XR10CX INTERFACE GUIDE MODBUS, BACNET GATEWAY, AND POINTS LIST

XR10CX

TempTrac

This guide covers direct interface with MODBUS RTU, or BACNET MSTP / IP interface using ProtoNode FPC-N34-2097

DIRECT INTERFACE WITH MODBUS RTU
GATEWAY INTERFACE ALLOWING BACNET MSTP OR BACNET IP
POINTS FOR INTERFACE (MODBUS AND BACNET)

Installation and interface must be performed by a qualified controls technician.
IMPORTANT: THIS MANUAL CONTAINS INFORMATION REQUIRED FOR INSTALLATION, INTERFACE AND CONFIGURATION OF THIS EQUIPMENT. READ AND FOLLOW THE INFORMATION IN THIS MANUAL AND ALL OTHER PROVIDED INSTRUCTIONS, LABELS AND MARKINGS BEFORE INSTALLING, OPERATING OR SERVICING THIS UNIT

TO THE INSTALLER / CONTROLS INTEGRATOR: After installation and integration, these instructions must be given to the equipment user or left near the appliance.

SPECIAL INSTRUCTIONS TO THE OWNER: Retain this manual for future reference. These instructions contain important integration information that will help you in maintaining and operating this appliance.

Hot Water Solutions

PVI Industries • Fort Worth, TX
USA: T: (817) 335-9531 • Toll Free: (800) 784-8326 • PVI.com
Technical Support • (800) 433-5654 (ext. 3) • Mon-Fri, 8 am - 5 pm CT

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TABLE OF CONTENTS:

Contents

TABLE OF CONTENTS: 2
THIS DOCUMENT (PV7266) 5
Integration of heaters using a ProtoNode Gateway 5
Integration Direct to Heaters 5
What this document does not cover: 5
BACNET MSTP to BACNET IP 5
MODBUS RTU to MODBUS TCP 5
Other Protocols and 3rd Party Gateways 5
Customer Support 5
General support questions and integration: 5
ProtoNode Advanced Support 5
GETTING STARTED: 6
OVERVIEW OF INTERFACE METHODS: 7
BMS to heaters using discrete connections: 7
BMS to Heaters direct, using MODBUS RTU: 7
BMS to heaters using a PVI Protocol Gateway: 7
BMS to heaters 3rd party GATEWAY to provide other Protocols not offered by PVI: 7
THE CONTROLS USED ON HEATERS 8
TempTrac Used on: 8
XR10CX Used on: 8
Set MODBUS Address: 9
Setting the TempTrac MODBUS address: 9
SETTING XR10CX MODBUS ADDRESS: 10
WIREING, MODBUS RTU INTERFACE CONNECTION, NO GATEWAY 11
Items Required for MODBUS RTU Direct Interface: 11
Wiring of Heater Control To BMS (Direct, no Gateway): 11
PROTONODE GATEWAY, MOUNTING AND WIRING POWER 11
Location to Mount ProtoNode: 11
Proper Power Supply 11
Alternative Power Adapters: 12
Power to the power supply 12
Connecting to Line Power: 12
Using power from a Heater Appliance: 12
WIRING GATEWAY TO HEATERS 13
WIRING GATEWAY TO BACNET MSTP NETWORK 14
WIRING PROTONODE TO BACNET IP NETWORK: 15
IDENTIFY EQUIPMENT ON HEATER WITH TEMPTRAC or XR10CX: 16
TempTrac Control: 16
XR10CX Control: 16
MODBUS Adapter: 16
ProtoNode Gateway: 16
Power Supply: 16
Building Management Connection: 17
REVIEW ALL WIRING WHEN USING PROTONODE GATEWAY: 17
PREP FOR CONFIGURING PROTONODE GATEWAY 18
Information needed from Controls Contractor: 18
For BACNET MSTP 18
For BACNET IP 18
For BACNET MSTP Single Node Profile 18
BACNET Router option: 18
MODBUS TCP option 18
CONFIGURE PROTONODE GATEWAY DIP SWITCHES: 18
DIP SWITCHES S0-3 PROTOCOL 19
Select the Protocol: 19
DIP SWITCHES B0-4 BAUD FOR BMS 3 PIN CONNECTOR 19
A0-7 (BACNET MSTP) MAC ADDRESS: 20
CONFIGURE PROTONODE USING HTML INTERFACE: 20
Connecting to ProtoNode for Configuration 20
SELECT SECURITY METHOD FOR INTERFACE 21
Setup Web Server Security 21
Login to the FieldServer 21

Finding the user name and password ... 22
Select the Security Mode ... 23
HTTPS with Own Trusted TLS Certificate ... 24
HTTPS with Default Untrusted Self-Signed TLS Certificate or HTTP with Built in Payload Encryption ... 24
CONFIGURE THE GATEWAY USING THE HTML INTERFACE: ... 25
Menu BACNET IP: S0-3 = OFF ... 25
Menu BACNET MSPT: S0 = ON, S1-3 = OFF ... 25
Menu BACNET MSTP (SINGLE NODE): S2 = ON, S0,S1,S3 = OFF ... 25
Other Protocol Configurations: ... 25
GATEWAY PARAMETER OPTIONS DETAILS: ... 26
BACnet Network Number: (BACNET IP and BACNET MSTP) ... 26
BACnet Node Offset: (BACNET IP and BACNET MSTP) ... 26
BACnet Node Offset: (SINGLE NODE BACNET MSTP) ... 26
BACnet IP Port: (BACNET IP) ... 26
BACnet COV: (All BACNET) ... 26
BACnet BBMD: (BACNET IP) ... 26
MSTP Max Master: (BACnet MSTP and SINGLE NODE BACnet MSTP) ... 26
BACnet Virtual Server Nodes: (Only on BACnet MSTP) ... 27
ADD THE DEVICE PROFILES: ... 27
TempTrac Configured to Display Degrees Fahrenheit ... 27
TempTrac Configured to Display Degrees Celsius with Format 000.0 ... 27
TempTrac Configured to Display Degrees Celsius with Format 000. ... 27
XR10CX Configured to Display Degrees Fahrenheit ... 27
XR10CX Configured to Display Degrees Celsius ... 27
Gateway Node Limitations: ... 28
CONFIRM OPERATION OF PROTONODE GATEWAY: ... 28
Heater Communication: ... 28
Building Management System Communication: ... 28
TROUBLESHOOTING GATEWAY: ... 29
LED On ProtoNode Gateway: ... 29
Verify polarity of all connections: ... 30
HOOKUP OVERVIEW: ... 31
BACNET MSTP ... 31
BACNET IP ... 31
MODBUS RTU Direct Connect ... 31
APPLICATION SPECIFIC: ... 32
Quickdraw Steam to Water Instantaneous / storage (TempTrac Control) ... 32
Alarms ... 32
Discrete connections ... 32
Quickdraw Water to Water Storage non-modulating (TempTrac Control) ... 32
Alarms ... 32
Discrete connections ... 33
(Return to GETTING STARTED) ... 33
Cobrex Steam to Water storage (TempTrac Control) ... 33
Alarms ... 33
Discrete connections ... 33
EZ Plate Storage (TempTrac Control) ... 33
Alarms ... 34
Discrete connections ... 34
Older Conquest 100 and 130 gallon : (TempTrac Control) ... 34
Alarms ... 34
Discrete connections: ... 34
Older Conquest 130 Gallon (500 – 800): (TempTrac Control) ... 35
Discrete connections: ... 35
Centauri Boiler, Centauri Plus Boiler, VT3 Boiler: (TempTrac Control) ... 35
Alarms ... 35
Discrete connections: ... 35
M3 Boiler (TempTrac Control) ... 36
Alarms ... 36
Discrete connections: ... 36
Quickdraw Steam to Water Storage (TempTrac Control) ... 36
Discrete connections: ... 36
Alarms ... 36
Quickdraw Steam to Water Instantaneous (TempTrac Control) ... 36
Discrete connections: ... 37
Alarms ... 37
EZ PLATE STORAGE (TempTrac Control) ... 37
Alarms ... 37
Discrete connections: ... 37

EZ Plate Instantaneous (XR10CX Control) 37
Discrete connections: 38
Alarms 38
Cobrex Steam to Water Storage (TempTrac Control) 38
Alarms 38
Discrete connections 38
Cpbrex Instantaneous (XR10CX Control) 38
Discrete connections: 39
Quickdraw Steam to Water Instantaneous / storage 39
Alarms 39
Discrete connections 39
Quickdraw Water to Water Storage non-modulating 39
Alarms 39
Discrete connections 40
Other Equipment and Equipment Custom features: 40
Other heaters not detailed: 40
POINTS LIST FOR TEMPTRAC: 41
Key: 41
TYPICAL POINTS FOR TEMPTRAC: 41
ALL POINTS INCLUDING ADVANCED FOR TEMPTRAC: 43
ADVANCED MODBUS LIST FOR TEMPTRAC: 50
XR10CX POINTS LIST: 54
Key: 54
TYPICAL POINTS XR10CX: 55
ADVANCED POINTS XR10CX: 56
XR10CX ADVANCED MODBUS LIST: 57
PROTONODE GATEWAY DETAILS: 58
ProtoNode Port R1: 58
ProtoNode Port S1: 59
ProtoNode Ethernet Port: 60
HEATER CONTROL INFORMATION: 61
THE TEMPTRAC CONTROL DETAILS: 61
THE XR10CX CONTROL DETAILS: 61
Native Protocol of TempTrac and XR10CX 61
MODBUS Data Types Used 61
TempTrac only uses one data type, Holding Registers 61
XR10CX uses only Holding Registers and Coils 61
The MODBUS adapter: 61
MODBUS fixed settings for TempTrac and XR10CX: 62
Physical Layer RS-485 of the MODBUS RTU 62
BIAS Resistors for the MODBUS RTU Connection: 62

THIS DOCUMENT (PV7266)

This document is a step by step guide for interfacing a TempTrac or XR10CX control on a PVI heater with a Building Management System (BMS). This can also be referred to as Building Automation System (BAS).

Integration of heaters using a ProtoNode Gateway

Integration using a gateway provide simple method to connect the heaters to a high level Protocol on a BMS. This saves labor and is much simpler than direct integration with MODBUS RTU. This guide covers the integration using the FieldServer ProtoNode FPC-N34-2097 PVI PN: 158711
For integration of other ProtoNodes, please contact PVI for proper documentation

Integration Direct to Heaters

Although this document contains a lot of information for the gateway, direct interface using MODBUS RTU or Discreet wiring are also covered in this document.

What this document does not cover:

BACNET MSTP to BACNET IP

BMS needing to interface with BACNET IP to a PVI heater with a EOS control or other BACNET MSTP
Contact PVI for additional documentation

MODBUS RTU to MODBUS TCP

BMS needing MODBUS TCP to interface with the TempTrac or XR10CX controls using MODBUS RTU
Contact PVI for additional documentation

Other Protocols and 3rd Party Gateways

Integration of 3rd party gateways for other Protocols.
The process if setting up a new gateway will require the integrator program the gateway to read the MODBUS RTU points and convert them to BACNET POINTS. This scope of this is beyond this manual and beyond typical technical support. It is advised to have an integration professional handle this type of project.

Customer Support

General support questions and integration:

PVI Customer service can help a qualified integrators and technicians with specific questions, but in no way does this imply that Customer Service can help develop a 3rd party integration or will participate in a 3rd party integration project. See www.PVI.com for customer support contact and hours.

ProtoNode Advanced Support

PVI is supplied the custom programmed ProtoNode from FieldServer. First level of support is PVI Customer Care. If an issue cannot be resolved directly with PVI, then PVI will pull in support from FieldServer to aid in resolving the issues.

GETTING STARTED:

Follow the steps in this section to jump to each critical section. This document contains links to bring you back to this GETTING STARTED so you can quickly complete each step and then identify you next step. For areas of concern that go beyond this quick start, use the TABLE OF CONTENTS

- Select the Interface method you will be using
  - Interface Methods
  - Hookup Overview
- Identify the controls
  - Heater Controls
  - Identify all controls
- Continue based on use of ProtoNode or not
  - No ProtoNode Gateway
    - Wiring MODBUS RTU Interface
    - Select heaters you are integrating from the APPLICATION SPECIFIC section
    - Integrate using Points List
      - TempTrac
        - MODBUS LIST
        - Typical Points
        - Advanced Points
      - XR10CX
        - MODBUS LIST
        - Typical Points
        - Advanced Points
  - With ProtoNode Gateway
    - Mounting and Wiring ProtoNode to Power
    - Wiring Gateway to Heaters
    - Wiring BACNET MSTP Interface
    - Wiring BACNET IP Interface
    - Review Wiring
    - Setup Modbus Address for each heater
      - TempTrac Modbus Address or XR10CX Modbus Address
    - Prep for Configuring ProtoNode
    - Configure ProtoNode Dip Switches
    - Configure ProtoNode with HTML Interface
      - Connect to ProtoNode with Computer using HTML interface
      - Select Security Method for ProtoNode
      - Configure ProtoNode via HTML interface
      - Add device Profiles
      - Confirm operation
      - Troubleshoot any issues
    - Integrate Points for Selected Heaters
      - TempTrac Typical Points
        - TempTrac Advanced Points
      - XR10CX Typical Points
        - XR10CX Advanced Points
    - Troubleshoot issues

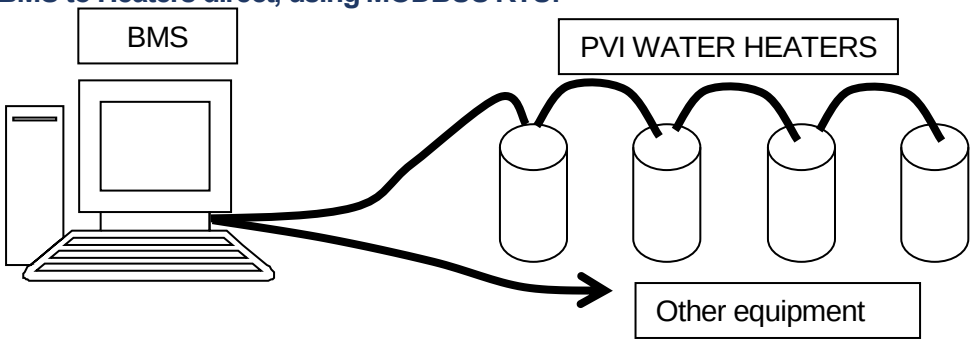
OVERVIEW OF INTERFACE METHODS:

Four methods to interface with a heater or group of heaters that have TempTrac controls.

BMS to heaters using discrete connections:

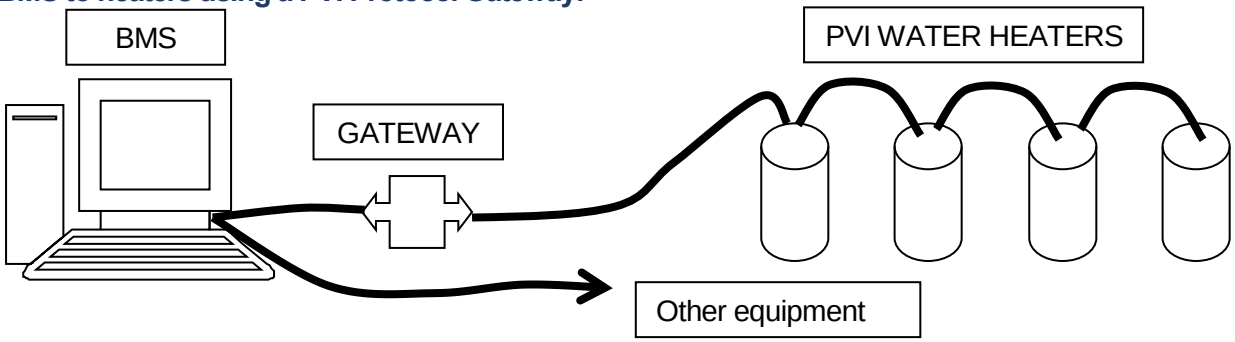
This is simply control of the heater using the external ENABLE/DISABLE contacts, remote equipment contacts and the alarm contacts. See wiring diagram of equipment for details.

BMS to Heaters direct, using MODBUS RTU:



Building Management System (BMS) connecting directly to water heaters using MODBUS RTU twisted pair wire. (Wiring is RS-485 physical layer.)

BMS to heaters using a PVI Protocol Gateway:



Building Management System (BMS) connecting to a PVI gateway. This can provide interface to BACNET MSTP, BACNET IP, and MODBUS TCP.
(Wiring from gateway to heaters is RS-485 physical layer. Wiring from BMS to gateway will be RS-485 for BACNET MSTP, and Ethernet for BACNET IP or MODBUS TCP)

BMS to heaters 3rd party GATEWAY to provide other Protocols not offered by PVI:

A 3rd party Gateway that will interface with PVI equipment using MODBUS RTU. This gateway will then provide the required protocol for interface. This requires customer integration, and the MODBUS RTU information contained in this manual.

(Return to GETTING STARTED)

THE CONTROLS USED ON HEATERS

TempTrac

XR10CX

This manual references both controls, be sure you are following instructions for the control you are working with. Above are images to help identify what type of control you have.
Details of the controls can be found at:

TempTrac Details and specs for the TempTrac control
TempTrac Used on:
Quick Draw products
Cobrex and EZ Plate storage heaters
Turbo Power Heaters
MAXIM
Custom heaters
Electric heaters
Legacy products
Older Conquest heaters (Legacy)
MAXIM 3 (Legacy)
Tricon, Power VT, Power VT Plus (Legacy)
TurboPower 99 (Legacy)
Primera, Centauri, Centauri Plus L, VT3, and M3 boilers (Legacy)

XR10CX Details and specs for the XR10XC control
XR10CX Used on:
Quickdraw Semi-Instantaneous
Cobrex Instantaneous
EZ Plate Instantaneous
Platinum (Legacy)
Custom

(Return to GETTING STARTED)

Set MODBUS Address:

The MODBUS address must be set to a unique number on the RS-485 MOBUS RTU network run. The MODBUS RTU standards support address numbers in the range of 1-247. Typically the first heater (nearest) will be Address #1, and the next Address #2, … Both the TempTrac and XR10XC ship with the MODBUS address set to #1. If you are installing only one heater, then you do not need to set this address. With multiple heaters, you will need to set all but heater #1.

Setting the TempTrac MODBUS address:

Disable Interference:
Editing parameters should be done without any device trying to communicate through the MODBUS port. To avoid interference from a gateway or BMS, you should unplug the MODBUS adapter at the white header on the back of the TempTrac. When finished updating the MODBUS address, be sure to reconnect the MODBUS Adapter.

Select a MODBUS address
Typically nearest or first in wiring will be MODBUS address #1, and going up by one for each heater. The default for TempTrac is Address #1. You can assign any number in the range of 1-247, and each control must have a unique address.
The MODBUS address is the **Adr** parameter, and it is in the **Pr2** menu

Enter Programming Mode
Enter the Programming mode by pressing the **SET** and **DOWN** key for more than 3 seconds. (Lead with the **SET** key.)

Enter Hidden Menu Pr2
Pressing the **DOWN** key, parameter name will display in top, and value in bottom.
Select **Pr2** / **PAS** (parameter / value), and press the **SET** key.
The lower display will show the value **0 - -** with a flashing zero.
Use **UP** or **DOWN** keys to input the security code in the flashing digit; confirm each digit by pressing **SET**. The security code is **321**.
After hitting **SET** on the last digit, you will be in the **Pr2** hidden menu.

Select and Edit the "Adr" Parameter:
Once you have entered the **Pr2** menu press the **DOWN** key to move through the parameters until the **Adr** parameter appears on the top display. Each control on a RS-485 network must have a unique MODBUS address.

Now press the **SET** key once and the value number will begin to blink. Use the arrow key to set the address and then hit the **SET** key.

Finished, Exit:
After hitting the **SET**, it will automatically go to the next parameter. Let it time out, or cycle power to the TempTrac.

With the power off, plug the adapter back in to the MODBUS port.
(Return to GETTING STARTED)

SETTING XR10CX MODBUS ADDRESS:

Disable Interference:
Editing parameters should be done without any device trying to communicate through the MODBUS port. To avoid interference from a gateway or BMS, you should unplug the MODBUS adapter port on the back of the XR10CX at the white header, while making changes to the XR10CX parameters.

Select MODBUS Address to be Assigned:
The first step to interfacing with a XR10CX or group of XR10CXs will be the assignment of the address number for each heater. The MODBUS Address need to be configured if you are interfacing direct with MODBUS RTU, and also if you are using the PROTOCOL GATEWAY for BACNET MSTP or BACNET IP. The default for XR10CX is Address #1. You can assign any number in the range of 1-247, and each control must have a unique address. This is the limitations of the MODBUS RTU standard.
The MODBUS address is the **Adr** parameter, and it is in the **Pr2** menu.

Enter Programming Mode:
Press the **SET** and **DOWN** key for more than 3 seconds. The **C** or **F** will start blinking. Release the buttons. You have entered the first menu level.

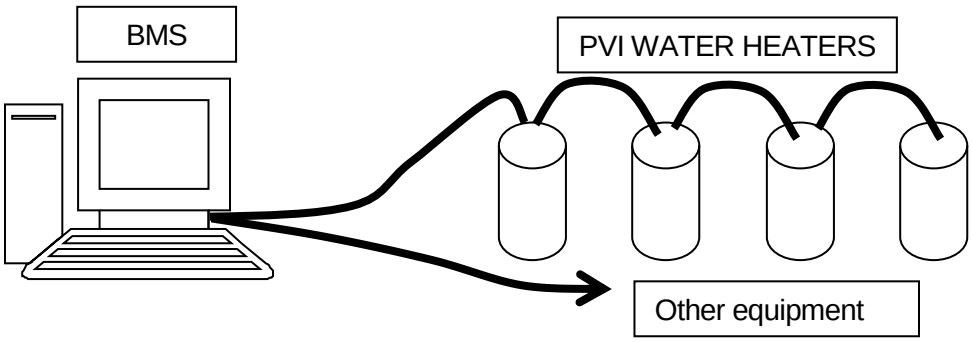
Enter HIDDEN MENU Pr2:
Press **SET** and **DOWN** key again, this time for more than 7 seconds. The **Pr2** label will be displayed briefly followed directly with the HY parameter. You are now in the HIDDEN MENU (**Pr2**).

Select and Edit the "Adr" Parameter:
Pressing the **DOWN** key, parameters names will display. Continue until **Adr** is displayed. Press the **SET** button and change the displayed value to the desired MODBUS address using the **UP** and **DOWN** keys. Use the **SET** button again to store the value.
Each control on a RS-485 network must have a unique MODBUS address.

Finished, Exit:
After hitting the **SET**, it will automatically go to the next parameter. Let it time out, or cycle power to the XR10CX.

With the power off, plug the adapter back in to the MODBUS port.
(Return to GETTING STARTED)

WIREING, MODBUS RTU INTERFACE CONNECTION, NO GATEWAY



Items Required for MODBUS RTU Direct Interface:

One or more water heaters with a TempTrac or XR10CX control
Adapter for each control w/cable PN 106623 or kit with manual PN 138710

PV7266.PDF Interface manual that covers specifics for interfacing with the XR10CX or TempTrac system. Also includes the points list for the TempTrac & XR10CX control system. (This document).

Wiring of Heater Control To BMS (Direct, no Gateway):

The back side of the XR10CX or TempTrac has a white header with an 8 inch cable, connecting to an orange adapter module with 2 green terminals labeled (+) & (-). This is the RS-485 MODBUS connection point.

Field connection for BMS	Heater #1 Orange adapter	Heater #2 Orange adapter	Heater #... Orange adapter	Testing VDC	Results for proper hookup
RS 485 +	(+)	(+)	(+)	Positive lead	+ 0.100 To + 5.500
RS R85 -	(-)	(-)	(-)	Negative lead	
GND					

Ensure the proper polarity, check with a Digital Voltmeter set to Volts DC. Take a reading at the orange adapter from the (-) Terminal to the (+) Terminal. The (+) should be the positive lead when connected.
(Return to GETTING STARTED)

PROTONODE GATEWAY, MOUNTING AND WIRING POWER

Location to Mount ProtoNode:

The ProtoNode ships as a lose items and is intended to be mounted separate from the heater. Mounting locations can vary from site to site. Typical locations are the control contractor's cabinet, it its own enclosure, and inside the heater's control panel.

Proper Power Supply

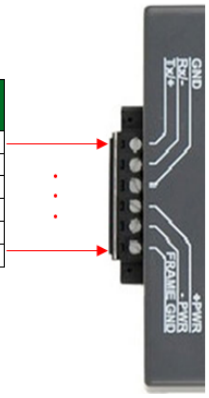
PVI provides 15VDC wall wart style power supply that is factory wired to the ProtoNode. No wiring is required to connect the power adapter to the ProtoNode Gateway. This is done to help prevent the use of other power sources. It is highly recommended to use this power supply as the power source for the ProtoNode Gateway. Do not power other devices with this power supply. If power adapter has not

already been connected or is being replaced, cut and discard the connector on the end, strip and terminate the power adapter in the proper terminals. Use a multimeter to determine polarity.

Alternative Power Adapters:

At times it is needed to provide alternate power to a ProtoNode Gateway, in this event, the power supply must be isolated from other equipment. Do not run it from the 24VAC transformer on the heater or in control contractor's cabinet, as both will have other equipment running of the same power.
The ProtoNode is rated for 9-30VDC or 12-24VAC at 2.5 Watts. This must be isolated power

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



On the 6-position connector:
#4(+PWR) +VDC or AC
#5(-PWR) -VDC or AC
#6(FRAME GND) Frame ground to be connected to the enclosure the ProtoNode is mounted in / on
For additional information on this port, see: ProtoNode S1 Port

Power to the power supply

The adapter that comes with the ProtoNode has a 2 prong 120VAC plug (NEMA 1-15P) and will need (NEMA 1-15R or 5-15R) receptacle for 120VAC 1/ph. power to operate it.

Connecting to Line Power:

As it is setup for a 120VAC socket, it may be necessary to obtain a female cable end (NEMA 1-15R or 5-15R) to adapt this power supply to line power from terminals. This is available at any local hardware store.

Using power from a Heater Appliance:

If a separate power service is not available, it may be desirable to use the power service present at one of the heaters to for the power adapter. As the power adapter is very low power, it is possible to operate it from the 120VAC supplied to one of the heaters.

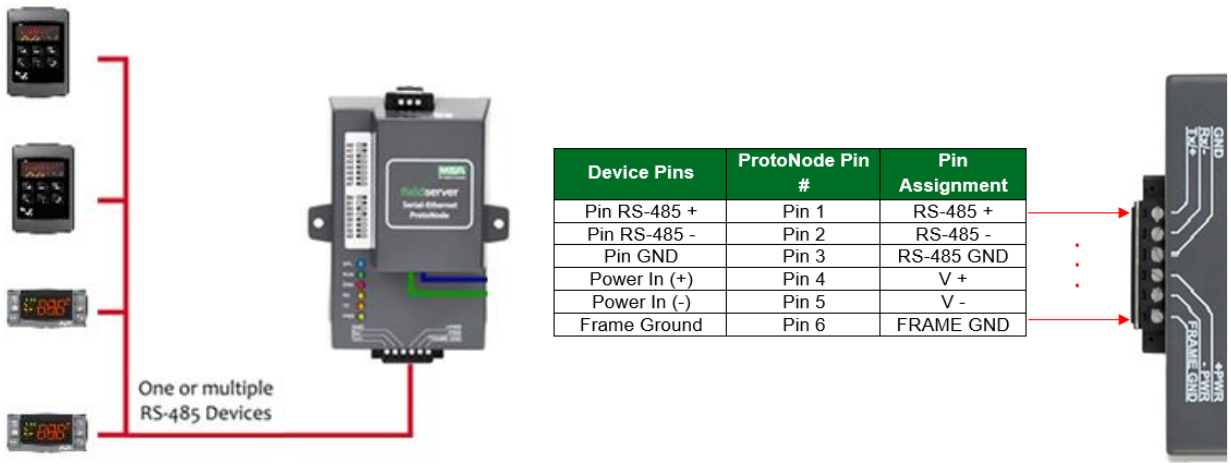
(Return to GETTING STARTED)

WIRING GATEWAY TO HEATERS

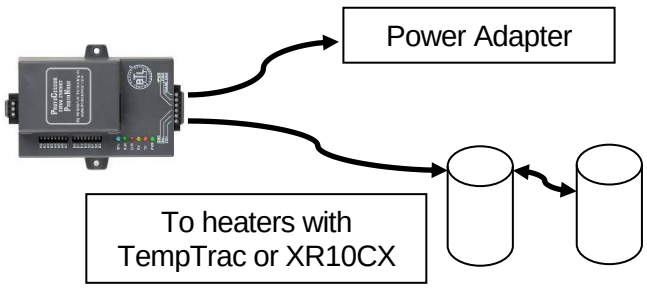
Wiring from Gateway to the heaters, use twisted pair wire.
Wires will be run from the ProtoNode Gateway 6 pin connector to the first MODBUS ADAPTER (+/-) and from that MODBUS Adapter wires will be run to the next MODBUS Adapter, and so on until the daisy chain is complete.

The wiring is standard 2 wire RS-485 wiring. You will connect all devices together in a daisy chain. We recommend the gateway to be at the start of this connection.

Gateway 6 Pos. terminal		Heater #1 Orange adapter		Heater #2 Orange adapter		Heater #... Orange adapter
Tx/+		(+)		(+)		(+)
Rx/-		(-)		(-)		(-)
GND						



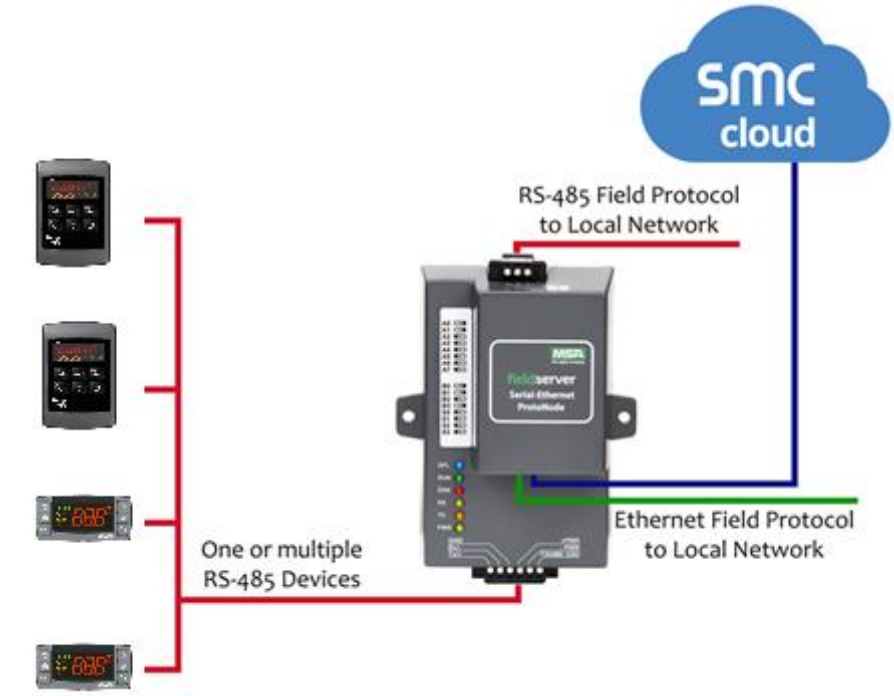
For details of this port on the ProtoNode Gateway see the ProtoNode S1 Port section. This will show the optional biasing jumpers and the optional termination resistor jumper.



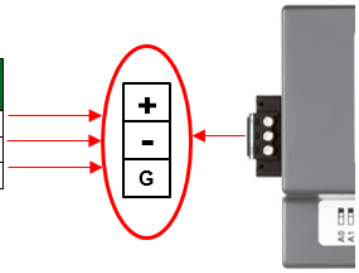
Connection of ProtoNode will be from the 6 pin connector pins 2/3 to the +/1 on the MODBUS adapter
(Return to GETTING STARTED)

WIRING GATEWAY TO BACNET MSTP NETWORK

Connection of the 3 position RS-485 connector to the Building automation system.



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

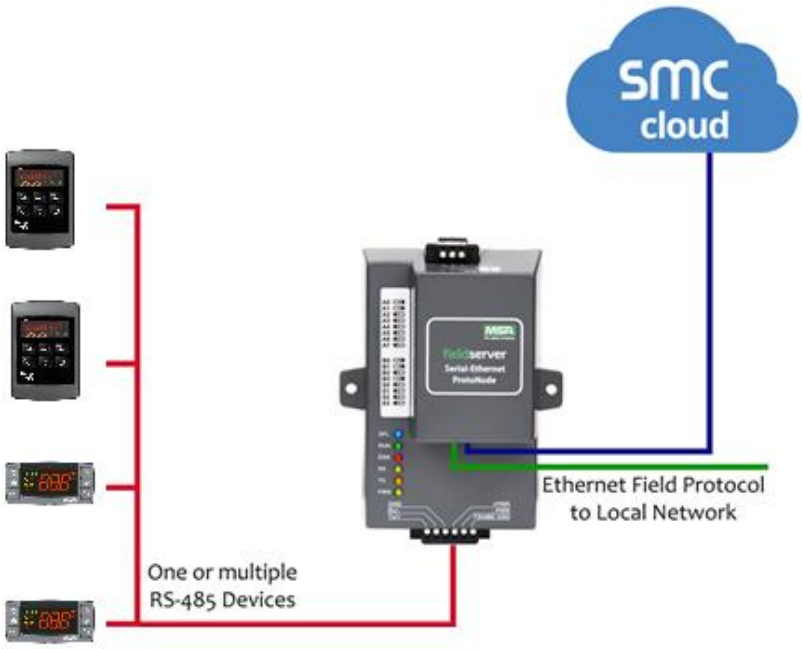


The ProtoNode should Be wired to the BMS systems RS-485 network. Ensure the proper polarity of the wires. The Ground terminal is a signal ground and should only be sued with a signal ground is available. Do not connect the signal ground to chassis ground, power ground of shielding of the RS-485.
The PVI gateway default has the biasing jumpers enabled for the PVI heater connection port, biasing resistors are disabled for the BMS port. The termination resistors are disabled on both ports. Changing the bias or termination on the BMS port should only be done at the request of the control's integrator. The PVI heater port settings should not be changed.

For details of this port on the ProtoNode Gateway see the ProtoNode R1 Port section. This will show the optional biasing dip switch and the optional termination resistor dip switch.
(Return to GETTING STARTED)

WIRING PROTONODE TO BACNET IP NETWORK:

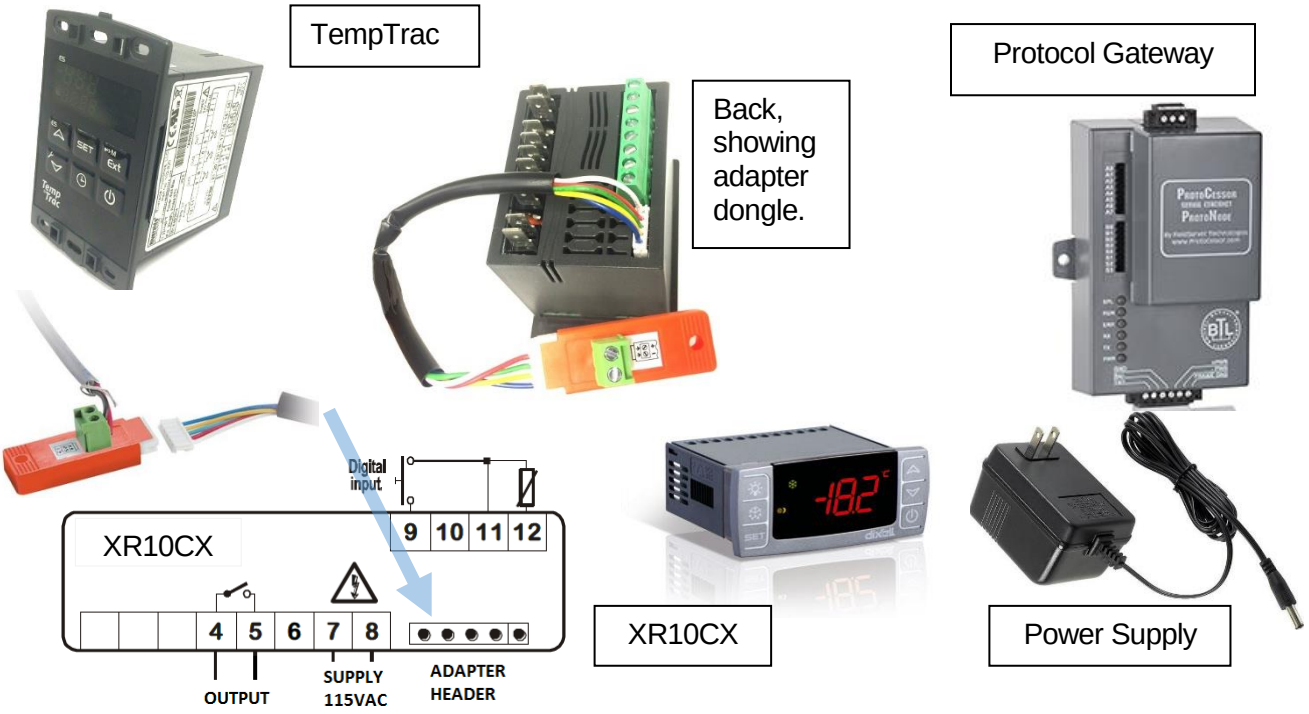
BACNET IP uses a ethernet cable and connects to the RJ-45 ETHERNET port on the ProtoNode. This is the same port that is used for configuration of the ProtoNode via the HTML interface and also the same that uses the advanced security features to connect to the secure server at FieldServer.



Once configuration is complete, and the interface method is BACNET IP, the connection of the BACNET IP network will be at the Ethernet port of the ProtoNode Gateway.

(Return to GETTING STARTED)

IDENTIFY EQUIPMENT ON HEATER WITH TEMPTRAC or XR10CX:



TempTrac Control:
TempTrac is mounted on the control panel of the heater. On the back side of the TempTrac is a white header for the MODBUS Adapter. TempTrac Details.

XR10CX Control:
XR10CX is mounted on the control panel of the heater. On the back side of the XR10CX is a white header for the MODBUS Adapter. XR10XC Details.

MODBUS Adapter:
The optional RS-485 MODBUS Adapter comes an 8-inch cable. The orange adapter has 2 green terminals labeled (+) & (-).

ProtoNode Gateway:
The optional Protocol Gateway kit comes with a power supply and this manual, the kit ships as a separate line item. ProtoNode Gateway Details.

Power Supply:
PVI pre-wires the power supply to the ProtoNode gateway. This is done to help prevent field connection of the gateway to the any 24VAC transformer on the heater, or the control contractor's 24VAC transformer. The supplied isolated power supplied should be used, if for any reason it cannot be used, then a suitable isolated power supply or transformer should be used that is not supplying power to any other piece of equipment.

The equipment should have a TempTrac or XR10CX controller mounted on the control panel. The RS-485 adapter may be installed or may be ordered separate. When a PVI gateway is purchased, it is a separate line item and may not ship with the heater. Please be aware that the gateway kit with power supply is not installed on a heater and must be installed in the field. The Protocol Gateway is a grey module that has a wall wart style power supply.

(Return to GETTING STARTED)

Building Management Connection:

BMS protocol		Connection Port on Gateway		Labeled
BACNET MSTP		3 TERMINAL CONNECTOR		FIELD
BACNET IP		ETHERNET PORT		ETHERNET
MODBUS TCP		ETHERNET PORT		ETHERNET

REVIEW ALL WIRING WHEN USING PROTONODE GATEWAY:

At this point, each heater and the gateway should all be powered, and have all wiring finished. The RUN LED will toggle every second to indicate the gateway is running.

- Control at each heater powers up
- Control at each heater has been given a unique MODBUS Address
- Heaters have orange dongle adapter with 2 green screw terminals labeled (+ / -)
- Wiring from orange dongle is going to each heater in a daisy chain, with ProtoNode as the starting point of daisy chain
- On the RS-485 MODBUS wiring from gateway 6 pin connector to all the heaters, ensure no other devices are connected to this run of wiring.
- If the RS-485 wiring has a shield:
    - Ensure each daisy chain connection, the shields are connected from each segment, but not connecting to any terminal, ground, or chassis.
    - Only one point should the shield be grounded, and this is to the chassis at the ProtoNode, such as the chassis ground of the enclosure the ProtoNode is mounted in.
    - The ground terminal of the ProtoNode 6 pin connector is for the power supply only
    - If the cable has a shield the shield is not to be implemented, then trim it back at each connection point to avoid any accidental shorting, and leave shield unconnected
- If the heater side RS-485 run is more than 2500 feet, then enable the termination jumper on the ProtoNode, and add a termination resistor at the last heater's (+ / -) terminals
- Power Supply to ProtoNode should have 120VAC power.
- Confirm the use of the power supply that came with the ProtoNode. 15VDC Wall Wart style power supply.
    - Although the ProtoNode can operate from a wide variety of power, it needs to be electrically isolated, and not share the secondary side of the power supply with any other devices
- For BACNET IP & MODBUS TCP, the Building Management System (BMS) connects to the Ethernet Port
- For BACNET MSTP the Building Management System (BMS) Connects to the 3 pin screw connector
- Wiring at this point belongs to the controls contractor, so the following is recommendations:
    - Ensure connection to the + / - terminals. Ground terminal on the 3-pin connector is for signal ground only and typically not used. This is **NOT** to be tied to the shield
    - Ensure all devices on the RS-485 trunk are set to the same baud rate

- If wiring needs termination resistors, then they must be enabled in 2 locations, both ends of the wiring run
- If the Trunk card has BIASING capability, it should be enabled to help with reliable consistent communication
- Only one device on a RS-485 run should have BIASING resistors enabled
- If a shield implemented on the communication RS-485 twisted pair, it must be tied to chassis ground at only the trunk card (start of the daisy chain)
- If termination resistors are implemented, they are at or before the first device in daisy chain and at or after last device in daisy chain

PREP FOR CONFIGURING PROTONODE GATEWAY

Information needed from Controls Contractor:

Protocol Type. BACNET MSTP, BACNET IP, or MODBUS TCP
(This manual does not cover MODBUS TCP interface)

For BACNET MSTP

Device Instance Number: One number for each heater to be interface, in sequential order
Max Master: Typically, 127
MAC address Default is 3, (1-127)
Network Number: if more than 1 heater is connected to the ProtoNode

For BACNET IP

Device Instance Number: One number for each heater to be interface, in sequential order
Device IP address

For BACNET MSTP Single Node Profile

This is a special profile for integrators that have issues with the virtual device feature of the ProtoNode. It takes all the attached heaters and make them look like one big heater with a set of points for each heater.
Device Instance Number: Just one number requires

BACNET Router option:

Converts BACNET MSTP to BACNET IP. Not covered in this manual

MODBUS TCP option

Converts the MODBUS RTU to MODBUT TCP. Not covered in this manual
(Return to GETTING STARTED)

CONFIGURE PROTONODE GATEWAY DIP SWITCHES:

The ON position is toward the center of the module, and OFF is toward the edge of the module. Only the BACNET gateway requires dip switch settings. The BACNET gateway is used for MODBUS TPC also.

DIP SWITCHES S0-3 PROTOCOL

The gateway protocol is determined on power up by looking at the "S" dip switches.
If the protocol is changed, the configuration/profiles must be cleared and reconfigured. Use the HTML interface to clear and set the configuration/profiles.

Select the Protocol:

BACNET IP
uses the Ethernet port for BACNET

BACNET MSTP
User 3 pin RS-485 port, multiple instance numbers

MODBUS TCP (Not covered in this manual)
Converts MODBUS RTU to MODBUS TCP

BACNET ROUTER: (Not used with TempTrac or XR10CX)
Converts BACNET MSTP to BACNET IP. This mode of operation is not covered in this manual. This will convert any BACNET MSTP to BACNET IP

SINGLE NODE BACNET MSTP:
Shows all heaters connected as one BACNET Device, only one instance number. This is used when the BMS is not capable of recognizing virtual device feature used in the BACNET MSTP protocol. Only for multiple heaters.

Protocol	S0	S1	S2	S3
BACNET IP	OFF	OFF	OFF	OFF
BACNET MSTP	ON	OFF	OFF	OFF
MODBUS TCP	OFF	ON	OFF	OFF
BACNET ROUTER	ON	ON	OFF	OFF
SN BACNET MSTP	OFF	OFF	ON	OFF

(Return to GETTING STARTED)

DIP SWITCHES B0-4 BAUD FOR BMS 3 PIN CONNECTOR

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
Configures the BAUD rate for the BMS interface. This is for the 3 pin connector. The default BAUD rate is 38400.
The Controls Contractor / Building / Facility must supply the required BACNET MSTP BAUD rate.

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

(Return to GETTING STARTED)

A0-7 (BACNET MSTP) MAC ADDRESS:

Default is MAC address 3. Configure the MAC address for the BACNET Gateway by summing the "A" dip switches that are ON.
MAC address range: 1 – 127
The Controls Contractor / Building / Facility must supply the required MAC ADDRESS.
A7 is reserved and should remain OFF.

1	2	4	8	16	32	64		<-sum for address	
A0	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**Address**	
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0	Invalid
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1	
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2	
ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	3 *	Default
OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	4	
ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	5	
OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	6	
ON	ON	ON	OFF	OFF	OFF	OFF	OFF	7	
OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	8	
ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	9	
OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	10	
…	…	…	…	…	…	…	…	…	
ON	ON	ON	ON	ON	ON	ON	OFF	127	

Examples:

Address	SUM of #	Switches
20:	16 + 4	A4,2=ON
30:	16 + 8 + 4 + 2	A4,3,2,1=ON
32	32	A5=ON

Address:	SUM of #	Switches
100:	64 + 32 + 4	A6,5,2=ON
101:	64 + 32 + 4 + 1	A6,5,2,0=ON
104:	64 + 32 + 8	A6,5,3=ON

(Return to GETTING STARTED)

CONFIGURE PROTONODE USING HTML INTERFACE:

Connecting to ProtoNode for Configuration.

Depending on how the controls contractor has his network setup, he may configure the ProtoNode gateway over the same Ethernet cabling as the BACNET IP network, or he may unplug the BACNET IP network and connected directly to the ProtoNode for configuration.

Ethernet Port

Configure your computer to be on the same network as the ProtoNode Gateway. If the IP Address has not been changed on the ProtoNode Gateway, then the gateway is on IP Address 192.168.1.24 with subnet mask 255.255.255.0.

An example of a computer on the same network would be at address 192.168.1.11 with Subnet Mask 255.255.255.0. In this example any final number between 0-255 are valid other than the ProtoNode's address of 24.

Changing the computer's IP address is outside the scope of this manual. If you need help with this, please consult your local IT department.

(Return to GETTING STARTED)

SELECT SECURITY METHOD FOR INTERFACE

The security section of this is meant to protect the PROTONODE form hacking attacks via the Ethernet port. If the Protonode is going to be on a BACNET MSTP network and will not have a Ethernet connection, then the security features are not needed, so the use of HTTP is acceptable.

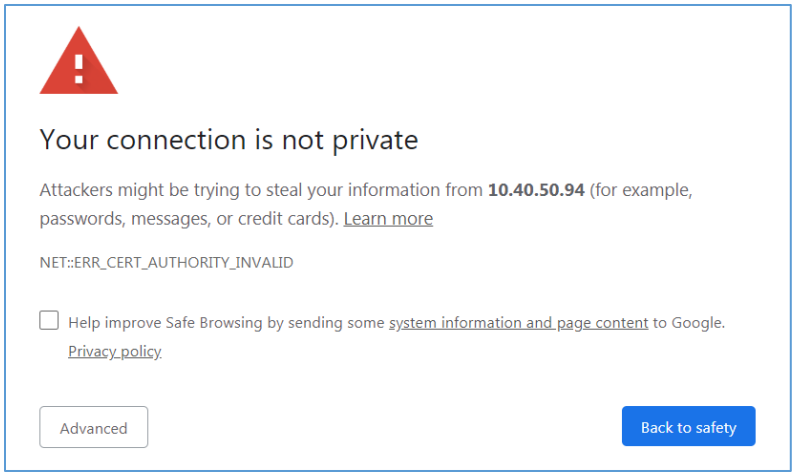
Setup Web Server Security

Navigate to the IP Address of the ProtoNode on the local PC by opening a web browser and entering the IP Address of the ProtoNode; the default Ethernet address is 192.168.1.24.
NOTE: If the IP Address of the ProtoNode has been changed, the assigned IP Address can be discovered using the FS Toolbox utility. See Section 8.1 for instructions.

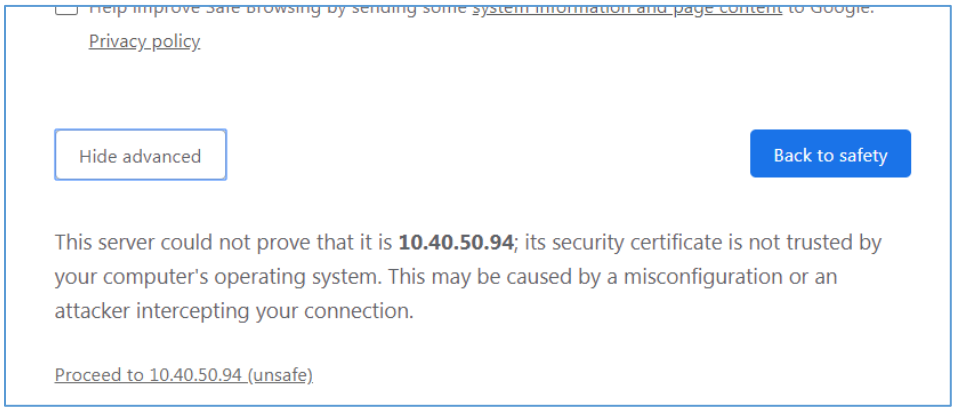
Login to the FieldServer

The first time the FieldServer GUI is opened in a browser, the IP Address for the gateway will appear as untrusted. This will cause the following pop-up windows to appear.
When the Web Server Security Unconfigured window appears, read the text and choose whether to move forward with HTTPS or HTTP.

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



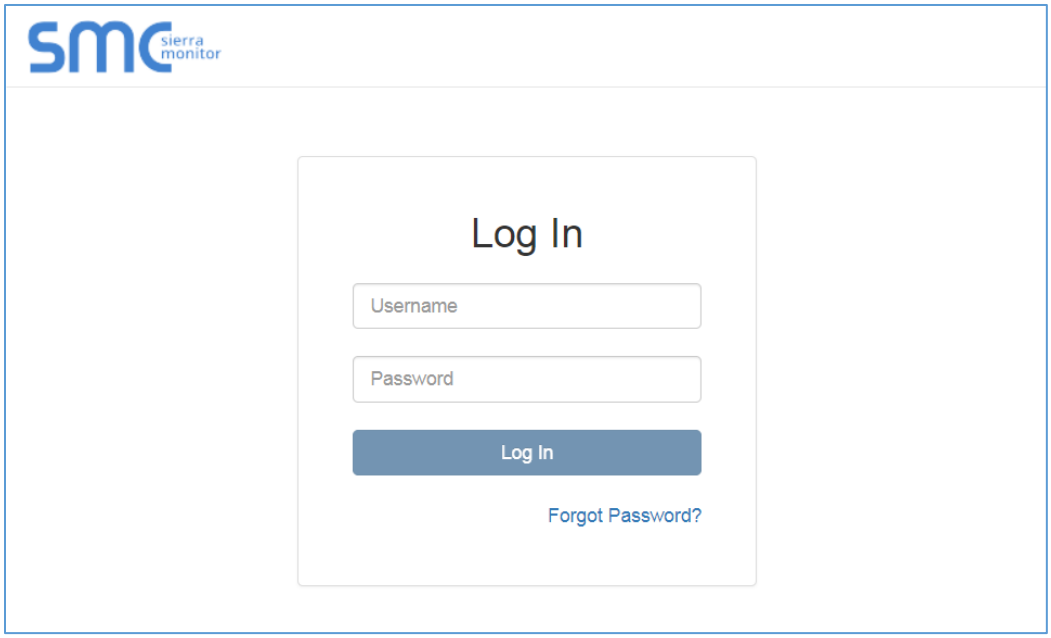
Additional text will expand below the warning, click the underlined text to go to the IP Address. In the below example this text is “Proceed to 10.40.50.94 (unsafe)”.



Finding the user name and password

When the login screen appears, put in the Username (default is “admin”) and the Password (found on the label of the FieldServer)
NOTE: There is also a QR code in the top right corner of the FieldServer label that shows the default unique password when scanned. Also, if you take the cover off of the ProtoNode, there is a label on the Ethernet port with the password on it.

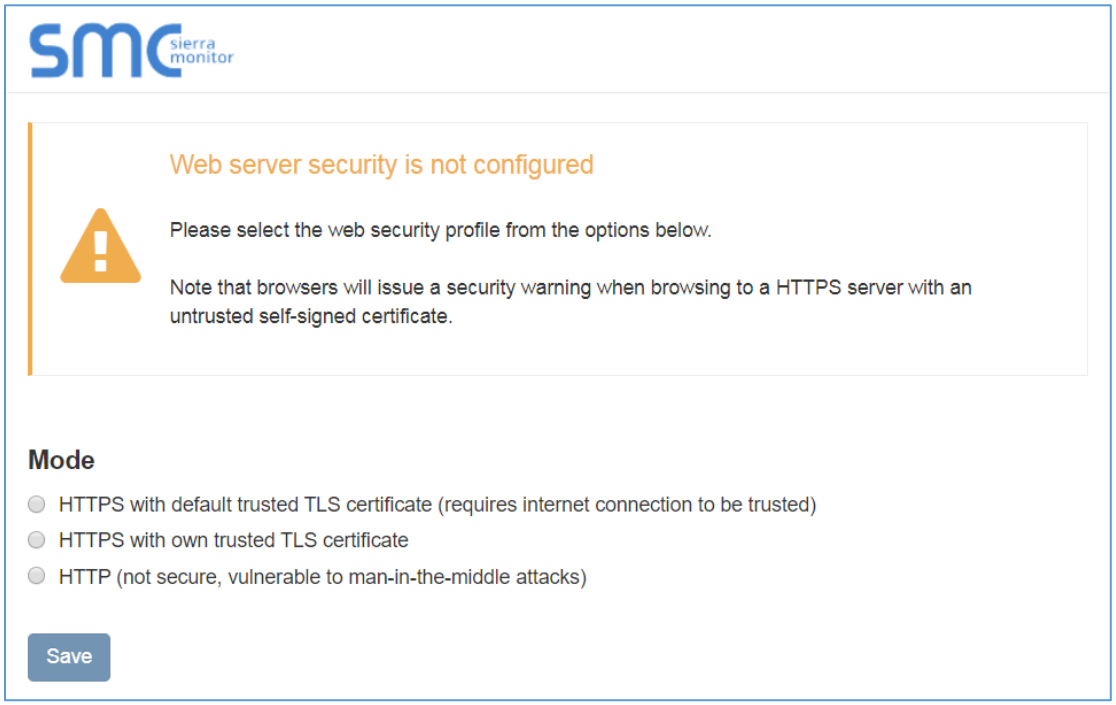
Do not call PVI or FieldServer to obtain the password, as we do not have it.



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

Select the Security Mode

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



NOTE: Cookies are used for authentication.

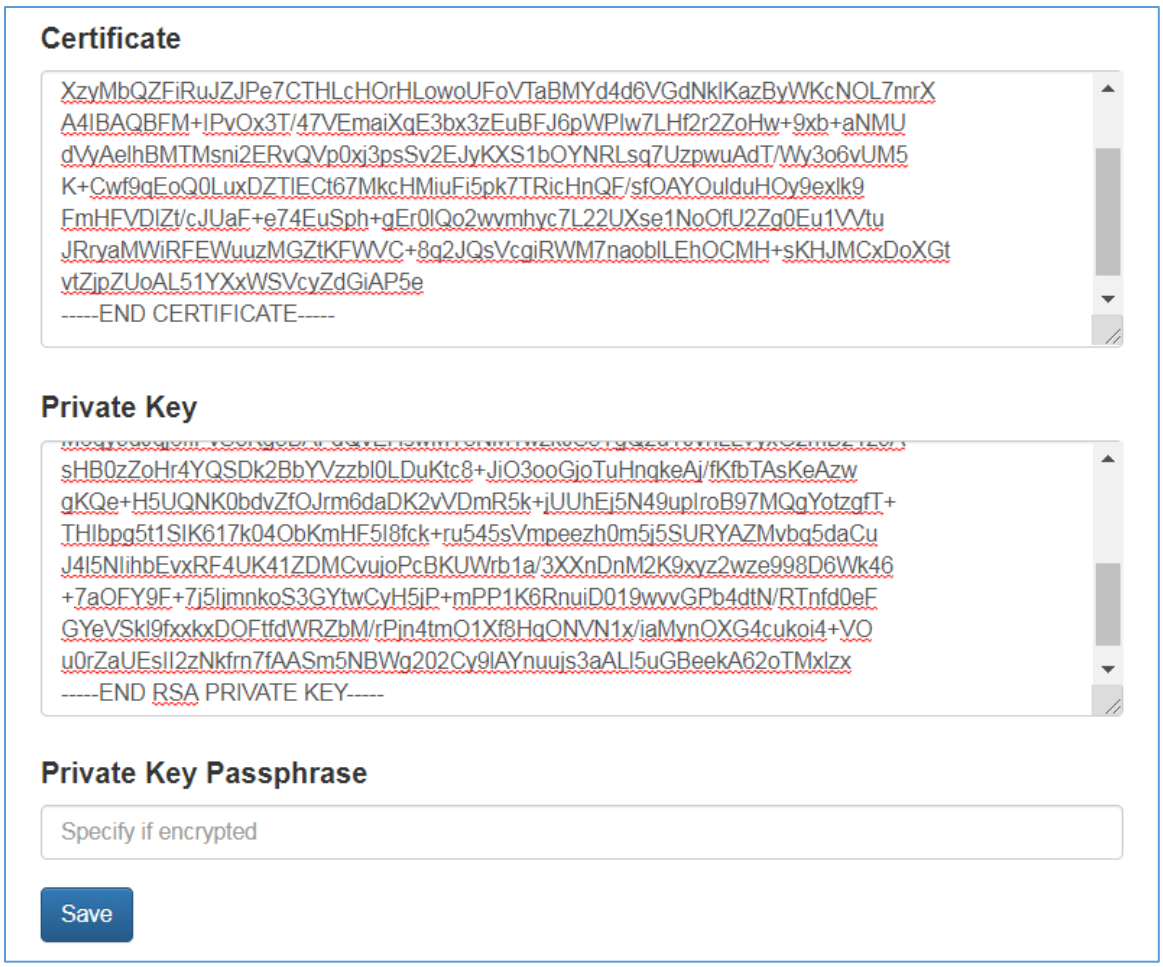
NOTE: To change the web server security mode after initial setup, go to Diagnostics > Setup > Security

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

HTTPS with Own Trusted TLS Certificate

This is the recommended selection and the most secure. Please contact your IT department to find out if you can obtain a TLS certificate from your company before proceeding with the Own Trusted TLS Certificate option.

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



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

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

Select one of these options and click the Save button.
A “Redirecting” message will appear. After a short time, the FieldServer GUI will open
(Return to GETTING STARTED)

CONFIGURE THE GATEWAY USING THE HTML INTERFACE:

Ethernet Port

Connect a Cat-5 Ethernet cable (straight through or cross-over) between the local PC and ProtoNode
Default IP address is 192.168.1.24. Subnet Mask is 255.255.255.0

This section will provide the parameters required for the TempTrac or XR10CX control. Connect your computer's Ethernet port to the Ethernet port of the gateway. Using a web browser, browse to the gateway at IP address: **192.168.1.24** default (If you have changed the IP address, go to the appropriate address.).
If the device IP address has been changed and is not known, a utility is available from Feildserver.com. Contact FieldServer for more information.

Menu options vary depending the S Dipswitch settings for the ProtoNode Gateway. This manual will cover 3 settings BACNET IP, BACNET MSTP, SINGLE NODE BACNET MSTP Select the proper menus below for the settings selected by the dipswitches. The bold items are the typical items that must be changed. After each change, select the submit button to the right of the parameter.

Menu BACNET IP: S0-3 = OFF

BACnet Network Number:	50	(1 – 65535)
BACnet Node Offset:	50000	(0 – 4194303)
BACnet IP Port:	47808	(1 – 65535)
BACnet COV:	COV_Disable	(COV_Disable / COV_Enable)
BACnet BBMD:	-	("-" / BBMD)
BACnet Virtual Server Nodes:	No	(No / Yes) No for only 1 heater, Yes for multiple heaters

Menu BACNET MSPT: S0 = ON, S1-3 = OFF

BACnet Network Number:	50	(1 – 65535)
BACnet Node Offset:	5000	(0 – 4194303)
BACnet MSTP Max Master:	127	(1-127)
BACnet COV:	COV_Disable	(COV_Disable / COV_Enable)
BACnet Virtual Server Nodes:	No	(No / Yes) No for only 1 heater, Yes for multiple heaters

Menu BACNET MSTP (SINGLE NODE): S2 = ON, S0,S1,S3 = OFF

BACnet Node Offset:	50000	(0 – 4194303)
BACnet MSTP Max Master:	127	(1-127)
BACnet COV:	COV_Disable	(COV_Disable / COV_Enable)

Other Protocol Configurations:

This manual does not cover the BACNET MSTP to BACNET IP ROUTER protocol setting or the MODBUS TCP

GATEWAY PARAMETER OPTIONS DETAILS:

BACnet Network Number: (BACNET IP and BACNET MSTP)

This sets the BACnet network number of the Gateway. This setting needs to be unique and should not match the network number of the BACnet front end

Only used when more than 1 heater is connected to the ProtoNode Gateway for BACNET MSTP or BACNET IP. This is not present for the SINGLE NODE BACNET MSTP protocol. Must get a unique Network Number from the Controls Contractor. This cannot be the same as other BACnet network number, any other ProtoNode Gateway Network Number, or the BACNET MSTP trunk card network number.

BACnet Node Offset: (BACNET IP and BACNET MSTP)

This is used to set the BACnet device instance. The device instance will be sum of the MODBUS device address and the node offset

BACnet Node Offset number will be added to the NODE # assigned for each heater, creating a DEVICE INSTANCE NUMBER for each heater attached. Example: If we have 3 heaters set to Node 1, 2, 3, and BACnet Node Offset is 50000, then the heaters will have Device Instance Numbers 50001, 50002, 50003 respectively. Controls Contractor must supply the desired Device Instance Numbers, and they should be sequential.

BACnet Node Offset: (SINGLE NODE BACNET MSTP)

This is used to set the BACnet device instance. The device instance will be sum of the A-bank dipswitches and the node offset.

the BACnet Node Offset number will be added to the MAC ADDRESS derived from the (A0-A6) DIP Switches. Example: If we have 3 heaters set to Node 1, 2, 3, BACnet Node Offset is 50000, and MAC ADDRESS of 30, then the ProtoNode will have DEVICE INSTANCE NUMBER OF 50030 and all the heaters will have points listed under this one device.

BACnet IP Port: (BACNET IP)

This sets the BACnet IP port of the Gateway. The default is 47808

Advanced option. Only change if Controls Contractor request it to be changed.

BACnet COV: (All BACNET)

This enables or disables COVs for the BACnet connection. Use COV_Enable to enable. Use COV_Disable to disable.

Advanced option. Do not change from default COV_Disable. Only change if Controls Contractor request it to be changed.

BACnet BBMD: (BACNET IP)

This enables BBMD on the BACnet IP connection. Use BBMD to enable. Use - to disable. The bdt.ini files also needs to be downloaded.

Advance option. Do not change from default "-". Only change if Controls Contractor request it to be changed.

MSTP Max Master: (BACnet MSTP and SINGLE NODE BACnet MSTP)

This sets the BACnet MSTP max master (1 - 127)

Advance option. Do not change from default of 127. Only change if Controls Contractor request it to be changed.

BACnet Virtual Server Nodes: (Only on BACnet MSTP)

Set to NO if the unit is only converting 1 device to BACnet. Set to YES if the unit is converting multiple devices.

This allows the ProtoNode Gateway to look like multiple heaters. If only one heater is connected to the ProtoNode Gateway, set this to NO. If more than one heater is connected to the ProtoNode Gateway, this must be set to YES.

If the Building Management System has issues seeing multiple devices on one ProtoNode Gateway, we created an alternate method, see the settings for SINGLE NODE BACnet MSTP.

(Return to GETTING STARTED)

ADD THE DEVICE PROFILES:

Once all the above parameters have been set, and the SUBMIT button has been pressed for each, next add each Heater Control.

Press the **ADD** button, under **Node ID** enter the MODBUS address of the first heater. Typically, you will have the nearest heater setup as MODBUS address 1, and the next heater MODBUS address 2. All heaters ship from factory with MODBUS Address set to 1. Each heater must have a unique MODBUS address. (See section **Setup heater MODBUS address for the respective control**)

Under **Current profile**, select the proper interface for the TempTrac or XR10CX control.

If the control is a TempTrac, you must select the profile for how the TempTrac is configured.

TempTrac Configured to Display Degrees Fahrenheit

If the TempTrac is configured to display degrees F, then chose the respective profile for the protocol. This profile will have some points that have conversions to degrees C, but keep in mind this is a conversion, and this profile if only for TempTrac controls that are configured to display Degrees Fahrenheit.

BAC_MSTP Temptrac Deg F	(for BACnet MSTP)
BAC_IP Temptrac Deg F	(For BACnet IP)

TempTrac Configured to Display Degrees Celsius with Format 000.0

If the TempTrac is configured to display degrees C with a decimal point, then chose the respective profile.

BAC_MSTP Temptrac Deg C	(For BACnet MSTP)
BAC_IP Temptrac Deg C	(For BACnet IP)

TempTrac Configured to Display Degrees Celsius with Format 000.

If the TempTrac is configured to display degrees C without a decimal point, then you cannot use the gateway, as a profile has not been created for this configuration.

This is a configuration setup that PVI does not implement and discourages anyone from implementing it.

XR10CX Configured to Display Degrees Fahrenheit

If the XR10CX is configured to display degrees F, then choose the respective profile based on the protocol. Both This profile will have some points that have conversions to degrees C, but keep in mind this is a conversion, and this profile if only for TempTrac controls that are configured to display Degrees Fahrenheit.

BAC_MSTP XR10CX	(for BACnet MSTP)
BAC_IP XR10CX	(For BACnet IP)

XR10CX Configured to Display Degrees Celsius

If the XR10CX is configured to display degrees C, you cannot use the gateway, as this profile has been developed. PVI has not XR10CX controls configured for degrees Celsius at this time. To obtain degrees

C for a Building Management System, the points are available with the Degrees F Profile, but the XR10CX Control will still display degrees F

Press the **Submit** button.
Add additional devices as required.
After adding all devices, restart the gateway by clicking the **SYSTEM RESTART** button.

Gateway Node Limitations:

One ProtoNode Gateway can support up to 12 heaters of TempTrac or XR10CX control type.
You can have all nodes as one control type or a combination of both controls types on one ProtoNode gateway.
(Return to GETTING STARTED)

CONFIRM OPERATION OF PROTONODE GATEWAY:

Heater Communication:

Communication between gateway and heaters is evident by rapid flashing of the TX and RX LEDs on the gateway.
If only the TX is flashing (may be as slow as 30 seconds between flashes), that will indicate no response from the heaters.
If the Blue SPL LED is on, this indicates that not all the configured devices are responding

Building Management System Communication:

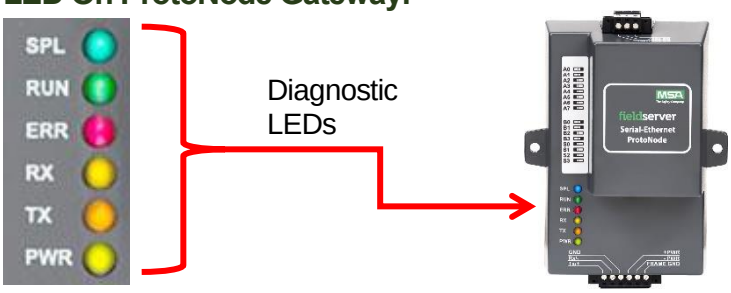
Using the HTML interface, you can confirm some operations and under USER MESSAGES, confirm there are no errors messages. At this point, the BMS will need to discover the gateway and implement the points into its integration.

BACNET MSTP communication, is visible via the HTML interface and there are TX and RX LEDs inside the PROTONODE CASE. See the PROTONODE DETAILS section

(Return to GETTING STARTED)

TROUBLESHOOTING GATEWAY:

LED On ProtoNode Gateway:



- SPL (BLUE)
  - The SPL LED will light if the unit is not getting a response from one or more of the configured devices.
- RUN (GREEN)
  - The RUN LED will start flashing 20 seconds after power, indicating normal operation
  - 1 second on, 1 second off
- ERR (RED)
  - Steady state on, Gateway is reporting an error. 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
- PWR LED not on
  - Confirm power on +PWR and –PWR
- TX & RX not flashing
  - Confirm connections to heaters and MODBUS addressing
  - Confirm gateway has been configured, and heater profiles have been loaded
- TX flashing, RX not flashing
  - Gateway is talking to TempTrac, but not getting response from TempTrac. Confirm wiring and polarity.
  - Ensure the BIAS resistors are enabled (Jumpers) See ProtoNode Port S1 for details

Verify polarity of all connections:

Set a Digital Volt Meter to read DC Volts. (Capable of reading less than 1.0VDC)

Pos. (red) Probe	Neg. (black) Probe	Min	Max	Actual Reading
Gateway 6 pin terminal block				
+PWR	-PWR	+9.0VDC	+30VDC	
Tx/+	Rx/-	+0.1VDC	+5.5VDC	
Gateway 3 pin terminal block (BACNET MSTP only)				
RS 485 +	RS 485 -	+0.1VDC	+5.5VDC	
TempTrac or XR10CX orange dongle (Each heater)				
(+)	(-)	+0.1VDC	+5.5VDC	
(+)	(-)	+0.1VDC	+5.5VDC	
(+)	(-)	+0.1VDC	+5.5VDC	
(+)	(-)	+0.1VDC	+5.5VDC	
(+)	(-)	+0.1VDC	+5.5VDC	

The use of Termination resistors will pull the voltage reading to very low levels.

The use of BIAS resistors will pull the voltages to high levels

The heater's wiring should have no termination resistors and the ProtoNode should have the BIAS resistors enabled. This should result in readings in the upper half of the MIN / MAX range. Termination resistors on the MODBUS RTU side are not required, as the speed is low (9600 BAUD) and the distance is typically minor, as must installs have all the heaters in one room.

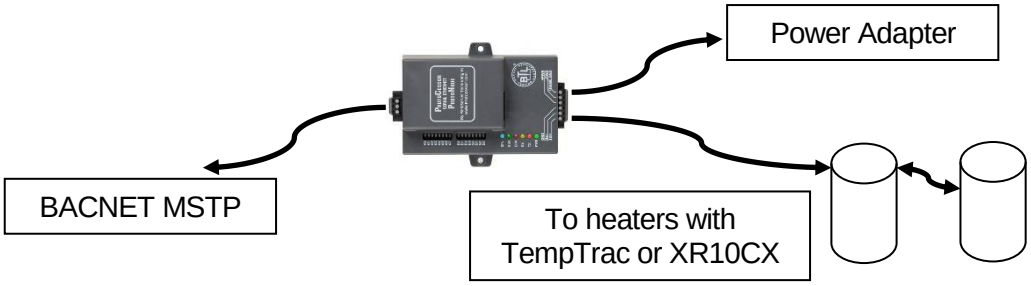
The BACNET MSTP run of RS-485, it not under our control. It may or may not have termination resistors. The ProtoNode had the ability of enable Termination resistor and it also have a switch to enable BIAS resistors. Please note that only one device on a RS-485 network should have BIAS resistors enabled.

(Return to GETTING STARTED)

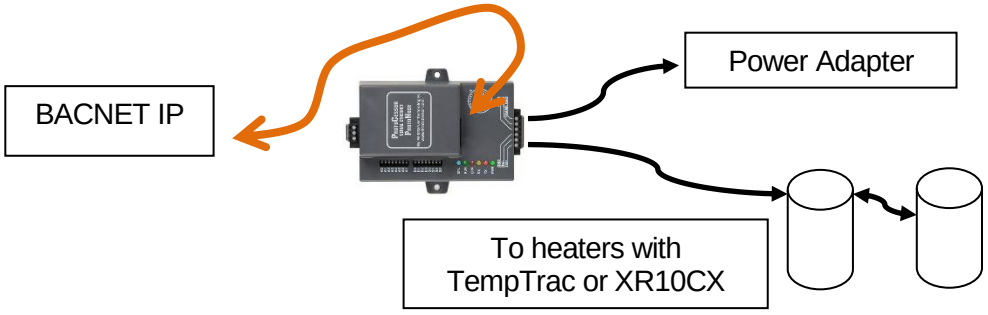
HOOKUP OVERVIEW:

High level connection diagram for each wiring configuration supported in this document.

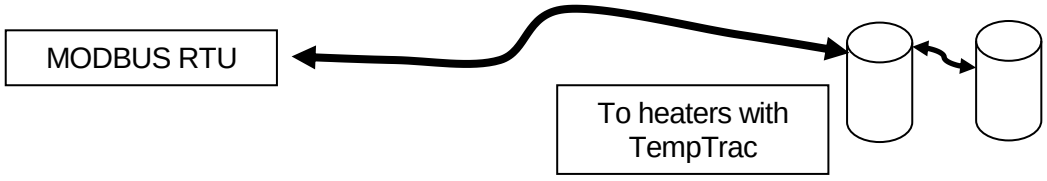
BACNET MSTP



BACNET IP



MODBUS RTU Direct Connect



(Return to GETTING STARTED)

APPLICATION SPECIFIC:

Each product that uses the TempTrac or XR10CX control may have subtle differences. The following products address the important information for that general product line.
(Return to GETTING STARTED)

Quickdraw Steam to Water Instantaneous / storage (TempTrac Control)

Probe 1: Lower Sensor
Probe 2: Upper Sensor
Burner_Relay1: Heating, control valve energized
Reference wiring diagram for more details. Options vary on this product.
Control_CNT: Enable Disable:
Setpoint: Setpoint_St1
Burner Runtime: Heating ON time in hours
Burner_Relay1: Heating
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL3: Alarm on any failure, if alarm option provided. Comes on after 3 minutes of alarm relay being energized
Alarm_LA: Low temperature alarm
Alarm_HA: High temperature alarm
Alarm_P1: Probe 1 error
Alarm_P2: Probe 2 error

Discrete connections

External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option REMEQ.
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. This is an option
Alarm: A terminal has 120VAC in reference to L2 when in Alarm state.
(Return to GETTING STARTED)

Quickdraw Water to Water Storage non-modulating (TempTrac Control)

Probe 1: Lower Sensor (Controlling sensor)
Probe 2: Upper Sensor
Relay1: Control valve and/or Pump depending on piping/options
Reference wiring diagram for more details. Options vary on this product.
Control_CNT: Enable Disable:
Setpoint: Setpoint_St1
Burner Runtime: Heating ON time in hours
Burner_Relay1: Heating
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL3: Alarm on any failure, if alarm option provided. Comes on after 3 minutes of alarm relay being energized

Alarm_LA: Low temperature alarm
Alarm_HA: High temperature alarm
Alarm_P1: Probe 1 error
Alarm_P2: Probe 2 error

Discrete connections

External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option REMEQ.
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. This is an option PKG #3
Alarm: A terminal has 120VAC in reference to L2 when in Alarm state
(Return to GETTING STARTED)

Cobrex Steam to Water storage (TempTrac Control)

Probe 1: Lower Sensor (Controls heat engine, not good to monitor, wide swings)
Probe 2: Upper Sensor (Outlet water Temperature, BAS should use this)
Burner_Relay1: Heating, Open condensate solenoid and start pump.
Reference wiring diagram for more details. This is OUTPUT #1 on the TempTrac. It is Terminals 4/5. When this drops out, the solenoid closes, and the pump runs for 30 seconds (Delay off relay) before turning off.
Control_CNT: Enable Disable: Can be used to enable or disable the heater.
Setpoint: Setpoint_St1 (uses Probe 1)
Burner Runtime: Heating ON time in hours
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL3: Alarm on any failure, if alarm option provided. Comes on after 3 minutes of alarm relay being energized.
Alarm_LA: Low temperature alarm (Only if configured in TempTrac)
Alarm_HA: High temperature alarm (Only if configured in TempTrac)
Alarm_P1: Probe 1 error (wiring is open or shorted, this will stop heater from heating)
Alarm_P2: Probe 2 error (wiring is open or shorted, this will not stop heater from heating)

Discrete connections

External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. This is an option
(Return to GETTING STARTED)

EZ Plate Storage (TempTrac Control)

Probe 1: Lower Sensor (Controlling sensor)
Probe 2: Upper Sensor
Probe 3: Not used
Relay1: Control valve and/or Pump depending on piping/options
Reference wiring diagram for more details. Options vary on this product.
Control_CNT: Enable Disable:
Setpoint: Setpoint_St1

Burner Runtime: This is the number of hours for the output #1. On a EZ Plate, this will be the cumulative run time of the pump
Burner_Relay1: This is actually the status of output 1. On a EZ Plate, this is the signal to heat. This output drives the pump, and if purchased, the Boiler Water Valve.
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL3: Alarm on Any Failure. On EZ Plate with the Alarm option that will be true for any of the following: LWCO, Temperature limiting device. This has a 3 min delay, so you will not see the alarm until after the condition has been true for 3 min, and a need for heat is present.**Alarm_LA**: Low temperature alarm
Alarm_HA: High temperature alarm
Alarm_P1: Probe 1 error
Alarm_P2: Probe 2 error

Discrete connections

External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option REMEQ.
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. No delay
AUX: E1-E2 Auxiliary Equipment. Dry contact. This can be used to drive a boiler valve, or boiler zone pump. It is made up when the potable water pump is energized.
(Return to GETTING STARTED)

Older Conquest 100 and 130 gallon : (TempTrac Control)

Model Numbers: 20 L 100A-GCL, 25 L 100A-GCL, 30 L 100A-GCL, 40 L 130A-GCL
Probe 1: Is in the top of the tank, and controls the burner
Probe 2: Is in the mid-section and controls the agitator pump using **Relay3**
Probe 3: Is in the flue
Burner_Relay1: Burner
Relay2: Alarm dry contact
Relay3: Agitator pump
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL2: Alarm on any failure

Discrete connections:

External Enable: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. This is a low current, low voltage contact. It is advised to use a contact with gold plating. If not available, use 2 contacts in parallel.
Alarm: A1 & A2 (Output from Heater) Closed = ALARM.
Remote Proving: C1 & C2. Ships with factory jumper. Open will prevent burner from operating. Keeping this open will create a lockout condition that will require user intervention.
Remote Equipment / Burner ON: Contact that will close P1 – P2 during a heating cycle. Open, the heater is not calling for heat.
No Setpoint Input: There is not a discreet method to send a setpoint signal to the Conquest.
(Return to GETTING STARTED)

Older Conquest 130 Gallon (500 – 800): (TempTrac Control)

Model Numbers: 50 L 130A-GCML, 60 L 130A-GCML, 70 L 130A-GCML, 80 L 130A-GCML
Same as the above Conquest with the addition of modulation.
Modulation Rate: Modulation rate, Low fire = 0, High Fire = 100

Discrete connections:

Same as the smaller Conquest with the following notes:
No Modulation Input: There is not discreet way for a building management system to control the modulation (firing rate) of the Conquest.
(Return to GETTING STARTED)

Centauri Boiler, Centauri Plus Boiler, VT3 Boiler: (TempTrac Control)

Model Numbers: All Centauri, Centauri Plus and VT3 Boilers
Probe 1: This temperature is displayed in yellow in the lower section of the display. With SSBCO option, this probe is located in the top of the boiler. Without this option, the probe is shipped uninstalled and should be installed in the BHWR piping to read the temperature of the water entering the boiler.
Probe 2: This temperature is displayed in red in the upper section of the display. With SSBCO option, this probe is shipped uninstalled and is intended to be installed in the field in the boiler's HWR piping. Without the SSBCO option, this probe is installed in the top of the boiler providing the outlet water temperature.
Probe 3: Is an Auxiliary probe that can be used for outdoor temperature or other temperature readings. This is optional and not standard.
Burner_Relay1: Burner
Relay2: Not used
Relay3: Isolation Valve control when the OnTrac boiler management system is controlling.
Modulation Rate: Modulation rate, Low fire = 0, High Fire = 100
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL3: Alarm on any failure

Discrete connections:

Ext Enable: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. (Recommend relay at boiler, min 10A at 24VAC.)
Remote Equipment: P1 & P2, this is a contact that is driven any time a call for heat is present. Note this is only provided if the Remote Equipment or Louver options are present.
Alarm: A1 & A2 provide a 3 min alarm signal that is present after a failure to ignite burner for 4 minutes. This output will be active for 3 minute and then the communication alarm will become active dropping the call for heat and dropping this signal. It is possible to get this alarm and the alarm condition that caused this alarm can be corrected before the 3 minutes, removing the alarm and not having a lockout or alarm condition over communication. (3 min signal of alarm condition and potential lockout.)
(Return to GETTING STARTED)

M3 Boiler (TempTrac Control)

Probe 1: Is in the top of the tank, and controls the burner. Provides outlet temperature.
Probe 2: Is wired but lose and field installed in the boiler HWR piping.
Probe 3: Is in the flue.
Burner_Relay1: Burner
Relay2: Alarm dry contact, goes to terminals A1 & A2.
Relay3: Isolation Valve control, used with OnTrac group control. Terminals labeled CIRCULATOR 1 & 2.
Modulation Rate: Modulation rate, Low fire = 0, High Fire = 100.
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL2: Alarm on any failure.

Discrete connections:

External Enable: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. This is a low current, low voltage contact. It is advised to use a contact with gold plating. If not available, use 2 contacts in parallel.
Alarm: A1 & A2 (Output from Heater) Closed = ALARM.
Remote Proving: C1 & C2. Ships with factory jumper. Open will prevent burner from operating. Keeping this open will create a lockout condition that will require user intervention.
Remote Equipment / Burner ON: Contact that will close P1 – P2 during a heating cycle. Open, the heater is not calling for heat.
No Setpoint Input: There is not a discreet method to send a setpoint signal to the M3 boiler.
No Modulation Input: There is not discreet way for a building management system to control the modulation (firing rate) of the Conquest.
(Return to GETTING STARTED)

Quickdraw Steam to Water Storage (TempTrac Control)

Probe 1: Lower Sensor
Probe 2: Upper Sensor
Relay1: Control valve
Reference wiring diagram for more details. Options vary greatly on this product.
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Discrete connections:

External Enable: Terminals
Remote Equipment / Heating: E1 & E2 terminals are closed when heating, and open when not. This is an option REMEQ.

Alarms

Alarm: A1 & A2 terminals are closed when in Alarm. This is an option REMAL.
(Return to GETTING STARTED)

Quickdraw Steam to Water Instantaneous (TempTrac Control)

Probe 1: Lower Sensor
Probe 2: Upper Sensor

Relay1: Control valve
Reference wiring diagram for more details. Options may vary on this product.
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Discrete connections:

External Enable: Terminals
Remote Equipment / Heating: E1 & E2 terminals are closed when heating, and open when not. This is an option REMEQ.

Alarms

Alarm: A1 & A2 terminals are closed when in Alarm. This is an option REMAL.
(Return to GETTING STARTED)

EZ PLATE STORAGE (TempTrac Control)

Control_CNT
Can be used to turn on and off the TempTrac control. Not used often for water haters
Setpoint_St1 is the Setpoint of the heater
Probe 1: Is the controlling probe, in the mid tank section. Not a good point for building management, as it will have a lot of fluctuation
Probe 2: Is the probe in the top of the tank, this is the exiting water temperature. Best for a BMS to monitor.
Probe 3: NOT USED. I will not list all other NOT USED points
Burner Runtime: This is the number of hours for the output #1. On a EZ Plate, this will be the cumulative run time of the pump
Burner_Relay1: This is actually the status of output 1. On a EZ Plate, this is the signal to heat. This output drives the pump, and if purchased, the Boiler Water Valve.
Relay2: (In Advanced section) Only used for dual HX models. This is Pump #2 output

Alarms

Alarm_AL3:
Alarm on Any Failure. On EZ Plate with the Alarm option that will be true for any of the following: LWCO, Temperature limiting device. This has a 3 min delay, so you will not see the alarm until after the condition has been true for 3 min, and a need for heat is present.
Com_Status: This is a special point actually located in the gateway. See documentation.
Some jobs that work with zones and not differential pressure on the boiler supply and return, like a single pipe configuration, they can use the boiler water valve signal to drive a zone pump to push boiler water through the EZ PLATE

Discrete connections:

R1-R2: Enable / Disable. Remove jumper to disable heater
A1-A2: Alarm out, dry contact. No delay.
E1-E2: Auxiliary Equipment. Dry contact. This can be used to drive a boiler valve, or boiler zone pump. It is made up when the Potable water pump is energized.
(Return to GETTING STARTED)

EZ Plate Instantaneous (XR10CX Control)

This controls is for monitoring temperature only, the output is not connected to anything.
Probe Temperature: Exiting water temperature
Alarm: The digital input for the alarm is active (Terminal #9 of XR10CX). See wiring diagram for details

Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.
Setpoint: Not used
Output: Not used

Discrete connections:

Remote ON/OFF: See wiring diagram

Alarms

A1 terminal has 120VAC when in ALARM.
C2 terminal has 120VAC when heating
(Return to GETTING STARTED)

Cobrex Steam to Water Storage (TempTrac Control)

Probe 1: Lower Sensor (Controls heat engine, not good to monitor, wide swings)
Probe 2: Upper Sensor (Outlet water Temperature, BMS should use this)
Burner_Relay1: Heating, Open condensate solenoid and start pump.
Reference wiring diagram for more details. This is OUTPUT #1 on the TempTrac. It is Terminals 4/5. When this drops out, the solenoid closes, and the pump runs for 30 seconds (Delay off relay) before turning off.
Control_CNT: Enable Disable: Can be used to enable or disable the heater.
Setpoint: Setpoint_St1 (uses Probe 1)
Burner Runtime: Heating ON time in hours
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.

Alarms

Alarm_AL3: Alarm on any failure, if alarm option provided. Comes on after 3 minutes of alarm relay being energized.
Alarm_LA: Low temperature alarm (Only if configured in TempTrac)
Alarm_HA: High temperature alarm (Only if configured in TempTrac)
Alarm_P1: Probe 1 error (wiring is open or shorted, this will stop heater from heating)
Alarm_P2: Probe 2 error (wiring is open or shorted, this will not stop heater from heating)

Discrete connections

External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. This is an option
(Return to GETTING STARTED)

Cpbrex Instantaneous (XR10CX Control)

This controls is for monitoring temperature only, the output is not connected to anything.
Probe Temperature: Exiting water temperature
Alarm: Not implemented yet. For future. If contact connects terminal 11 to 9, The digital input for the alarm is active
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.
Setpoint: Not used

Output: Not used
Discrete connections:
External Enable: See wiring diagram, remove power to disable
External Equipment: See wiring diagram
(Return to GETTING STARTED)

Quickdraw Steam to Water Instantaneous / storage

Probe 1: Lower Sensor
Probe 2: Upper Sensor
Burner_Relay1: Heating, control valve energized
Reference wiring diagram for more details. Options vary on this product.
Control_CNT: Enable Disable:
Setpoint: Setpoint_St1
Burner Runtime: Heating ON time in hours
Burner_Relay1: Heating
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.
Alarms
Alarm_AL3: Alarm on any failure, if alarm option provided. Comes on after 3 minutes of alarm relay being energized
Alarm_LA: Low temperature alarm
Alarm_HA: High temperature alarm
Alarm_P1: Probe 1 error
Alarm_P2: Probe 2 error
Discrete connections
External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option REMEQ.
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. This is an option
Alarm: A terminal has 120VAC in reference to L2 when in Alarm state.
(Return to GETTING STARTED)

Quickdraw Water to Water Storage non-modulating

Probe 1: Lower Sensor (Controlling sensor)
Probe 2: Upper Sensor
Relay1: Control valve and/or Pump depending on piping/options
Reference wiring diagram for more details. Options vary on this product.
Control_CNT: Enable Disable:
Setpoint: Setpoint_St1
Burner Runtime: Heating ON time in hours
Burner_Relay1: Heating
Com_Status: This is a special point actually located in the gateway. If 1, the gateway is communicating with the heater, if 0 then the gateway is not able to reach the heater and all heater values are suspect. See documentation.
Alarms
Alarm_AL3: Alarm on any failure, if alarm option provided. Comes on after 3 minutes of alarm relay being energized

Alarm_LA: Low temperature alarm
Alarm_HA: High temperature alarm
Alarm_P1: Probe 1 error
Alarm_P2: Probe 2 error

Discrete connections

External Enable: Terminals R1 & R2, Remove jumper and use dry contact
Remote Equipment / Heating: E1 & E2 dry contact terminals are closed when heating, and open when not. This is an option REMEQ.
Heating: R2 terminal has 120VAC in reference to L2 on control Can be used to drive a relay coil
Alarm: A1 & A2 dry contact terminals are closed when in Alarm. This is an option PKG #3
Alarm: A terminal has 120VAC in reference to L2 when in Alarm state
(Return to GETTING STARTED)

Other Equipment and Equipment Custom features:

Reference supplied wiring diagram and the I & O Manual. Contact PVI for additional information.
Below is a list of other products that can use the TempTrac controller:

Other heaters not detailed:

See wiring diagram for each heater that does not have details defined above.
TURBOPOWER 99 (TempTrac Control)
TURBOPOWER (TempTrac Control)
POWER VT PLUS (TempTrac Control)
TRICON (TempTrac Control)
MAXIM (TempTrac Control)
MAXIM LOW NOX (TempTrac Control)
MAXIM 3 (TempTrac Control)
DURAWATT (With TTRAC option) (TempTrac Control)
MAXIM (With TTRAC option) (TempTrac Control)
QUICKDRAW SEMI-INSTANT (XR10CX)
CSX (XR10CX)
(Return to GETTING STARTED)

POINTS LIST FOR TEMPTRAC:

The gateway will provide a full points list, including typical points and advanced points. Normal interface will only require the TYPICAL POINTS. Many points are provided as ADVANCED POINTS and not advised to be used in normal integration. The Advanced Points are present for future development and custom applications. Please consult factory if any points not in the TYPICAL POINTS are required.

Key:

(#) represent the device. MODBUS address with ":" to designate single bit usage of register. Number following colon represents bit location, 0 is the least significant bit.

Point Name	Read/Write	Short Description	
MODBUS	Register Type	Address Offset	MODBUS Address
BACNET	BACNET Name	Object Instance	BACNET Units
NOTES			

TYPICAL POINTS FOR TEMPTRAC:

The points that are typically used to interface with the heater. Most integrations only require points from this list.

(Return to GETTING STARTED)

TYPICAL POINTS TempTrac:

Control_CNT	Write	Enable Heater 257=on 1 = off	
MODBUS	Holding Register	1280	41281
BACNET	Enable	128100	
This can be used to prevent the heater from heating via communication. 257 or 0X0101 = on, 1 or 0x0000 = off The resister cannot be read. The register should only be written to with the values 257 and 1, as it has other undocumented functions.			

Setpoint_St1	Read/Write	System Setpoint	
MODBUS	Holding Register	768	40769
BACNET	Setpoint_St1	76900	Deg-F
This is the setpoint for the heater.			

Probe 1	Read Only	Controlling Probe Degrees F	
MODBUS	Holding Register	256	40257
BACNET	Probe1	25700	Deg-F
Probe that provides control of heating. Location can vary depending on equipment and application. See section that discussed the various equipment to determine actual location of probe. Connection on TempTrac is green screw terminals 14 and common 17.			

TYPICAL POINTS TempTrac:

Probe 2	Read Only	Probe 2 in degrees F	
MODBUS	Holding Register	258	40259
BACNET	Probe2	25900	Deg-F
Optional probe on some devices, usually installed on most devices. If installed and enabled, returns the temperature of the probe in degrees F. Connection on TempTrac is green screw terminals 15 and common 17.			

Probe 3	Read Only	Probe 3 in degrees F	
MODBUS	Holding Register	260	40261
BACNET	Probe3	26100	Deg-F
Optional probe on some devices, not usually installed on most devices. If installed and enabled, returns the temperature of the probe in degrees F. Connection on TempTrac is green screw terminals 16 and common 17.			

Burner Runtime	Read/Write	Burner Runtime Hours 0-65535	
MODBUS	Holding Register	848	40849
BACNET	BURNER_HOURS_ou1	84900	Hours
NOTE: Number of hours the burner has been enabled. Once it reaches 9999. This can be written to, as a way to reset it.			

Modulation Rate	Read Only	Monitor the modulation signal	
MODBUS	Holding Register	262	40263
BACNET	Modulation_FR	26300	
Modulation rate on the analog output 4-20ma is represented as 0-100. This feature was introduced in Firmware 0.5 (5) and is not available from older TempTrac modules already in the field.			

Burner_Relay1	Read Only	Status of burner, Relay1 (Output 1)	
MODBUS	Holding Register	2049	42050:0
BACNET	Burner_Relay1	205050	
This is Bit 0 of the Relay status word. It is the relay that controls the main heating output. Typically the Burner Status. BACNET has this broke out into state logic points. MODBUS, you will have to break it out yourself. Read value, BITWISE AND with 0x0001, if result = 0, relay is off. If result = 1, relay is on.			

Alarm_AL2	Read Only	Status of digital input #2 Alarm	
MODBUS	Holding Register	3328	43329:11
BACNET	Alarm_AL2	332961	
Digital Input #2 alarm. On some products, this is a general failure to operate alarm. See product specific information. This is Bit 11 of the ALARM STATUS ALL word. Flashes 'AL2' or 'LP' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0800 = 0x0800 Alarm is active. = 0x0000 Alarm is not active.			

TYPICAL POINTS TempTrac:

Alarm_AL3	Read Only	Status of digital input #3 Alarm	
MODBUS	Holding Register	3328	43329:12
BACNET	Alarm_AL3	332962	
Digital Input #3 alarm. On some products, this is a general failure to operate alarm. See product specific information. This is Bit 12 of the ALARM STATUS ALL word. Flashes 'AL3' or 'HP' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x1000 = 0x1000 Alarm is active. = 0x0000 Alarm is not active.			

Com Status	Read Only	Communication Status bit	
MODBUS	Input Register	NA	NA
BACNET	Gateway_TT_Com_OK	200	
NOTE: This point is not generated by the heater; it is generated internally by the gateway. It is a status of the communication connection between the gateway and the heater. If active (GOOD), the gateway is talking to the heater. If inactive (NOT_PRESENT) then the gateway does not have good communication with the heater. This point may take up to 3 minutes to register properly after communication is established or interrupted. If this value if reading NOT_PRESENT, then no all over values are suspect, as the device is not communicating. Generally the Gateway will hold the last value received. The only way to ensure you have the current values from the heater is to verify this point is ACTIVE as well.			

(Return to GETTING STARTED)

ALL POINTS INCLUDING ADVANCED FOR TEMPTRAC:

Points listed below that are not in the TYPICAL POINTS are provided for advanced interface and for custom applications. Contact factory for additional information.

(Return to GETTING STARTED)

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Control_CNT	Write	Enable Heater 257=on 1 = off	
MODBUS	Holding Register	1280	41281
BACNET	Enable	128100	
This can be used to prevent the heater from heating via communication. 257 or 0X0101 = on, 1 or 0x0000 = off The resister cannot be read. The register should only be written to with the values 257 and 1, as it has other undocumented functions.			

Setpoint_St1	Read/Write	System Setpoint	
MODBUS	Holding Register	768	40769
BACNET	Setpoint_St1	76900	Deg-F
This is the setpoint for the heater.			

Setpoint_St1 C	Read/Write	System Setpoint	
MODBUS			
BACNET	Setpoint_St1_C	76900	Deg-C
Special BACNET point that converts the Setpoint value to degrees C in the gateway. Not available in MODBUS.			

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Hy1	Read	Setpoint Differential	
MODBUS	Holding Register	772	40773
BACNET	Hy1	77300	delta-degrees-Fahrenheit
Differential. (if Hy1 is negative) The heater will begin heating when Probe #1 must fall this far below St1 setpoint, and stay on until the heater reaches St1 setpoint. (If Hy1 is positive) The heater will come on when Probe #1 falls to or below St1 setpoint, and will not turn off until it has reached this far above St1 Setpoint. BACNET, with MODBUS there is no protection from changing this value.			

St4	Read Only	Modulation Start	
MODBUS	Holding Register	792	40793
BACNET	St4	79300	No Units
Starting point of modulation. Related to the St1 setpoint. If Probe 1 is above St1 + St4, then Modulation signal will be low fire. If Probe 1 falls below (St1 + St4) then the analog output signal will modulate based on the setting in the SR register. This is set to No Units in BACNET because it can relative to St1 or is can be independent value. Typically it is configured as relative to St1. BACNET has this point is configured as a read only, with MODBUS, there is no protection from changing this value.			

SR	Read	Modulation bandwidth	
MODBUS	Holding Register	793	40794
BACNET	SR	79400	delta-degrees-Fahrenheit
Normally this is a negative number. Number of degrees of change in Probe 1 that will modulate from 0 to 100%. St1 + St4 = low fire, St1 + St4 + SR = High Fire. Temperatures above low fire will be low fire, temperatures below high fire will be high fire. In-between, the output will modulate from 4-20mA (0-100%) BACNET has this point is configured as a read only, with MODBUS, there is no protection from changing this value.			

Probe 1	Read Only	Controlling Probe Degrees F	
MODBUS	Holding Register	256	40257
BACNET	Probe1	25700	Deg-F
Probe that provides control of heating. Location can vary depending on equipment and application. See section that discussed the various equipment to determine actual location of probe. Connection on TempTrac is green screw terminals 14 and common 17.			

Probe 2	Read Only	Probe 2 in degrees F	
MODBUS	Holding Register	258	40259
BACNET	Probe2	25900	Deg-F
Optional probe on some devices, usually installed on most devices. If installed and enabled, returns the temperature of the probe in degrees F. Connection on TempTrac is green screw terminals 15 and common 17.			

Probe 3	Read Only	Probe 3 in degrees F	
MODBUS	Holding Register	260	40261
BACNET	Probe3	26100	Deg-F
Optional probe on some devices, not usually installed on most devices. If installed and enabled, returns the temperature of the probe in degrees F. Connection on TempTrac is green screw terminals 16 and common 17.			

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Probe 1 C	Read Only	Controlling Probe Degrees C	
MODBUS			
BACNET	Probe1_C	25790	Deg-C
Special BACNET point that converts the Probe value to degrees C in the gateway. Not available in MODBUS.			

Probe 2 C	Read Only	Probe 2 in degrees C	
MODBUS			
BACNET	Probe2_C	25990	Deg-C
Special BACNET point that converts the Probe value to degrees C in the gateway. Not available in MODBUS.			

Probe 3 C	Read Only	Probe 3 in degrees C	
MODBUS			
BACNET	Probe3_C	26190	Deg-C
Special BACNET point that converts the Probe value to degrees C in the gateway. Not available in MODBUS.			

Manual Modulation	Read/Write	Force modulation to a level	
MODBUS	Holding Register	797	40798
BACNET	PS4	79800	
Used to force a modulation rate. Typically used by service tech to make combustion adjustments at a particular firing rate. Normal setting is 101 = Auto. This allows the heater to modulate ad the load requires. If you put a value 0-100, it will force the heater to that firing rate when operating. 0=Low Fire, 100=High Fire Use with caution. Advise allowing the heater do control its own modulation.			

ALL	Read/Write	Minimum Temperature Alarm	
MODBUS	Holding Register	814	40815
BACNET	ALL	81500	Deg-F
Minimum temperature for Probe 1. Alarm will be activated if Probe 1 falls below this temperature. See Alarm points.			

ALU	Read/Write	Flame Current for proof of flame	
MODBUS	Holding Register	815	40816
BACNET	ALU	81600	Deg-F
Maximum temperature for Probe 1. Alarm will be activated if Probe 1 rises above this temperature. See Alarm points.			

Burner Runtime	Read/Write	Burner Runtime Hours 0-65535	
MODBUS	Holding Register	848	40849
BACNET	BURNER_HOURS_ou1	84900	Hours
NOTE: Number of hours the burner has been enabled. Once it reaches 9999. This can be written to, as a way to reset it.			

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Maintenance Reminder	Read/Write	Number of burner cycles 0-9999	
MODBUS	Holding Register	851	40852
BACNET	oP1	85200	
Maintenance feature, set the value to 0.			

Output #2 Mode	Read/Write	Output #2 mode, ON, OFF, AUTO	
MODBUS	Holding Register	855	40856
BACNET	TT_2on	85600	
TempTrac relay output spade 6 & 7. 0= Force relay off, 1=Force relay ON, 2= Auto (operates from thermostat functions).			

Output #3 Mode	Read/Write	Output #2 mode, ON, OFF, AUTO	
MODBUS	Holding Register	856	40857
BACNET	TT_3on	85700	
TempTrac relay output spade 8 & 9. 0= Force relay off, 1=Force relay ON, 2= Auto (operates from thermostat functions).			

Software Version	Read Only	Firmware revision	
MODBUS	Holding Register	859	40860
BACNET	VERSION_rEL	86000	
Software/Firmware revision number. At time of this manual, current version is 0.5 read as 5.			

Modulation Rate	Read Only	Monitor the modulation signal	
MODBUS	Holding Register	262	40263
BACNET	Modulation_FR	26300	
Modulation rate on the analog output 4-20ma is represented as 0-100. This feature was introduced in Firmware 0.5 (5) and is not available from older TempTrac modules already in the field.			

RELAYS Status ALL	Read Only	Shows the current state of the 3 output relays	
MODBUS	Holding Register	2049	42050:0,1,2
BACNET	RELAYS	205000	
This register contains the relay status for all 3 relays. Bit 0 = relay 1 (4&5), Bit 1 = relay 2 (6&7), Bit 2 = relay 3 (8&9). See below breakout of each relay.			

Burner_Relay1	Read Only	Status of burner, Relay1 (Output 1)	
MODBUS	Holding Register	2049	42050:0
BACNET	Burner_Relay1	205050	
This is Bit 0 of the Relay status word. It is the relay that controls the main heating output. Typically the Burner Status. BACNET has this broke out into state logic points. MODBUS, you will have to break it out yourself. Read value, BITWISE AND with 0x0001, if result = 0, relay is off. If result = 1, relay is on.			

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Relay2	Read Only	Status of Relay2 (Output 3)	
MODBUS	Holding Register	2049	42050:1
BACNET	Relay2	205051	
This is Bit 1 of the Relay status word. It is the output #2 relay. BACNET has this broke out into state logic points. MODBUS, you will have to break it out yourself. Read value, BITWISE AND with 0x0002, if result = 0, relay is off. If result = 2, relay is on.			

Relay3	Read Only	Status of Relay3 (Output 3)	
MODBUS	Holding Register	2049	42050:2
BACNET	Relay3	205052	
This is Bit 2 of the Relay status word. It is the output #3 relay. BACNET has this broke out into state logic points. MODBUS, you will have to break it out yourself. Read value, BITWISE AND with 0x0004, if result = 0, relay is off. If result = 4, relay is on.			

ALARM STATUS ALL	Read Only	ALL ALARMS STATUS	
MODBUS	Holding Register	3328	43329
BACNET	DIA	332900	
Alarm word, each bit represent separate alarms.			

Alarm_LA	Read Only	Status of low temperature Alarm	
MODBUS	Holding Register	3328	43329:0
BACNET	Alarm_LA	332950	
Low water temperature alarm. Probe 1 is lower than temperature in ALL point. This is Bit 0 of the ALARM STATUS ALL word. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0001 = 0x0001 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_HA	Read Only	Status of high temperature Alarm	
MODBUS	Holding Register	3328	43329:1
BACNET	Alarm_HA	332951	
High water temperature alarm. Probe 1 is higher than temperature in ALU point. This is Bit 1 of the ALARM STATUS ALL word. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0002 = 0x0002 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_P1	Read Only	Status of Probe 1 Alarm	
MODBUS	Holding Register	3328	43329:2
BACNET	Alarm_P1	332952	
Probe 1 alarm. This can be a disconnected, open or shorted probe. This will shut down heating operation. This is Bit 2 of the ALARM STATUS ALL word. Flashes 'P1' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0004 = 0x0004 Alarm is active. = 0x0000 Alarm is not active.			

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Alarm_P2	Read Only	Status of Probe 1 Alarm	
MODBUS	Holding Register	3328	43329:8
BACNET	Alarm_P2	332958	
Probe 2 alarm. This can be a disconnected, open or shorted probe. This is Bit 8 of the ALARM STATUS ALL word. Flashes 'P2' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0100 = 0x0100 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_P3	Read Only	Status of Probe 1 Alarm	
MODBUS	Holding Register	3328	43329:9
BACNET	Alarm_P3	332959	
Probe 3 alarm. This can be a disconnected, open or shorted probe. This is Bit 9 of the ALARM STATUS ALL word. Flashes 'P3' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0200 = 0x0200 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_AL1	Read Only	Status of digital input #1 Alarm	
MODBUS	Holding Register	3328	43329:10
BACNET	Alarm_AL1	332960	
Digital Input #1 alarm. This is typically not implemented. Refer to product specific details for information on this alarm. This is Bit 10 of the ALARM STATUS ALL word. Flashes 'AL1' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0400 = 0x0400 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_AL2	Read Only	Status of digital input #2 Alarm	
MODBUS	Holding Register	3328	43329:11
BACNET	Alarm_AL2	332961	
Digital Input #2 alarm. On some products, this is a general failure to operate alarm. See product specific information. This is Bit 11 of the ALARM STATUS ALL word. Flashes 'AL2' or 'LP' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x0800 = 0x0800 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_AL3	Read Only	Status of digital input #3 Alarm	
MODBUS	Holding Register	3328	43329:12
BACNET	Alarm_AL3	332962	
Digital Input #3 alarm. On some products, this is a general failure to operate alarm. See product specific information. This is Bit 12 of the ALARM STATUS ALL word. Flashes 'AL3' or 'HP' on TempTrac display. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x1000 = 0x1000 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_Nn1	Read Only	Maintenance Alarm for output #1	
MODBUS	Holding Register	3328	43329:13
BACNET	Alarm_Nn1	332963	
Maintenance Alarm. This is enabled when the time on ou1 is greater than the value in oP1. Flashes 'Nn1' on TempTrac display. Bit #13 of Alarms. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x2000 = 0x2000 Alarm is active. = 0x0000 Alarm is not active.			

ALL POINTS INCLUDING ADVANCE FOR TEMPTRAC:

Alarm_Nn2	Read Only	Maintenance Alarm for output #2	
MODBUS	Holding Register	3328	43329:14
BACNET	Alarm_Nn2	332963	
Maintenance Alarm. This is enabled when the time on ou2 is greater than the value in oP2. Flashes 'Nn2' on TempTrac display. Bit #14 of Alarms. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x4000 = 0x4000 Alarm is active. = 0x0000 Alarm is not active.			

Alarm_Nn3	Read Only	Maintenance Alarm for output #3	
MODBUS	Holding Register	3328	43329:15
BACNET	Alarm_Nn3	332963	
Maintenance Alarm. This is enabled when the time on ou3 is greater than the value in oP3. Flashes 'Nn3' on TempTrac display. Bit #15 of Alarms. In BACNET has this is broken out into a state logic point. For MODBUS ALARMS && 0x8000 = 0x8000 Alarm is active. = 0x0000 Alarm is not active.			

Com Status	Read Only	Communication Status bit	
MODBUS	Input Register	NA	NA
BACNET	Gateway_TT_Com_OK	200	
NOTE: This point is not generated by the heater; it is generated internally by the gateway. It is a status of the communication connection between the gateway and the heater. If active (GOOD), the gateway is talking to the heater. If inactive (NOT_PRESENT) then the gateway does not have good communication with the heater. This point may take up to 3 minutes to register properly after communication is established or interrupted. If this value if reading NOT_PRESENT, then no all over values are suspect, as the device is not communicating. Generally the Gateway will hold the last value received. The only way to ensure you have the current values from the heater is to verify this point is ACTIVE as well.			

(Return to GETTING STARTED)

ADVANCED MODBUS LIST FOR TEMPTRAC:

The following is the direct MODBUS interface addresses. Descriptions of most to the MODBUS parameters are listed in the correlating TYPICAL POINTS defined previously. Many MODBUS parameters are not supported in the gateway interface. This is a complete reference list and contains advanced parameters. All MODBUS points normally required for interface are represented in the TYPICAL POINTS section. If there is a need for interfacing using other parameters, consult factory to confirm proper use.

(Return to GETTING STARTED)

Label	Firm	Description	Range	Rev 0.3	Rev 0.5	Hex Add MODBUS	Register
	Version		X÷Y	**Level**	**Level**	**base 0**	
							40000+
St1	0.3 & 0.5	Set point1	LS1÷US1	Pr1	Pr1	0x300	769
St2	0.3 & 0.5	Set point2	LS2÷US2	Pr1	Pr1	0x301	770
St3	0.3 & 0.5	Set point3	LS3÷US3	Pr1	Pr1	0x302	771
St5	0.3 & 0.5	Set point5 Set point 3 alternate	-20÷70°F	Pr1	Pr1	0x303	772
HY1	0.3 & 0.5	Differential for St1	-22÷22°F	Pr2	Pr2	0x304	773
LS1	0.3 & 0.5	Minimum set point1	-40°F÷SET	Pr2	Pr2	0x305	774
US1	0.3 & 0.5	Maximum set point1	SET ÷ 230°F	Pr2	Pr2	0x306	775
AC1	0.3 & 0.5	Anti-short cycle delay for output 1	0÷30 min.	Pr2	Pr2	0x307	776
S2c	0.3 & 0.5	Configuration of St2: dependent on St1 or independent	diP; ind	Pr3	Pr2	0x308	777
HY2	0.3 & 0.5	Differential for St2	-22÷22°F	Pr2	Pr2	0x309	778
LS2	0.3 & 0.5	Minimum set point2	-40°F÷St2	Pr2	Pr2	0x30A	779
uS2	0.3 & 0.5	Maximum set point2	St2 ÷ 230°F	Pr2	Pr2	0x30B	780
AC2	0.3 & 0.5	Anti-short cycle delay for output 2	0÷30 min.	Pr2	Pr2	0x30C	781
S3c	0.3 & 0.5	Configuration of St3: dependent on St1 or independent	diP; ind	Pr2	Pr2	0x30D	782
HY3	0.3 & 0.5	Differential for set point 3 St3	-22÷22°F	Pr2	Pr2	0x30E	783
LS3	0.3 & 0.5	Minimum set point 3 St3	-40°F÷St3	Pr2	Pr2	0x30F	784
uS3	0.3 & 0.5	Maximum set point 3 St3	St3 ÷ 230°F	Pr2	Pr2	0x310	785
AC3	0.3 & 0.5	Anti-short cycle delay for output 3	0÷30 min.	Pr2	Pr2	0x311	786
o3P	0.3 & 0.5	Probe selection for output 3	Pb1 / Pb2	Pr2	Pr2	0x312	787
SSE	0.3 & 0.5	Set point shift for output 3 enable disable	No; Yes	Pr2	Pr2	0x313	788
HY5	0.3 & 0.5	Differential for set point 5	-22÷22°F	Pr2	Pr2	0x314	789
Ac5	0.3 & 0.5	Anti-short cycle delay for output 3 alternate set point	0÷30 min.	Pr2	Pr2	0x315	790
AcA	0.3 & 0.5	Time delay between the St3 to St5 set point shift	0÷15 min.	Pr2	Pr2	0x316	791
		ANALOGUE OUTPUT 4÷20mA (output 4)					
S4c	0.3 & 0.5	Configuration of St4: dependent on St1 or independent	diP; ind	Pr3	Pr2	0x317	792
St4	0.3 & 0.5	Analogue output set point	-100÷100°F	Pr2	Pr2	0x318	793
SR	0.3 & 0.5	Analogue output band width	-100÷100°F	Pr2	Pr2	0x319	794
Th4	0.3 & 0.5	Outlet temperature threshold for forcing to 4ma the analog output	-40°F ÷ 230°F	Pr2	Pr2	0x31A	795
HY4	0.3 & 0.5	Differential for restart working of analog output	-45 ÷ -1 °F	Pr2	Pr2	0x31B	796
Ac4	0.3 & 0.5	Anti-short cycle delay for output 4	0÷30 min.	Pr2	Pr2	0x31C	797
PS4	0.3 & 0.5	Analog output percentage (nu=101)	0÷100, nu	Pr2	Pr2	0x31D	798
PP4	0.3 & 0.5	Analog output percentage with fault probe 1 (nu=101)	0÷100, nu	Pr3	Pr2	0x31E	799

Label	Firm	Description	Range	Rev 0.3	Rev 0.5	Hex Add MODBUS	Register
		DYNAMIC RESET					
tt	0.3 & 0.5	Outdoor temperature threshold for dynamic reset of St1	-40÷230°F	Pr2	Pr2	0x31F	800
rr2	0.3 & 0.5	Outdoor temperature band width	-100÷100°F	Pr2	Pr2	0x320	801
rr1	0.3 & 0.5	Maximum shift of St1	-100÷100°F	Pr2	Pr2	0x321	802
tt2	0.3 & 0.5	Outdoor temperature threshold to open all the loads	-40÷230°F	Pr2	Pr2	0x322	803
Ht2	0.3 & 0.5	Differential for restart working of controller	-45 ÷ -1 °F	Pr2	Pr2	0x323	804
		DIGITAL INPUTS					
i1P	0.3 & 0.5	Digital input 1 polarity	CL÷OP	Pr3	Pr2	0x324	805
i2P	0.3 & 0.5	Digital input 2 polarity	CL÷OP	Pr2	Pr2	0x325	806
i2d	0.3 & 0.5	Digital input 2 alarm delay	0÷255 min.	Pr3	Pr2	0x326	807
i3P	0.3 & 0.5	Digital input 3 polarity	CL÷OP	Pr2	Pr2	0x327	808
i3d	0.3 & 0.5	Digital input 3 alarm delay	0÷255 min.	Pr3	Pr2	0x328	809
		DISPLAY					
cF	0.3 & 0.5	Temperature measurement unit	°C ÷ °F	Pr3	Pr2	0x329	810
rES	0.3 & 0.5	Resolution (integer/decimal point) only for °C	in ÷ de	Pr3	Pr2	0x32A	811
dS2	0.3	Default showing for display #2 Top (red)	Pb2, Pb3	Pr2		0x32B	812
dS2	0.5	Default showing for display #2 Top (red) Pb3 will display yellow EXT, Ani will display yellow Valve/M	Pb1,Pb2,Pb3,AnI		Pr2	0x32B	812
dS1	0.3	Default showing for display #1 Bottom (Yellow)	Pb1; tiM	Pr2		0x32C	813
dS1	0.5	Default showing for display #1 Bottom (Yellow) Pb3 will display yellow EXT, Ani will display yellow Valve/M	Pb1,Pb2,Pb3,AnI, TiM		Pr2	0x32C	813
		ALARMS					
Alc	0.3 & 0.5	Temperature alarms configuration: dependent on St1 or independent	rE÷Ab	Pr3	Pr2	0x32D	814
ALL	0.3	minimum temperature alarm for Pb1 (Alarm LA flash only)	-40÷230°F	Pr2	Pr2	0x32E	815
ALL	0.5	minimum temperature alarm for Pb1 (Alarm LA flash and signal on 3329)	-40÷230°F	Pr2	Pr2	0x32E	815
Alu	0.3	MAXIMUM temperature alarm for Pb1 (Alarm HA flash only)	-40÷230°F	Pr3	Pr2	0x32F	816
Alu	0.5	MAXIMUM temperature alarm for Pb1 (Alarm HA flash and signal on 3329)	-40÷230°F	Pr3	Pr2	0x32F	816
AFH	0.3 & 0.5	Differential for temperature alarm recovery	1÷45°F	Pr2	Pr2	0x330	817
ALd	0.3 & 0.5	Temperature alarm delay	0÷255 min.	Pr2	Pr2	0x331	818
dAo	0.3 & 0.5	Delay of temperature alarm at start up 1 = 10 min disp 0.1	0 ÷ 23h 50 min.	Pr2	Pr2	0x332	819
		ANALOGUE INPUTS					
oF1	0.3 & 0.5	First probe calibration	-21÷21°F	Pr3	Pr2	0x333	820
P2P	0.3 & 0.5	Second probe presence	No; Yes	Pr2	Pr2	0x334	821
oF2	0.3 & 0.5	Second probe calibration	-21÷21°F	Pr3	Pr2	0x335	822
P3P	0.3 & 0.5	Third probe presence	No; Yes	Pr2	Pr2	0x336	823

Label	Firm	Description	Range	Rev 0.3	Rev 0.5	Hex Add MODBUS	Register
oF3	0.3 & 0.5	Third probe calibration	-21÷21°F	Pr3	Pr2	0x337	824
		TIME AND DATE					
Hur	0.3 & 0.5	Current hour	0 ÷ 23	Pr2	Pr2	0x338	825
Min	0.3 & 0.5	Current minute	0 ÷ 59	Pr2	Pr2	0x339	826
dAY	0.3 & 0.5	Current day	Sun ÷ SAt	Pr2	Pr2	0x33A	827
		ENERGY SAVING TIMES					
E1	0.3 & 0.5	Energy saving start on Sunday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x33B	828
S1	0.3 & 0.5	Energy saving stop on Sunday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x33C	829
Sb1	0.3 & 0.5	Set back temperature on Sunday	-40÷40°F	Pr2	Pr2	0x33D	830
E2	0.3 & 0.5	Energy saving start on Monday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x33E	831
S2	0.3 & 0.5	Energy saving stop on Monday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x33F	832
Sb2	0.3 & 0.5	Set back temperature on Monday	-40÷40°F	Pr2	Pr2	0x340	833
E3	0.3 & 0.5	Energy saving start on Tuesday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x341	834
S3	0.3 & 0.5	Energy saving stop on Tuesday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x342	835
Sb3	0.3 & 0.5	Set back temperature on Tuesday	-40÷40°F	Pr2	Pr2	0x343	836
E4	0.3 & 0.5	Energy saving start on Wednesday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x344	837
S4	0.3 & 0.5	Energy saving stop on Wednesday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x345	838
Sb4	0.3 & 0.5	Set back temperature on Wednesday	-40÷40°F	Pr2	Pr2	0x346	839
E5	0.3 & 0.5	Energy saving start on Thursday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x347	840
S5	0.3 & 0.5	Energy saving stop on Thursday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x348	841
Sb5	0.3 & 0.5	Set back temperature on Thursday	-40÷40°F	Pr2	Pr2	0x349	842
E6	0.3 & 0.5	Energy saving start on Friday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x34A	843
S6	0.3 & 0.5	Energy saving stop on Friday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x34B	844
Sb6	0.3 & 0.5	Set back temperature on Friday	-40÷40°F	Pr2	Pr2	0x34C	845
E7	0.3 & 0.5	Energy saving start on Saturday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x34D	846
S7	0.3 & 0.5	Energy saving stop on Saturday	0 ÷ 23h 50 min. - nu	Pr2	Pr2	0x34E	847
Sb7	0.3 & 0.5	Set back temperature on Saturday	-40÷40°F	Pr2	Pr2	0x34F	848
		WORKING HOURS					
ou1	0.3 & 0.5	working hours actual of relay 1	0÷9999 Hours	Pr1	Pr2	0x350	849
ou2	0.3 & 0.5	working hours actual of relay 2	0÷9999 Hours	Pr1	Pr2	0x351	850
ou3	0.3 & 0.5	working hours actual of relay 3	0÷9999 Hours	Pr2	Pr2	0x352	851
oP1	0.3 & 0.5	working hours limit of relay 1, Nn1 Alarm when reached	0÷9999, 0=disabled	Pr2	Pr2	0x353	852
oP2	0.3 & 0.5	working hours limit of relay 2, Nn2 Alarm when reached	0÷9999, 0=disabled	Pr2	Pr2	0x354	853
oP3	0.3 & 0.5	working hours limit of relay 3, Nn3 Alarm when reached	0÷9999, 0=disabled	Pr2	Pr2	0x355	854
		OUTPUTS SETTING					
1on	0.3 & 0.5	The output 1 force ON / OFF or Temperature regulation	rEG=2; on=1; oFF=0	Pr2	Pr2	0x356	855

Label	Firm	Description	Range	Rev 0.3	Rev 0.5	Hex Add MODBUS	Register
2on	0.3 & 0.5	The output 2 force ON / OFF or Temperature regulation	rEG=2; on=1; oFF=0	Pr2	Pr2	0x357	856
3on	0.3 & 0.5	The output 3 force ON / OFF or Temperature regulation	rEG=2; on=1; oFF=0	Pr2	Pr2	0x358	857
		OTHER					
Adr	0.3 & 0.5	Serial address	0÷247	Pr2	Pr2	0x359	858
Ptb	0.3 & 0.5	Parameter map code always = 1	readable only	Pr2	Pr2	0x35A	859
rEL	0.3 & 0.5	Software release 5 = V0.5, 3 = V0.3	readable only	Pr2	Pr2	0x35B	860
i1S	0.5	Analog output when Digital Input 1 is activated	4-20mA		Pr2	0x35C	861
i1t	0.5	Analog output at i1S extra time if Digital Input 1 is not activated	0÷30 sec.		Pr2	0x35D	862
i1d	0.5	Digital Input 1 Alarm Delay	0÷255 min.		Pr2	0x35E	863
i1F	0.5	If Yes, Digital Input 1 will function as Alarm. Operating only when trying to call for output 1 and Input 1 is active, subject to i1d timer	No; Yes		Pr2	0x35F	864
i2F	0.5	Digital Input 2 will function only when Output 1 is energized	No; Yes		Pr2	0x360	865
i3F	0.5	Digital Input 3 will function only when Output 1 is energized, When Edi is selected, Output 1 will open when digital input 3 is activated	No; Yes; Edi		Pr2	0x361	866
oS2	0.5	Output 2 function: either temp relay or alarm relay	Std; AL		Pr2	0x362	867
(TP1)	0.3 & 0.5	Probe 1 temperature	Degrees F/C		Pr2	0x100	257
	0.3	Probe 1 Information/Status Normal=512 or 0x0200, Fault=515 or 0x0203. Fault will, drop call for heat, buz, Flash Yellow P1, light yellow valve/M	bit (0,1 on) probe failure		Pr2	0x101	258
(TP2)	0.3 & 0.5	Probe 2 temperature	Degrees F/C		Pr2	0x102	259
	0.3	Probe 2 Information/Status Normal=512 or 0x0200, Fault=515 or 0x0203. Fault will buz, Flash Red P2	bit (0,1 on) probe failure		Pr2	0x103	260
(TP3)	0.3 & 0.5	Probe 3 temperature	Degrees F/C		Pr2	0x104	261
	0.3	Probe 3 Information/Status Normal=512 or 0x0200, Fault=515 or 0x0203. Fault will buz, Flash Red P3	bit (0,1 on) probe failure		Pr2	0x105	262
	0.5	Modulation rate output (4 to 20mA)	0÷100%		Pr2	0x106	263
	0.3 & 0.5	Statas of Relay 1,2&3	bit 0,1,2		Pr2	0x801	2050
	0.3	Input 3 Alarm, buz, ALMMB, Flashes HP= 4096 or 0x0800	bit # 12 or 13th bit		Pr2	0xD00	3329
	0.3	Input 2 Alarm, buz, Flashes LP= 4096 or 0x0800	bit # 12 or 13th bit		Pr2	0xD00	3329
	0.3	Input 2 & 3, buz, Flashed HP & LP= 4096 or 0X0800	bit # 12 or 13th bit		Pr2	0xD00	3329
	0.5	Low Temperature Alarm, beep, Flash Yellow LA= 1 or 0x0001	bit # 0 or 1st bit		Pr2	0xD00	3329
	0.5	High Temperature Alarm, beep, Flash yellow HA= 2 or 0x0002	bit # 1 or 2nd bit		Pr2	0xD00	3329
	0.5	Probe 1 error, open or shorted, Drops call for heat, yel valve/M on, Flash Yellow P1=4 or 0x0004	bit # 2 or 3rd bit		Pr2	0xD00	3329
	0.5	Probe 2 error, open or shorted, Flashing red P2=256 or 0x0100	bit # 8 or 9th bit		Pr2	0xD00	3329
	0.5	Probe 3 error, open or shorted, Flashing red P3=512 or 0x0200	bit # 9 or 10th bit		Pr2	0xD00	3329
	0.5	ALARM 1 (stops heating) Input 1, beep, Flash AL1 = 1024 or 0x0400. Will recover if Input 1 goes away, or need for call for heat goes away	bit # 10 or 11th bit		Pr2	0xD00	3329
	0.5	ALARM 2 (Lockout, stops heating) Input 2, Flash AL2 & Lguage & valve= 2048 or 0x1000	bit # 11 or 12th bit		Pr2	0xD00	3329

Label	Firm	Description	Range	Rev 0.3	Rev 0.5	Hex Add MODBUS	Register
	0.5	ALARM 3 (Lockout, stops heating) Input 3/ALMMB/ALOAF, beep, Flash AL3 & Hguage & valve (This is ALARM ON ANY FAILURE)= 4096 or 0x0800	bit # 12 or 13th bit		Pr2	0xD00	3329
	0.5	Maintenance Relay1, beep, Flash Nn1 & wrench=8192 or 0x2000 You must reset hours ou1 or set oP1=0	bit # 13 or 14th bit		Pr2	0xD00	3329
	0.5	Maintenance Relay2, beep, Flash Nn2 & wrench=16384 or 0x4000 You must reset hours ou2 or set oP2=0	bit # 14 or 15th bit		Pr2	0xD00	3329
	0.5	Maintenance Relay3, beep, Flash Nn3 & wrench=32768 or 0x8000 You must reset hours ou3 or set oP3=0	bit # 15 or 16th bit		Pr2	0xD00	3329
	0.3 & 0.5	On/Off On=257 or 0x0101, Off=1 or 0x0001 Can be used to reset ALMMB alarm by cycling OFF, wait 30 sec , ON	Low byte is mask, Hi byte is command. Bit # 0 & #8		Pr2	0x500	1281
	0.3 & 0.5	Keyboard Lock Lock=2056 or 0x0808, Unlock=8 or 0x0008. If locked PoF is displayed when keypad edit is attempted	Low byte is mask, Hi byte is command. Bit # 3 & #11		Pr2	0x500	1281
	0.3 & 0.5	Reset audible alarm when condition is corrected, 4112 or 0x1010 does not reset alarm, just stops the beeping	Low byte is mask, Hi byte is command. Bit # 3 & #12		Pr2	0x500	1281

Energy Savings Registers are enumerated 0 to 145 w/145=n/u
10 min each with 145=nu
All other enumerations start at 0 and count up
(Return to GETTING STARTED)

XR10CX POINTS LIST:

The gateway will provide a full points list, including typical points and advanced points. Normal interface will only require the TYPICAL POINTS. For future expansion and custom applications, many points are provided designated as ADVANCED POINTS and not advised to be used in normal integration. The Advanced Points are present for the purpose of future development and custom applications. Please consult factory if any points in the ADVANCED POINTS LIST are required.

Key:

Point Name	Read/Write	Short Description	
MODBUS	Register Type	Address Offset	MODBUS Address
BACNET	BACNET Name	Object Instance	BACNET Units
NOTES			

TYPICAL POINTS XR10CX:

The points that are typically used to interface with the XR10CX control on a heater.

(Return to GETTING STARTED)

TYPICAL POINTS XR10CX:

Setpoint	Read/Write	System Setpoint	
MODBUS	Holding Register	863	40864
BACNET	SEt_864	40864	Deg-F
This is the setpoint for the heater. Note not all devices that has this control are used as controllers, some are used as monitoring.			

Probe Temperature	Read	Temperature of the probe	
MODBUS	Holding Register	256	40257
BACNET	PRB1_257	40257	Deg-F
Probe temperature reading.			

On Off for Control	Read/Write	Controller Enable / Disable	
MODBUS	Coil	512	513
BACNET	ON_513	513	ON / OFF
Control bit for the controller. 1 = Controller is enabled and can operate. 0 = Controller is disabled and the output will be open.			

Relay	Read	Call for heat output	
MODBUS	Coil	542	543
BACNET	RELAY_543	543	ON / OFF
Output, this is active when the controller has a call for heat. It is open if the controller is powered off or disabled.			

COM Status	Read	Com Status of heater with Gateway	
MODBUS	N/A	N/A	N/A
BACNET	ComStatus	200	NO PRESENT / GOOD
This point is not from the XR10CX, it is generated from the Gateway. It represents the communication between the XR10CX and the gateway. 1 = Communication is good, device is responding when polled. 0 = Device not responding, possibly not installed. If the status of this is 0, then all other points are suspect.			

(Return to GETTING STARTED)

ADVANCED POINTS XR10CX:

Points listed below are provided for advanced interface and for custom applications. Contact factory for additional information.

(Return to GETTING STARTED)

ADVANCED POINTS XR10CX:

Digital Input	Read	Status of digital input #1	
MODBUS	Coil	519	520
BACNET	DIG_INPUT_520	520	0 / 1
Not used by our applications. Status of the digital input. Input terminal is #9, and common for this is #11. If open, then the status = 0, if closed then the status = 1			

Probe ERROR	Read	Probe failure. Open or shorted	
MODBUS	Coil	520	521
BACNET	ERRPB1_521	521	0 / 1
Controller is unable to read temperature due to failure of the probe. Typically this would be an open or shorted probe input. 0 = normal, 1 = PROBE ERROR			

EEPROM FAIL	Read	EEPROM has failed	
MODBUS	Coil	531	532
BACNET	EEP_FAIL_532	532	ON / OFF
Indication that the EEPOM is corrupt. Replacement of the control is required. 0 = Normal, 1 = EEPROM FAILED			

Alarm	Read	Alarm any	
MODBUS	Coil	537	538
BACNET	ALARM_538	538	ON / OFF
Not implemented in our applications. This is a general alarm from anything that can create an alarm on the control.			

Setpoint C	Read	Com Status of heater with Gateway	
MODBUS	N/A	N/A	N/A
BACNET	SEt_864C	1864	Deg-C
Setpoint in degrees C. This is calculated in the gateway and is provided for BACNET.			

Probe Temperature C	Read	Com Status of heater with Gateway	
MODBUS	N/A	N/A	N/A
BACNET	PRB1_257C	1257	Deg-C
Probe temperature in degrees C. This is calculated in the gateway and is provided for BACNET.			

(Return to GETTING STARTED)

XR10CX ADVANCED MODBUS LIST:

The following is the direct MODBUS interface reference list. This is a complete list; many parameters are not supported in the gateway interface. All MODBUS points normally required for interface are listed in the TYPICAL POINTS section. If there is a need for interfacing using other parameters, consult factory to confirm proper use.

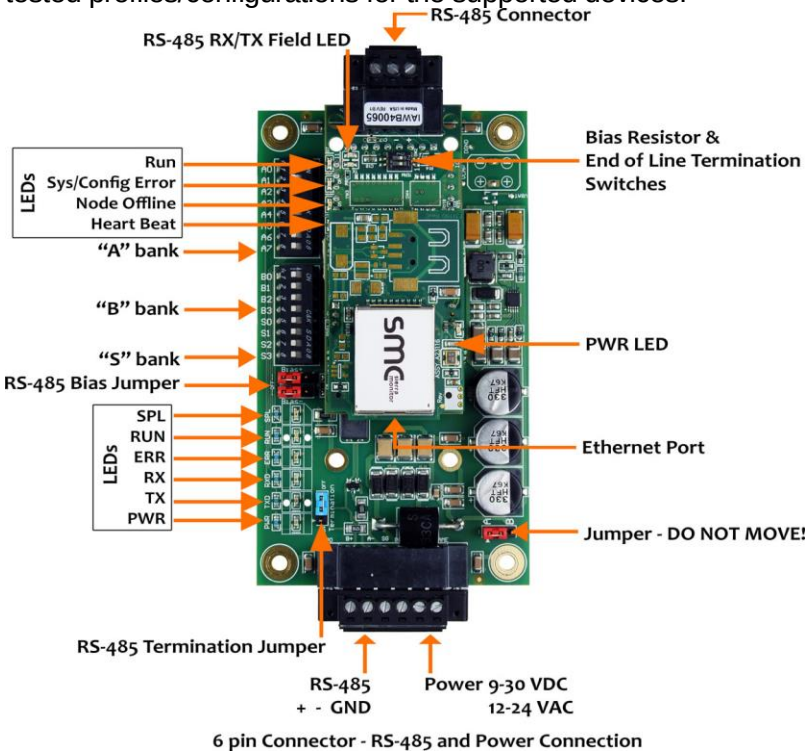
(Return to GETTING STARTED)

Label		Description			OFFSET	Coil	Register
PRB1	Read	Probe 1 Temperature			256		40257
HY	Read/Write	Differential			768		40769
ALd	Read/Write	Temperature Alarm Delay			829		40830
DAo	Read/Write	Temp Alarm Delay at Startup			830		40831
Did	Read/Write	Dig Input Alarm Delay 0-255min			846		40847
Adr	Read/Write	MODBUS Address 1-247			851		40852
Set	Read/Write	System Setpoint			863		40864
						Coil	
	Read/Write	On Off for Control			512	513	
	Read/Write	Keypad Lock			515	516	
	Read/Write	Mute Buz and Any-Alarm			516	517	
	Read	Digital input Pin 9			519	520	
	Read	Probe 1 Error			520	521	
	Read	Probe 2 Error			521	522	
	Read	Probe 3 Error			522	523	
	Read	Probe 4 Error			523	524	
	Read	High Temperature Alarm Pb1			524	525	
	Read	Low Temperature Alarm Pb1			525	526	
	Read	Alarm from External input			528	529	
	Read	EEPROM Failure			531	532	
	Read	ANY-Alarm Can be Muted			537	538	
	Read	Relay Call For Heat			542	543	
	Read	Buzzer On with Ext or Hi Alarm			544	545	

(Return to GETTING STARTED)

PROTONODE GATEWAY DETAILS:

The ProtoNode is an external, high performance building automation multi-protocol gateway that is preconfigured to automatically communicate between PVI Heaters connected to the ProtoNode and automatically configures them for BACnet MS/TP, BACnet/IP, or Modbus TCP. 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.

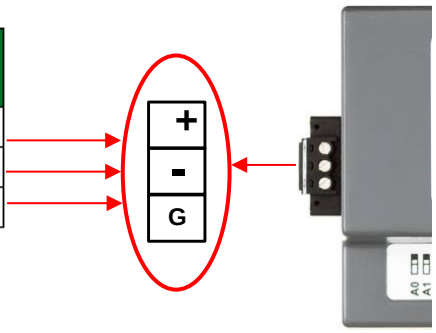


6 pin Connector - RS-485 and Power Connection

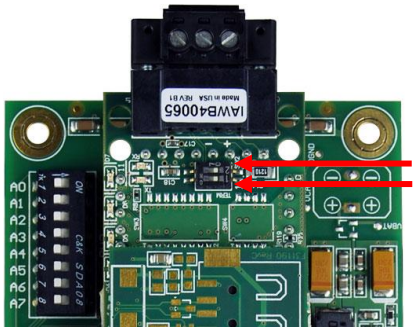
ProtoNode Port R1:

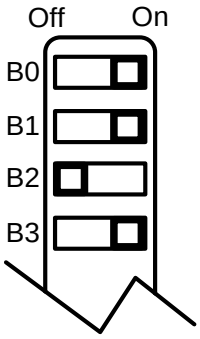
3 position screw terminal: RS-485(+), RS-485(-), Signal Ground
Used for BMS connection point using RS-485 network and communicating with BACNET MSTP
Has dip switch for adding termination resistor. Default OFF
Has dip switch for adding BIAS resistors. Default OFF
BAUD rate configurable using dip switches B0-4
Addressing configurable using dip switches A0-7

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



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. See settings section for the BAUD configurations.



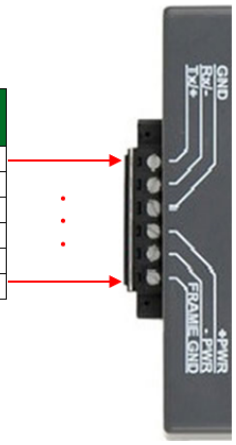


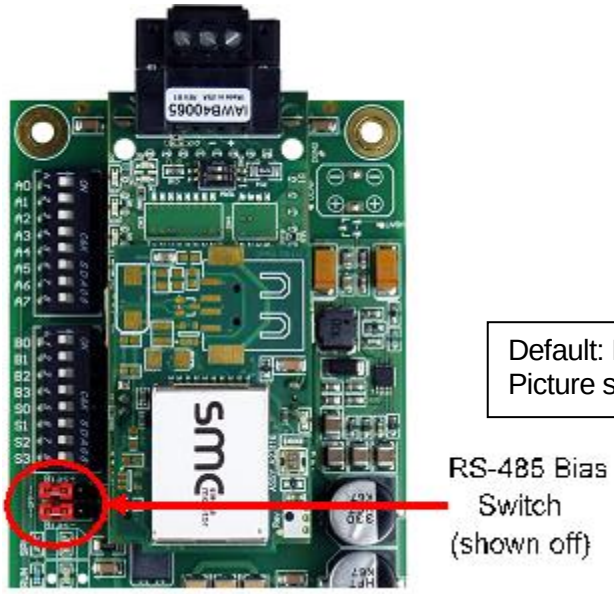
When setting DIP switches, ensure power to the ProtoNode is OFF.

ProtoNode Port S1:

Located on 6 position screw terminal. Pins 1,2,3 RS-485(+), RS-485(-), Signal Ground
Used for connection to PVI heaters using RS-485 network and communicating with MODBUS RTU.
BAUD rate if fixed at 9600, as all devices PVI USES PVI heater have same fixed BAUD rate.
The power supply connects to this terminal also. FRAME GND should be connected to the ground of the enclosure the ProtoNode Gateway is mounted in.

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

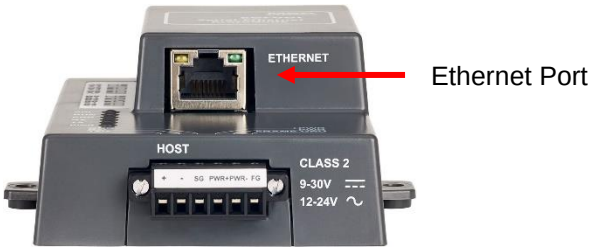




Default: BIAS Jumpers set to ON.
Picture shows BIAS jumpers set to OFF

ProtoNode Ethernet Port:

Ethernet Port: Used for configuration, BMS interface via BACNET IP or MODBUS TCP, security verification via certificates on the SMC Cloud (via internet)



The Ethernet port has 2 LEDs that indicate connection and packets transmission. .
Configuration is accomplished by connecting a computer to the Ethernet Port, and accessing the HTML interface located local on the ProtoNode Gateway. Default IP address is 192.168.1.24

HEATER CONTROL INFORMATION:

THE TEMPTRAC CONTROL DETAILS:

Displays 2 Temperatures, top in RED, bottom in AMBER.
The TempTrac control is a multipurpose controller that has 3 ON/OFF outputs, 1 analog 4-20m Amp output, 3 digital inputs, and 1 to 3 temperature probe inputs. The ON/OFF outputs are a normally open relay contact, the digital inputs expect a dry contact that can switch low voltage signals, and the temperature probes 10K OHM NTC direct emersion sensors.
As the setup of this control can vary greatly, please refer to the application specific section for what each of the inputs/outputs are used for in your application.

THE XR10CX CONTROL DETAILS:

The XR10CX control has a 1 ON/OFF output, a 1 temperature input probe, and 1 digital input for alarm that can be monitored over communication. The output is a normally open relay contact. The probe is a 10K OHM NTC direct emersion sensor. The digital input expects a dry contact. This control is used on some heaters as the temperature controlling device, and on some it is only a means to monitor water temperature, with no control capabilities.

Native Protocol of TempTrac and XR10CX

Built into the control is the MODBUS protocol. With the TTL to RS-485 adapter module, this control offers MODBUS RTU (MODBUS over RS-485 physical layer) The MODBUS RTU protocol is well established industry protocol, technical references for this are readily available on the Internet.

MODBUS Data Types Used

TempTrac only uses one data type, Holding Registers

Holding Registers (40001 – 49999) Read/Write
Other data types such as Coils are not implemented in the TempTrac control.

XR10CX uses only Holding Registers and Coils

Holding Registers (40001 – 49999) Read/Write
Coils (1 – 9999) Read/Write

Other data types are not implemented in the controls.

Only the data points in the POINTS LIST should be accessed.

The MODBUS adapter:

The same MODBUS adapter is used for both the TempTrac and XR10CX control. MODBUS adapter is an orange dongle with 2 green screw terminals attached to an 8-inch cable that plugs into the white header at the back of either control. This can be an option that is factory installed on a heater, or it may be a separate line item part. On current products, the option that includes this adapter is typically called COMMUNICATION PACKAGE. As a standalone line item part, it is kit PVI PN 138710 (with a manual), or without the manual for situations such as replacement PVI PN: 106623 (no manual)

MODBUS fixed settings for TempTrac and XR10CX:

Most of the MODBUS RTU and Port settings are not adjustable
Baud Rate: 9600bps (Not adjustable)
Data Length: 8 bit (Not adjustable)
Parity: None (Not adjustable)
Stop Bits: 1 (Not adjustable)
Start/Stop: Silent interval of 3 characters minimum
Minimum Time Between Retry: 500 msec.
Maximum read command is 5 words

Physical Layer RS-485 of the MODBUS RTU

MODBUS RTU uses the physical layer RS-485.
RS-485 (EIA-485): A two wire (twisted pair) multi drop network. Each device can send data by holding positive and negative voltage on the line and reversing polarity on the 2 wires. When no devices are transmitting, the line will be tristate. The recommended arrangement of the wires is as a connected series of point-to-point (multi-dropped) nodes, i.e. a line or bus, not a star, ring, or multiply connected network. The number of devices that can be connected to a single line is defined in the RS-485 standard by the input impedance of 32 UNIT LOADs. The wire and circuits interfacing on this two wire connection is considered the PHYSICAL LAYER. (RS-485 is the same physical layer as used with BACNET MSTP and MODBUS RTU.)

BIAS Resistors for the MODBUS RTU Connection:

No provisions for biasing resistors or termination resistors are provided on the TempTrac or XR10CX control or adapter. When required, this will need to be provided externally.
For reliable operations, one and only one device on the RS-485 network needs to have biasing resistors enabled. The PVI gateway has jumpers for biasing resistors on the heater connection port, and our default setup is implementing them.