI	128	AI	40012	nvoU11AcFnSp_XXX	SNVT_count_f	
BM_Unit_11_SupplySensor	R	AI	129	AI	40031	nvoU11SupSen_XXX	SNVT_temp_p	
BM_Unit_11_ReturnSensor	R	AI	130	AI	40033	nvoU11RetSen_XXX	SNVT_temp_p	
BM_Unit_11_FlueSensor	R	AI	131	AI	40036	nvoU11FlSen_XXX	SNVT_temp_p	
BM_Unit_11_TotBurnHours	R	AI	132	AI	40053	nvoU11ToBnHr_XXX	SNVT_time_hour	
BM_Unit_12_CurrentState	R	AI	133	AI	40101	nvoU12CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_Error	R	AI	134	AI	40102	nvoU12Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_CalcSetpoint	R	AI	135	AI	40103	nvoU12ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_12_PowerLevel	R	AI	136	AI	40104	nvoU12PwLv_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_GenPumpStatus	R	AI	137	AI	40107	nvoU12GnPmSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_ChFlowRate	R	AI	138	AI	40110	nvoU12ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_ActualFanSpeed	R	AI	139	AI	40112	nvoU12AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_12_SupplySensor	R	AI	140	AI	40131	nvoU12SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_12_ReturnSensor	R	AI	141	AI	40133	nvoU12RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_12_FlueSensor	R	AI	142	AI	40136	nvoU12FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_12_TotBurnHours	R	AI	143	AI	40153	nvoU12ToBnHr_XXX	SNVT_time_hour	In Cascade mode only
BM_Unit_13_CurrentState	R	AI	144	AI	40201	nvoU13CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_13_Error	R	AI	145	AI	40202	nvoU13Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_13_CalcSetpoint	R	AI	146	AI	40203	nvoU13ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_13_PowerLevel	R	AI	147	AI	40204	nvoU13PwLv_XXX	SNVT_count_f	In Cascade mode only

BM_Unit_13_GenPumpStatus	R	AI	148	AI	40207	nvoU13GnPmSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_13_ChFlowRate	R	AI	149	AI	40210	nvoU13ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_13_ActualFanSpeed	R	AI	150	AI	40212	nvoU13AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_13_SupplySensor	R	AI	151	AI	40231	nvoU13SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_13_ReturnSensor	R	AI	152	AI	40233	nvoU13RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_13_FlueSensor	R	AI	153	AI	40236	nvoU13FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_13_TotBurnHours	R	AI	154	AI	40253	nvoU13ToBnHr_XXX	SNVT_time_hour	In Cascade mode only
BM_Unit_14_CurrentState	R	AI	155	AI	40301	nvoU14CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_Error	R	AI	156	AI	40302	nvoU14Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_CalcSetpoint	R	AI	157	AI	40303	nvoU14ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_14_PowerLevel	R	AI	158	AI	40304	nvoU14PwLv_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_GenPumpStatus	R	AI	159	AI	40307	nvoU14GnPmSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_ChFlowRate	R	AI	160	AI	40310	nvoU14ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_ActualFanSpeed	R	AI	161	AI	40312	nvoU14AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_14_SupplySensor	R	AI	162	AI	40331	nvoU14SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_14_ReturnSensor	R	AI	163	AI	40333	nvoU14RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_14_FlueSensor	R	AI	164	AI	40336	nvoU14FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_14_TotBurnHours	R	AI	165	AI	40353	nvoU14ToBnHr_XXX	SNVT_time_hour	In Cascade mode only
BM_Unit_15_CurrentState	R	AI	166	AI	40401	nvoU15CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_Error	R	AI	167	AI	40402	nvoU15Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_CalcSetpoint	R	AI	168	AI	40403	nvoU15ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_15_PowerLevel	R	AI	169	AI	40404	nvoU15PwLv_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_GenPumpStatus	R	AI	170	AI	40407	nvoU15GnPmSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_ChFlowRate	R	AI	171	AI	40410	nvoU15ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_ActualFanSpeed	R	AI	172	AI	40412	nvoU15AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_15_SupplySensor	R	AI	173	AI	40431	nvoU15SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_15_ReturnSensor	R	AI	174	AI	40433	nvoU15RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_15_FlueSensor	R	AI	175	AI	40436	nvoU15FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_15_TotBurnHours	R	AI	176	AI	40453	nvoU15ToBnHr_XXX	SNVT_time_hour	In Cascade mode only
BM_Unit_16_CurrentState	R	AI	177	AI	40501	nvoU16CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_Error	R	AI	178	AI	40502	nvoU16Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_CalcSetpoint	R	AI	179	AI	40503	nvoU16ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_16_PowerLevel	R	AI	180	AI	40504	nvoU16PwLv_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_GenPumpStatus	R	AI	181	AI	40507	nvoU16GnPmSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_ChFlowRate	R	AI	182	AI	40510	nvoU16ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_ActualFanSpeed	R	AI	183	AI	40512	nvoU16AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_16_SupplySensor	R	AI	184	AI	40531	nvoU16SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_16_ReturnSensor	R	AI	185	AI	40533	nvoU16RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_16_FlueSensor	R	AI	186	AI	40536	nvoU16FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_16_TotBurnHours	R	AI	187	AI	40553	nvoU16ToBnHr_XXX	SNVT_time_hour	In Cascade mode only
BM_Unit_17_CurrentState	R	AI	188	AI	40601	nvoU17CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_17_Error	R	AI	189	AI	40602	nvoU17Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_17_CalcSetpoint	R	AI	190	AI	40603	nvoU17ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_17_PowerLevel	R	AI	191	AI	40604	nvoU17PwLv_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_17_GenPumpStatus	R	AI	192	AI	40607	nvoU17GnPmSt_XXX	SNVT_count_f	In Cascade mode only

BM_Unit_17_ChFlowRate	R	AI	193	AI	40610	nvoU17ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_17_ActualFanSpeed	R	AI	194	AI	40612	nvoU17AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_17_SupplySensor	R	AI	195	AI	40631	nvoU17SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_17_ReturnSensor	R	AI	196	AI	40633	nvoU17RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_17_FlueSensor	R	AI	197	AI	40636	nvoU17FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_17_TotBurnHours	R	AI	198	AI	40653	nvoU17ToBnHr_XXX	SNVT_time_hour	In Cascade mode only
BM_Unit_18_CurrentState	R	AI	199	AI	40701	nvoU18CrSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_Error	R	AI	200	AI	40702	nvoU18Err_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_CalcSetpoint	R	AI	201	AI	40703	nvoU18ClSP_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_18_PowerLevel	R	AI	202	AI	40704	nvoU18PwLv_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_GenPumpStatus	R	AI	203	AI	40707	nvoU18GnPmSt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_ChFlowRate	R	AI	204	AI	40710	nvoU18ChFlRt_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_ActualFanSpeed	R	AI	205	AI	40712	nvoU18AcFnSp_XXX	SNVT_count_f	In Cascade mode only
BM_Unit_18_SupplySensor	R	AI	206	AI	40731	nvoU18SupSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_18_ReturnSensor	R	AI	207	AI	40733	nvoU18RetSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_18_FlueSensor	R	AI	208	AI	40736	nvoU18FlSen_XXX	SNVT_temp_p	In Cascade mode only
BM_Unit_18_TotBurnHours	R	AI	209	AI	40753	nvoU18ToBnHr_XXX	SNVT_time_hour	In Cascade mode only

Appendix D. Lockout & Alert Codes (Sola)

Appendix D.1. Lockout Codes (Sola)

Code	Description	Note
0	None	No lockout/hold
1	Unconfigured safety data	Lockout
2	Waiting for safety data verification	Lockout
3	Internal fault: Hardware fault	Hold
4	Internal fault: Safety relay feedback error	Hold
5	Internal fault: Unstable power (DCDC) output	Hold
6	Internal fault: Invalid processor clock	Hold
7	Internal fault: Safety relay drive error	Hold
8	Internal fault: Zero crossing not detected	Hold
9	Internal fault: Flame bias out of range	Hold
10	Internal fault: Invalid burner control state	Lockout
11	Internal fault: Invalid burner control state flag	Lockout
12	Internal fault: Safety relay drive cap short	Hold
13	Internal fault: PII shorted to ILK	Hold/Lockout
14	Internal fault: HFS shorted to LCI	Hold/Lockout
15	Internal fault: Safety relay test failed due to feedback ON	Lockout
16	Internal fault: Safety relay test failed due to safety relay OFF	Lockout
17	Internal fault: Safety relay test failed due to safety relay not OFF	Lockout
18	Internal fault: Safety relay test failed due to feedback not ON	Lockout
19	Internal fault: Safety RAM write	Lockout
20	Internal fault: Flame ripple and overflow	Hold
21	Internal fault: Flame number of sample mismatch	Hold
22	Internal fault: Flame bias out of range	Hold
23	Internal fault: Bias changed since heating cycle starts	Hold
24	Internal fault: Spark voltage stuck low or high	Hold
25	Internal fault: Spark voltage changed too much during flame sensing time	Hold
26	Internal fault: Static flame ripple	Hold
27	Internal fault: Flame rod shorted to ground detected	Hold
28	Internal fault: A/D linearity test failed	Hold
29	Internal fault: Flame bias cannot be set in range	Hold
30	Internal fault: Flame bias shorted to adjacent pin	Hold
31	Internal fault: SLO electronics unknown error	Hold
32	Internal fault: Safety key 0	Lockout
33	Internal fault: Safety key 1	Lockout
34	Internal fault: Safety key 2	Lockout
35	Internal fault: Safety key 3	Lockout
36	Internal fault: Safety key 4	Lockout
37	Internal fault: Safety key 5	Lockout
38	Internal fault: Safety key 6	Lockout
39	Internal fault: Safety key 7	Lockout
40	Internal fault: Safety key 8	Lockout

41	Internal fault: Safety key 9	Lockout
42	Internal fault: Safety key 10	Lockout
43	Internal fault: Safety key 11	Lockout
44	Internal fault: Safety key 12	Lockout
45	Internal fault: Safety key 13	Lockout
46	Internal fault: Safety key 14	Lockout
47	Flame rod to ground leakage	Hold
48	Static flame (not flickering)	Hold
49	24Vac voltage low/high	Hold
50	Modulation fault	Hold
51	Pump fault	Hold
52	Motor tachometer fault	Hold
53	AC inputs phase reversed	Lockout
54	Safety GVT model ID doesn't match application's model ID	Lockout
55	Application configuration data block CRC errors	Lockout
56-57	RESERVED	
58	Internal fault: HFS shorted to IAS	Lockout
59	Internal fault: Mux pin shorted	Lockout
60	Internal fault: HFS shorted to LFS	Lockout
61	Anti-short cycle	Hold
62	Fan speed not proved	Hold
63	LCI off	Hold
67	ILK off	Hold
68	ILK on	Hold
69	Pilot test hold	Hold
70	Wait for leakage test completion	Hold
71-77	RESERVED	
78	Demand lost in run	Hold
79	Outlet high limit	Hold
81	Delta T inlet/outlet limit	Hold
82	Stack limit	Lockout
91	Inlet sensor fault	Hold
92	Outlet sensor fault	Hold
93	DHW sensor fault	Hold
94	S2 (J8-6) sensor fault	Hold
95	Stack sensor fault	Hold
96	S5 (J8-11) sensor fault	Hold
97	Internal fault: A2D mismatch	Lockout
98	Internal fault: Exceeded VSNSR voltage tolerance	Lockout
99	Internal fault: Exceeded 28V voltage tolerance	Lockout
101-104	RESERVED	
105	Flame detected out of sequence	Lockout
106	Flame lost in MFEP	Lockout
107	Flame lost early in run	Lockout
108	Flame lost in run	Lockout
109	Ignition failed	Lockout
110	Ignition failure occurred	Hold
111	Flame current lower than WEAK threshold	Hold

112	Pilot test flame timeout	Lockout
113	Flame circuit timeout	Lockout
114-121	RESERVED	
122	Lightoff rate proving failed	Lockout
123	Purge rate proving failed	Lockout
124	High fire switch OFF	Hold
125	High fire switch stuck ON	Hold
126	Low fire switch OFF	Hold
127	Low fire switch stuck ON	Hold
128	Fan speed failed during prepurge	Hold
129	Fan speed failed during preignition	Hold
130	Fan speed failed during ignition	Hold
131	Fan movement detected during standby	Hold
132	Fan speed failed during run	Hold
133-135	RESERVED	
136	Interrupted Airflow Switch failed to close	Hold
137	ILK failed to close	Hold
138-142	RESERVED	
143	Internal fault: Flame bias out of range 1	Lockout
144	Internal fault: Flame bias out of range 2	Lockout
145	Internal fault: Flame bias out of range 3	Lockout
146	Internal fault: Flame bias out of range 4	Lockout
147	Internal fault: Flame bias out of range 5	Lockout
148	Internal fault: Flame bias out of range 6	Lockout
149	Flame detected	Lockout
150	Flame not detected	Hold
151	High fire switch ON	Hold
158	Main valve ON	Lockout
159	Main valve OFF	Lockout
160	Ignition ON	Lockout
161	Ignition OFF	Lockout
162	Pilot valve ON	Lockout
163	Pilot valve OFF	Lockout
166-171	RESERVED	
172	Main relay feedback incorrect	Lockout
173	Pilot relay feedback incorrect	Lockout
174	Safety relay feedback incorrect	Lockout
175	Safety relay open	Lockout
176	Main relay ON and safe start check	Lockout
177	Pilot relay ON at safe start check	Lockout
178	Safety relay ON at safe start check	Lockout
179-183	RESERVED	
184	Invalid Blower/HIS output setting	Lockout
185	Invalid Delta T limit enable setting	Lockout
186	Invalid Delta T limit response setting	Lockout
187	Invalid DHW high limit enable setting	Lockout
188	Invalid DHW high limit response setting	Lockout
189	Invalid Flame sensor type setting	Lockout

192	Invalid igniter on during setting	Lockout
193	Invalid ignite failure delay setting	Lockout
194	Invalid ignite failure response setting	Lockout
195	Invalid ignite failure retries setting	Lockout
196	Invalid ignition source setting	Lockout
197	Invalid interlock open response setting	Lockout
198	Invalid Interlock start check setting	Lockout
199	Invalid LCI enable setting	Lockout
200	Invalid lightoff rate setting	Lockout
201	Invalid lightoff rate proving setting	Lockout
202	Invalid Main Flame Establishing Period setting	Lockout
203	Invalid MFEP flame failure response setting	Lockout
204	Invalid NTC sensor type setting	Lockout
205	Invalid Outlet high limit response setting	Lockout
206	Invalid Pilot Flame Establishing Period setting	Lockout
207	Invalid PII enable setting	Lockout
208	Invalid pilot test hold setting	Lockout
209	Invalid pilot type setting	Lockout
210	Invalid postpurge time setting	Lockout
211	Invalid power up with lockout setting	Lockout
212	Invalid preignition time setting	Lockout
213	Invalid prepurge rate setting	Lockout
214	Invalid prepurge time setting	Lockout
215	Invalid purge rate proving setting	Lockout
216	Invalid run flame failure response setting	Lockout
217	Invalid run stabilization time setting	Lockout
218	Invalid stack limit enable setting	Lockout
219	Invalid stack limit enable setting	Lockout
224	Invalid DHW demand source setting	Lockout
225	Invalid flame threshold setting	Lockout
226	Invalid outlet high limit setpoint setting	Lockout
228	Invalid Stack limit setpoint setting	Lockout
229	Invalid modulation output setting	Lockout
230	Invalid CH demand source setting	Lockout
231	Invalid Delta T limit delay setting	Lockout
234	Invalid outlet high limit enable setting	Lockout
235	Invalid outlet connector type setting	Lockout
236	Invalid inlet connector type setting	Lockout
237	Invalid DHW connector type setting	Lockout
238	Invalid Stack connector type setting	Lockout
239	Invalid S2 (J8-6) connector type setting	Lockout
240	Invalid S5 (J8-11) connector type setting	Lockout
244	Internal fault: Safety relay test invalid state	Lockout
246	4-20mA cannot be used for both modulation and setpoint control	Lockout
250	Invalid fan speed error message	Lockout
252-255	RESERVED	

Appendix D.2. Alert Codes (Sola)

Code	Description
0	None (No alert)
1	Alert PCB was restored from factory defaults
2	Safety configuration parameters were restored from factory defaults
3	Configuration parameters were restored from factory defaults
4	Invalid Factory Invisibility PCB was detected
5	Invalid Factory Range PCB was detected
6	Invalid range PCB record has been dropped
7	EEPROM lockout history was initialized
8	Switched application annunciation data blocks
9	Switched application configuration data blocks
10	Configuration was restored from factory defaults
11	Backup configuration settings was restored from active configuration
12	Annunciation configuration was restored from factory defaults
13	Annunciation configuration was restored from backup
14	Safety group verification table was restored from factory defaults
15	Safety group verification table was updated
16	Invalid Parameter PCB was detected
17	Invalid Range PCB was detected
18	Alarm silence time exceeded maximum
19	Invalid safety group verification table was detected
20	Backdoor password could not be determined
21	Invalid safety group verification table was not accepted
22	CRC errors were found in application configuration data blocks
23	Backup Alert PCB was restored from active one
24	RESERVED
25	Lead Lag operation switch was turned OFF
26	Lead Lag operation switch was turned ON
27	Safety processor was reset
28	Application processor was reset
29	Burner switch was turned OFF
30	Burner switch was turned ON
31	Program Module (PM) was inserted into socket
32	Program Module (PM) was removed from socket
33	Alert PCB was configured
34	Parameter PCB was configured
35	Range PCB was configured
36	Program Module (PM) incompatible with product was inserted into socket
37	Program Module application parameter revision differs from application processor
38	Program Module safety parameter revision differs from safety processor
39	PCB incompatible with product contained in Program Module
40	Parameter PCB in Program Module is too large for product
41	Range PCB in Program Module was too large for product
42	Alert PCB in Program Module was too large for product
43	IAS start check was forced on due to IAS enabled
44	Low voltage was detected in safety processor
45	High line frequency occurred
46	Low line frequency occurred
47	Invalid subsystem reset request occurred
48	Write large enumerated Modbus register value was not allowed
49	Maximum cycle count was reached
50	Maximum hours count was reached

51	Illegal Modbus write was attempted
52	Modbus write attempt was rejected (NOT ALLOWED)
53	Illegal Modbus read was attempted
54	Safety processor brown-out reset occurred
55	Application processor watchdog reset occurred
56	Application processor brown-out reset occurred
57	Safety processor watchdog reset occurred
58	Alarm was reset by the user at the control
59	Burner control firing rate was > absolute max rate
60	Burner control firing rate was < absolute min rate
61	Burner control firing rate was invalid, % vs. RPM
62	Burner control was firing with no fan request
63	Burner control rate (nonfiring) was > absolute max rate
64	Burner control rate (nonfiring) was < absolute min rate
65	Burner control rate (nonfiring) was absent
66	Burner control rate (nonfiring) was invalid, % vs. RPM
67	Fan off cycle rate was invalid, % vs. RPM
68	Setpoint was overridden due to sensor fault
69	Modulation was overridden due to sensor fault
70	No demand source was set due to demand priority conflicts
71	CH 4-20mA signal was invalid
72-	RESERVED
74	Periodic Forced Recycle
75	Absolute max fan speed was out of range
76	Absolute min fan speed was out of range
77	Fan gain down was invalid
78	Fan gain up was invalid
79	Fan minimum duty cycle was invalid
80	Fan pulses per revolution was invalid
81	Fan PWM frequency was invalid
82-	RESERVED
84	Lead Lag CH 4-20mA water temperature setting was invalid
85	No Lead Lag add stage error threshold was configured
86	No Lead Lag add stage detection time was configured
87	No Lead Lag drop stage error threshold was configured
88	No Lead Lag drop stage detection time was configured
89	Lead Lag all boiler off threshold was invalid
90	Modulation output type was invalid
91	Firing rate control parameter was invalid
92	Forced rate was out of range vs. min/max modulation
93	Forced rate was invalid, % vs. RPM
94	Slow start ramp value was invalid
95	Slow start degrees value was invalid
96	Slow start was ended due to outlet sensor fault
97	Slow start was end due to reference setpoint fault
98	CH max modulation rate was invalid, % vs. RPM
99	CH max modulation rate was > absolute max rate
100	CH modulation range (max minus min) was too small (< 4% or 40 RPM)
101	DHW max modulation rate was invalid, % vs. RPM
102	DHW max modulation rate was > absolute max rate
103	DHW modulation range (max minus min) was too small (< 4% or 40 RPM)
104	Min modulation rate was < absolute min rate
105	Min modulation rate was invalid, % vs. RPM
106	Manual rate was invalid, % vs. RPM

107	Slow start enabled, but forced rate was invalid
108	Analog output hysteresis was invalid
109	Analog modulation output type was invalid
110	IAS open rate differential was invalid
111	IAS open step rate was invalid
112	Mix max modulation rate was invalid, % vs. RPM
113	Mix max modulation rate was > absolute max or < absolute min rates
114	Mix modulation range (max minus min) was too small (< 4% or 40 RPM)
115	Fan was limited to its minimum duty cycle
116	Manual rate was > CH max modulation rate
117	Manual rate was > DHW max modulation rate
118	Manual rate was < min modulation rate
119	Manual rate in Standby was > absolute max rate
120	Modulation commanded rate was > CH max modulation rate
121	Modulation commanded rate was > DHW max modulation rate
122	Modulation commanded rate was < min modulation rate
123	Modulation rate was limited due to Outlet limit
124	Modulation rate was limited due to Delta-T limit
125	Modulation rate was limited due to Stack limit
126	Modulation rate was limited due to anticondensation
127	Fan speed out of range in RUN
128	Modulation rate was limited due to IAS was open
129	Slow start ramp setting of zero will result in no modulation rate change
130	No forced rate was configured for slow start ramp
131	CH demand source was invalid
132	CH P-gain was invalid
133	CH I-gain was invalid
134	CH D-gain was invalid
135	CH OFF hysteresis was invalid
136	CH ON hysteresis was invalid
137	CH sensor type was invalid
138	CH hysteresis step time was invalid
139	CH remote control parameter was invalid
140	CH ODR not allowed with remote control
141	Steam P-gain was invalid
142	Steam I-gain was invalid
143	Steam D-gain was invalid
144	Steam OFF hysteresis was invalid
145	Steam ON hysteresis was invalid
146	CH control was suspended due to fault
147	CH header temperature was invalid
148	CH Outlet temperature was invalid
149	CH steam pressure was invalid
150	Steam setpoint source parameter was invalid
151	Minimum water temperature parameter was greater than setpoint
152	Minimum water temperature parameter was greater than time of day setpoint
153	Minimum pressure parameter was greater than setpoint
154	Minimum pressure parameter was greater than time of day setpoint
155	CH modulation rate source parameter was invalid
156	Steam modulation rate source parameter was invalid
157	DHW demand source was invalid
158	DHW P-gain was invalid
159	DHW I-gain was invalid
160	DHW D-gain was invalid

161	DHW OFF hysteresis was invalid
162	DHW ON hysteresis was invalid
163	DHW hysteresis step time was invalid
164	DHW sensor type was invalid
165	Inlet sensor type was invalid for DHW
166	Outlet sensor type was invalid for DHW
167	DHW storage OFF hysteresis was invalid
168	DHW storage ON hysteresis was invalid
169	DHW modulation sensor type was invalid
170	DHW modulation sensor was not compatible for Auto mode
171	DHW control was suspended due to fault
172	DHW temperature was invalid
173	DHW inlet temperature was invalid
174	DHW outlet temperature was invalid
175	DHW high limit must be disabled for Auto mode
176	DHW sensor type was not compatible for Auto mode
177	DHW priority source setting was invalid
178	DHW priority method setting was invalid
179	CH S5 (J8-11) sensor was invalid
180	CH Inlet temperature was invalid
181	CH S10 (J10-7) sensor was invalid
182	Lead Lag CH setpoint source was invalid
183	Lead Lag P-gain was invalid
184	Lead Lag I-gain was invalid
185	Lead Lag D-gain was invalid
186	Lead Lag OFF hysteresis was invalid
187	Lead Lag ON hysteresis was invalid
188	Lead Lag slave enable was invalid
189	Lead Lag hysteresis step time was invalid
190	No Lead Lag Modbus port was assigned
191	Lead Lag base load common setting was invalid
192	Lead Lag DHW demand switch setting was invalid
193	Lead Lag Mix demand switch setting was invalid
194	Lead Lag modulation sensor setting was invalid
195	Lead Lag backup modulation sensor setting was invalid
196	Lead Lag slave mode setting was invalid
197	Lead Lag rate allocation setting was invalid
198	Lead selection setting was invalid
199	Lag selection setting was invalid
200	Lead Lag slave return setting was invalid
201	Lead Lag add stage method setting was invalid
202	STAT may not be a Lead Lag CH demand source when Remote Stat is enabled
203	Lead Lag base load rate setting was invalid
204	Lead Lag master was suspended due to fault
205	Lead Lag slave was suspended due to fault
206	Lead Lag header temperature was invalid
207	Lead Lag was suspended due to no enabled Program Module installed
208	Lead Lag slave session has timed out
209	Too many Lead Lag slaves were detected
210	Lead Lag slave was discovered
211	Incompatible Lead Lag slave was discovered
212	No base load rate was set for Lead Lag slave
213	Lead Lag slave unable to fire before demand to fire delay expired
214	Adding Lead Lag slave aborted due to add requirement change
215	No Lead Lag slaves available to service demand

216	No Lead Lag active service was set due to demand priority conflicts
217	No Lead Lag add stage method was specified
218	No Lead Lag drop stage method was specified
219	Using backup Lead Lag header sensor due to sensor failure
220	Lead Lag frost protection rate was invalid
221	Lead Lag drop stage method setting was invalid
222	CH frost protection temperature was invalid
223	CH frost protection inlet temperature was invalid
224	DHW frost protection temperature was invalid
225-226	RESERVED
227	DHW priority override time was not derated due to invalid outdoor temperature
228	Warm weather shutdown was not checked due to invalid outdoor temperature
229	Lead Lag slave communication timeout
230	RESERVED
231	Lead Lag CH setpoint was invalid
232	Lead Lag CH time of day setpoint was invalid
233	Lead Lag outdoor temperature was invalid
234	Lead Lag ODR time of day setpoint was invalid
235	Lead Lag ODR time of day setpoint exceeded normal setpoint
236	Lead Lag ODR max outdoor temperature was invalid
237	Lead Lag ODR min outdoor temperature was invalid
238	Lead Lag ODR low water temperature was invalid
239	Lead Lag ODR outdoor temperature range was too small (minimum 12 C / 22
240	Lead Lag ODR water temperature range was too small (minimum 12 C / 22 F)
241	Lead Lag DHW setpoint was invalid
242	Lead Lag Mix setpoint was invalid
243	Lead Lag CH demand switch was invalid
244	Lead Lag ODR min water temperature was invalid
245	RESERVED
246	CH setpoint was invalid
247	CH time of day setpoint was invalid
248	CH outdoor temperature was invalid
249	CH ODR time of day setpoint was invalid
250	CH ODR time of day setpoint exceeds normal setpoint
251	CH max outdoor setpoint was invalid
252	CH min outdoor setpoint was invalid
253	CH ODR low water temperature was invalid
254	CH ODR outdoor temperature range was too small
255	CH ODR water temperature range was too small
256	Steam setpoint was invalid
257	Steam time of day setpoint was invalid
258	Steam minimum pressure was invalid
259	CH ODR min water temperature was invalid
260	RESERVED
261	DHW setpoint was invalid
262	DHW time of day setpoint was invalid
263	DHW storage setpoint was invalid
264	STAT may not be a DHW demand source when Remote Stat is enabled
265-266	RESERVED
267	STAT may not be a CH demand source when Remote Stat is enabled
268	CH 4mA water temperature setting was invalid
269	CH 20mA water temperature setting was invalid
270	Steam 4mA water temperature setting was invalid
271	Steam 20mA water temperature setting was invalid
272	Abnormal Recycle: Pressure sensor fault

273	Abnormal Recycle: Safety relay drive test failed
274	Abnormal Recycle: Demand off during Pilot Flame Establishing Period
275	Abnormal Recycle: LCI off during Drive to Purge Rate
276	Abnormal Recycle: LCI off during Measured Purge Time
277	Abnormal Recycle: LCI off during Drive to Lightoff Rate
278	Abnormal Recycle: LCI off during Pre-Ignition test
279	Abnormal Recycle: LCI off during Pre-Ignition time
280	Abnormal Recycle: LCI off during Main Flame Establishing Period
281	Abnormal Recycle: LCI off during Ignition period
282	Abnormal Recycle: Demand off during Drive to Purge Rate
283	Abnormal Recycle: Demand off during Measured Purge Time
284	Abnormal Recycle: Demand off during Drive to Lightoff Rate
285	Abnormal Recycle: Demand off during Pre-Ignition test
286	Abnormal Recycle: Demand off during Pre-Ignition time
287	Abnormal Recycle: Flame was on during Safe Start check
288	Abnormal Recycle: Flame was on during Drive to Purge Rate
289	Abnormal Recycle: Flame was on during Measured Purge Time
290	Abnormal Recycle: Flame was on during Drive to Lightoff Rate
291	Abnormal Recycle: Flame was not on at end of Ignition period
292	Abnormal Recycle: Flame was lost during Main Flame Establishing Period
293	Abnormal Recycle: Flame was lost early in Run
294	Abnormal Recycle: Flame was lost during Run
295	Abnormal Recycle: Leakage test failed
296	Abnormal Recycle: Interrupted air flow switch was off during Drive to Purge
297	Abnormal Recycle: Interrupted air flow switch was off during Measured Purge
298	Abnormal Recycle: Interrupted air flow switch was off during Drive to Lightoff
299	Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition test
300	Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition time
301	Abnormal Recycle: Interrupted air flow switch was off during Main Flame
302	Abnormal Recycle: Ignition failed due to interrupted air flow switch was off
303	Abnormal Recycle: ILK off during Drive to Purge Rate
304	Abnormal Recycle: ILK off during Measured Purge Time
305	Abnormal Recycle: ILK off during Drive to Lightoff Rate
306	Abnormal Recycle: ILK off during Pre-Ignition test
307	Abnormal Recycle: ILK off during Pre-Ignition time
308	Abnormal Recycle: ILK off during Main Flame Establishing Period
309	Abnormal Recycle: ILK off during Ignition period
310	Run was terminated due to ILK was off
311	Run was terminated due to interrupted air flow switch was off
312	Stuck reset switch
313	Run was terminated due to fan failure
314	Abnormal Recycle: Fan failed during Drive to Purge Rate
315	Abnormal Recycle: Fan failed during Measured Purge Time
316	Abnormal Recycle: Fan failed during Drive to Lightoff Rate
317	Abnormal Recycle: Fan failed during Pre-Ignition test
318	Abnormal Recycle: Fan failed during Pre-Ignition time
319	Abnormal Recycle: Fan failed during Ignition period
320	Abnormal Recycle: Fan failed during Main Flame Establishing Period
321	Abnormal Recycle: Main Valve off after 10 seconds of RUN
322	Abnormal Recycle: Pilot Valve off after 10 seconds of RUN
323	Abnormal Recycle: Safety Relay off after 10 seconds of RUN
324	Abnormal Recycle: Hardware flame bias
325	Abnormal Recycle: Hardware static flame
326	Abnormal Recycle: Hardware flame current invalid

327	Abnormal Recycle: Hardware flame rod short
328	Abnormal Recycle: Hardware invalid power
329	Abnormal Recycle: Hardware invalid AC line
330	Abnormal Recycle: Hardware SLO flame ripple
331	Abnormal Recycle: Hardware SLO flame sample
332	Abnormal Recycle: Hardware SLO flame bias range
333	Abnormal Recycle: Hardware SLO flame bias heat
334	Abnormal Recycle: Hardware SLO spark stuck
335	Abnormal Recycle: Hardware SLO spark changed
336	Abnormal Recycle: Hardware SLO static flame
337	Abnormal Recycle: Hardware SLO rod shorted
338	Abnormal Recycle: Hardware SLO AD linearity
339	Abnormal Recycle: Hardware SLO bias not set
340	Abnormal Recycle: Hardware SLO bias shorted
341	Abnormal Recycle: Hardware SLO electronics
342	Abnormal Recycle: Hardware processor clock
343	Abnormal Recycle: Hardware AC phase
344	Abnormal Recycle: Hardware A2D mismatch
345	Abnormal Recycle: Hardware VSNSR A2D
346	Abnormal Recycle: Hardware 28V A2D
347	Abnormal Recycle: Hardware HFS IAS shorted
348	Abnormal Recycle: Hardware PII INTLK shorted
349	Abnormal Recycle: Hardware HFS LCI shorted
350	Abnormal Recycle: Hardware HFS LFS shorted
351	Abnormal Recycle: Invalid zero crossing
352	Abnormal Recycle: fault stack sensor
353	Abnormal Recycle: stack limit
354	Abnormal Recycle: delta T limit
355	Abnormal Recycle: fault outlet sensor
356	Abnormal Recycle: outlet high limit
357	Abnormal Recycle: fault DHW sensor
358	Abnormal Recycle: DHW high limit
359	Abnormal Recycle: fault inlet sensor
360	Abnormal Recycle: Check Parameters Failed
361	Internal error: No factory parameters were detected in control
362	Internal error: PID iteration frequency was invalid
363	Internal error: Demand-Rate interval time was invalid
364	Internal error: Factory calibration parameter for modulation was invalid
365	Internal error: CH PID P-scaler was invalid
366	Internal error: CH PID I-scaler was invalid
367	Internal error: CH PID D-scaler was invalid
368	Internal error: DHW PID P-scaler was invalid
369	Internal error: DHW PID I-scaler was invalid
370	Internal error: DHW PID D-scaler was invalid
371	Internal error: Lead Lag master PID P-scaler was invalid
372	Internal error: Lead Lag master PID I-scaler was invalid
373	Internal error: Lead Lag master PID D-scaler was invalid
374	Abnormal Recycle: Hardware flame bias high
375	Abnormal Recycle: Hardware flame bias low
376	Abnormal Recycle: Hardware flame bias delta high
377	Abnormal Recycle: Hardware flame bias delta low
378	Abnormal Recycle: Hardware flame bias dynamic high
379	Abnormal Recycle: Hardware flame bias dynamic low
380	Abnormal Recycle: Fan Speed Not Proven
381	Abnormal Recycle: Fan Speed Range Low

382	Abnormal Recycle: Fan Speed Range High
383-450	RESERVED
451	Circulator control was invalid
452	Circulator P-gain was invalid
453	Circulator I-gain was invalid
454	Circulator temperature was invalid
455	Circulator outlet temperature was invalid
456	Circulator inlet temperature was invalid
457	Circulator outdoor temperature was invalid
458	Circulator sensor choice was invalid
459	Circulator PID setpoint was invalid
460	LCI lost in run
461	Abnormal Recycle: Demand lost in run from application
462	Abnormal Recycle: Demand lost in run due to high limit
463	Abnormal Recycle: Demand lost in run due to no flame
464	LCI lost in Combustion Pressure Establishing Period
465	LCI lost in Combustion Pressure Stabilization Period
466	RESERVED
467	Internal error: EEPROM write was attempted before EEPROM was initialized
468	Internal error: EEPROM cycle count address was invalid
469	Internal error: EEPROM days count address was invalid
470	Internal error: EEPROM hours count address was invalid
471	Internal error: Lockout record EEPROM index was invalid
472	Internal error: Request to write PM status was invalid
473	Internal error: PM parameter address was invalid
474	Internal error: PM safety parameter address was invalid
475	Internal error: Invalid record in lockout history was removed
476	Internal error: EEPROM write buffer was full
477	Internal error: Data too large was not written to EEPROM
478	Internal error: Safety key bit 0 was incorrect
479	Internal error: Safety key bit 1 was incorrect
480	Internal error: Safety key bit 2 was incorrect
481	Internal error: Safety key bit 3 was incorrect
482	Internal error: Safety key bit 4 was incorrect
483	Internal error: Safety key bit 5 was incorrect
484	Internal error: Safety key bit 6 was incorrect
485	Internal error: Safety key bit 7 was incorrect
486	Internal error: Safety key bit 8 was incorrect
487	Internal error: Safety key bit 9 was incorrect
488	Internal error: Safety key bit 10 was incorrect
489	Internal error: Safety key bit 11 was incorrect
490	Internal error: Safety key bit 12 was incorrect
491	Internal error: Safety key bit 13 was incorrect
492	Internal error: Safety key bit 14 was incorrect
493	Internal error: Safety key bit 15 was incorrect
494	Internal error: Safety relay timeout
495	Internal error: Safety relay commanded off
496	Internal error: Unknown safety error occurred
497	Internal error: Safety timer was corrupt
498	Internal error: Safety timer was expired
499	Internal error: Safety timings
500	Internal error: Safety shutdown
501	RESERVED
502	Mix setpoint was invalid
503	Mix time of day setpoint was invalid

504	Mix outdoor temperature was invalid
505	Mix ODR time of day setpoint was invalid
506	Mix ODR time of day setpoint exceeds normal setpoint
507	Mix ODR max outdoor temperature was invalid
508	Mix ODR min outdoor temperature was invalid
509	Mix ODR low water temperature was invalid
510	Mix ODR outdoor temperature range was invalid
511	Mix ODR water temperature range was invalid
512	Mix demand switch was invalid
513	Mix ON hysteresis was invalid
514	Mix OFF hysteresis was invalid
515	Mix ODR min water temperature was invalid
516	Mix hysteresis step time was invalid
517	Mix P-gain was invalid
518	Mix I-gain was invalid
519	Mix D-gain was invalid
520	Mix control was suspended due to fault
521	Mix S10 (J10-7) temperature was invalid
522	Mix outlet temperature was invalid
523	Mix inlet temperature was invalid
524	Mix S5 (J8-11) temperature was invalid
525	Mix modulation sensor type was invalid
526	Mix ODR min water temperature setpoint was invalid
527	Mix circulator sensor was invalid
528	Mix flow control was invalid
529	Mix temperature was invalid
530	Mix sensor was invalid
531	Mix PID setpoint was invalid
532	STAT may not be a Mix demand source when Remote Stat is enabled
533-539	RESERVED
540	Delta T inlet/outlet enable was invalid
541	Delta T exchanger/outlet enable was invalid
542	Delta T inlet/exchanger enable was invalid
543	Delta T inlet/outlet degrees was out of range
545	Delta T inlet/exchanger degrees was out of range
546	Delta T response was invalid
547	Delta T inversion limit response was invalid
548	Delta T rate limit enable was invalid
549	Delta T exchanger/outlet wasn't allowed due to stack limit setting
550	Delta T inlet/outlet limit was exceeded
551	Delta T exchanger/outlet limit was exceeded
552	Delta T inlet/exchanger limit was exceeded
553	Inlet/outlet inversion occurred
554	Exchanger/outlet inversion occurred
555	Inlet/exchanger inversion occurred
556	Delta T exchanger/outlet wasn't allowed due to stack connector setting
557	Delta T inlet/exchanger wasn't allowed due to stack limit setting
558	Delta T inlet/exchanger wasn't allowed due to stack connector setting
559	Delta T delay was not configured for recycle response
560	Outlet T-rise enable was invalid
561	Heat exchanger T-rise enable was invalid
562	T-rise degrees was out of range
563	T-rise response was invalid
564	Outlet T-rise limit was exceeded
565	Heat exchanger T-rise limit was exceeded

566	Heat exchanger T-rise wasn't allowed due to stack limit setting
567	Heat exchanger T-rise wasn't allowed due to stack connector setting
568	Outlet T-rise wasn't allowed due to outlet connector setting
569	T-rise delay was not configured for recycle response
570	Heat exchanger high limit setpoint was out of range
571	Heat exchanger high limit response was invalid
572	Heat exchanger high limit was exceeded
573	Heat exchanger high limit wasn't allowed due to stack limit setting
574	Heat exchanger high limit wasn't allowed due to stack connector setting
575	Heat exchanger high limit delay was not configured for recycle response
576	CH pump output was invalid
577	DHW pump output was invalid
578	Boiler pump output was invalid
579	Auxiliary pump output was invalid
580	System pump output was invalid
581	Mix pump output was invalid
582-589	RESERVED
590	DHW plate preheat setpoint was invalid
591	DHW plate preheat ON hysteresis was invalid
592	DHW plate preheat OFF hysteresis was invalid
593	Tap detect degrees was out of range
594	Tap detect ON hysteresis was invalid
595	Inlet - DHW tap stop degrees was out of range
596	Outlet - Inlet tap stop degrees was out of range
597	DHW tap detect on threshold was invalid
598	DHW plate preheat detect on threshold was invalid
599	DHW plate preheat detect off threshold was invalid
600	Delta T inlet temperature was invalid
601	Delta T outlet temperature was invalid
602	Delta T exchanger temperature was invalid
603	Parameter PCB was switched to backup
604	Range PCB was switched to backup
605	Lead Lag ODR boost max offpoint temperature was invalid
606	Lead Lag ODR boost max offpoint temperature was too low
607	Mix ODR boost max offpoint temperature was invalid
608	Mix ODR boost max offpoint temperature was too low
609	Time to rotate lead boiler to next firing slave
610	Time to rotate lead boiler to next available slave
611	Time to rotate lead boiler to first firing slave in order
612	Time to rotate lead boiler to lowest running slave
613	Lead boiler was rotated based on new firing sequence order
614	Lead boiler was rotated based on measured run time
615	Parameter PCB was switched to backup
616	Range PCB was switched to backup
617	Lead Lag steam pressure was invalid
618	Lead Lag steam setpoint was invalid
619	Lead Lag steam OFF hysteresis was invalid
620	Lead Lag steam ON hysteresis was invalid
621	Lead Lag steam minimum pressure was invalid
622	Lead Lag modulation sensor was not valid with setpoint source

Appendix D.3. Pump Status Codes (Sola)

Status	Description Note
92	Forced On from manual pump control
93	Forced On due to Outlet high limit is active
94	Forced On from burner demand
95	Forced On due to Lead Lag slave has demand
96	Forced Off from local DHW priority service
97	Forced Off from Lead Lag DHW priority service
98	Forced Off from Central Heat anti-condensation
99	Forced Off from DHW anti-condensation
100	Forced Off due to DHW high limit is active
101	Forced Off from EnviraCOM DHW priority service
102	On due to local CH frost protection is active
103	On due to Lead Lag CH frost protection is active
104	On due to local DHW frost protection is active
105	On due to Lead Lag DHW frost protection is active
106	On from local Central Heat demand
107	On from Lead Lag Central Heat demand
108	On from local DHW demand
109	On from Lead Lag DHW demand
110	On from local Mix demand
111	On from Lead Lag Mix demand
112	On from local Central Heat service
113	On from Lead Lag Central Heat service
114	On from local DHW service
115	On from Lead Lag DHW service
116	On from local Mix service
117	On from Lead Lag Mix service
118	On from Lead Lag auxiliary pump X
119	On from Lead Lag auxiliary pump Y
120	On from Lead Lag auxiliary pump Z
121	On, but inhibited by pump start delay
122	On from pump override
123	Off, not needed
124	On from burner demand
125	On from exercise
126	On from local Lead Lag service
127	On from local Lead Lag pump demand

Appendix E. MAC Address DIP Switch Settings

Appendix E.1. MAC Address DIP Switch Settings

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

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

Address	A0	A1	A2	A3	A4	A5	A6	A7
92	Off	Off	On	On	On	Off	On	Off
93	On	Off	On	On	On	Off	On	Off
94	Off	On	On	On	On	Off	On	Off
95	On	On	On	On	On	Off	On	Off
96	Off	Off	Off	Off	Off	On	On	Off
97	On	Off	Off	Off	Off	On	On	Off
98	Off	On	Off	Off	Off	On	On	Off
99	On	On	Off	Off	Off	On	On	Off
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138	Off	On	Off	On	Off	Off	Off	On
139	On	On	Off	On	Off	Off	Off	On
140	Off	Off	On	On	Off	Off	Off	On
141	On	Off	On	On	Off	Off	Off	On

Address	A0	A1	A2	A3	A4	A5	A6	A7
142	Off	On	On	On	Off	Off	Off	On
143	On	On	On	On	Off	Off	Off	On
144	Off	Off	Off	Off	On	Off	Off	On
145	On	Off	Off	Off	On	Off	Off	On
146	Off	On	Off	Off	On	Off	Off	On
147	On	On	Off	Off	On	Off	Off	On
148	Off	Off	On	Off	On	Off	Off	On
149	On	Off	On	Off	On	Off	Off	On
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180	Off	Off	On	Off	On	On	Off	On
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182	Off	On	On	Off	On	On	Off	On
183	On	On	On	Off	On	On	Off	On
184	Off	Off	Off	On	On	On	Off	On
185	On	Off	Off	On	On	On	Off	On
186	Off	On	Off	On	On	On	Off	On
187	On	On	Off	On	On	On	Off	On
188	Off	Off	On	On	On	On	Off	On
189	On	Off	On	On	On	On	Off	On
190	Off	On	On	On	On	On	Off	On
191	On	On	On	On	On	On	Off	On

Address	A0	A1	A2	A3	A4	A5	A6	A7
192	Off	Off	Off	Off	Off	Off	On	On
193	On	Off	Off	Off	Off	Off	On	On
194	Off	On	Off	Off	Off	Off	On	On
195	On	On	Off	Off	Off	Off	On	On
196	Off	Off	On	Off	Off	Off	On	On
197	On	Off	On	Off	Off	Off	On	On
198	Off	On	On	Off	Off	Off	On	On
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211	On	On	Off	Off	On	Off	On	On
212	Off	Off	On	Off	On	Off	On	On
213	On	Off	On	Off	On	Off	On	On
214	Off	On	On	Off	On	Off	On	On
215	On	On	On	Off	On	Off	On	On
216	Off	Off	Off	On	On	Off	On	On
217	On	Off	Off	On	On	Off	On	On
218	Off	On	Off	On	On	Off	On	On
219	On	On	Off	On	On	Off	On	On
220	Off	Off	On	On	On	Off	On	On
221	On	Off	On	On	On	Off	On	On
222	Off	On	On	On	On	Off	On	On
223	On	On	On	On	On	Off	On	On

Address	A0	A1	A2	A3	A4	A5	A6	A7
224	Off	Off	Off	Off	Off	On	On	On
225	On	Off	Off	Off	Off	On	On	On
226	Off	On	Off	Off	Off	On	On	On
227	On	On	Off	Off	Off	On	On	On
228	Off	Off	On	Off	Off	On	On	On
229	On	Off	On	Off	Off	On	On	On
230	Off	On	On	Off	Off	On	On	On
231	On	On	On	Off	Off	On	On	On
232	Off	Off	Off	On	Off	On	On	On
233	On	Off	Off	On	Off	On	On	On
234	Off	On	Off	On	Off	On	On	On
235	On	On	Off	On	Off	On	On	On
236	Off	Off	On	On	Off	On	On	On
237	On	Off	On	On	Off	On	On	On
238	Off	On	On	On	Off	On	On	On
239	On	On	On	On	Off	On	On	On
240	Off	Off	Off	Off	On	On	On	On
241	On	Off	Off	Off	On	On	On	On
242	Off	On	Off	Off	On	On	On	On
243	On	On	Off	Off	On	On	On	On
244	Off	Off	On	Off	On	On	On	On
245	On	Off	On	Off	On	On	On	On
246	Off	On	On	Off	On	On	On	On
247	On	On	On	Off	On	On	On	On
248	Off	Off	Off	On	On	On	On	On
249	On	Off	Off	On	On	On	On	On
250	Off	On	Off	On	On	On	On	On
251	On	On	Off	On	On	On	On	On
252	Off	Off	On	On	On	On	On	On
253	On	Off	On	On	On	On	On	On
254	Off	On	On	On	On	On	On	On
255	On	On	On	On	On	On	On	On

Appendix F. Reference

Appendix F.1. Specifications

	ProtoNode FPC-N34	ProtoNode FPC-N35
Electrical Connections	One 6-pin Phoenix connector with: RS-485 port (+ / - / gnd) Power port (+ / - / Frame-gnd) One 3-pin Phoenix connector with RS-485 port (+ / - / gnd) One Ethernet 10/100 BaseT port	One 6-pin Phoenix connector with: RS-485 port (+ / - / gnd) Power port (+ / - / Frame-gnd) One 2-pin Phoenix connector with: One FTT-10 LonWorks port One Ethernet 10/100 BaseT port
Approvals	CE certified; UL 916 approved; WEEE compliant; REACH compliant; EN 50491-3 and CSA C22-2 standards; FCC Class A Part 15; DNP 3.0 conformance tested; RoHS 3 compliant; CSA 205 approved	
	BTL Marked	LonMark Certified
Power Requirements	9-30VDC or 12-24VAC	
Physical Dimensions	11.5 cm L x 8.3 cm W x 4.1 cm H (4.5 x 3.2 x 1.6 in.)	
Weight	0.2 kg (0.4 lbs)	
Operating Temperature	-40°C to 75°C (-40°F to167°F)	
Surge Suppression	EN61000-4-2 ESD EN61000-4-3 EMC EN61000-4-4 EFT	
Humidity	5 - 90% RH (non-condensing)	
(Specifications subject to change without notice)		

Figure 47: Specifications

Appendix F.1.1. Compliance with UL Regulations

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

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

Appendix G. 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.