Installation, Operation & Maintenance Manual

EOS Interface Guide, and Points List
For EOS BTCII Firmware Version J1239D-570 and Newer

Contents

Important: This manual contains information required for installation, operation and maintenance 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.

Installation and service must be performed by a qualified service installer, service agency or the gas supplier.

To the installer / controls integrator: After installation, 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 information that will help you in maintaining and operating this appliance.

Hot Water Solutions

OVERVIEW OF INTERFACE METHODS:

This document is a quick reference for connecting the EOS (BTCII) water heater control to a Building Automation System (BAS). Direct connection via MODBUS RTU or BACNET MSTP.

BAS to Heaters direct, using MODBUS RTU or BACNET MSTP:
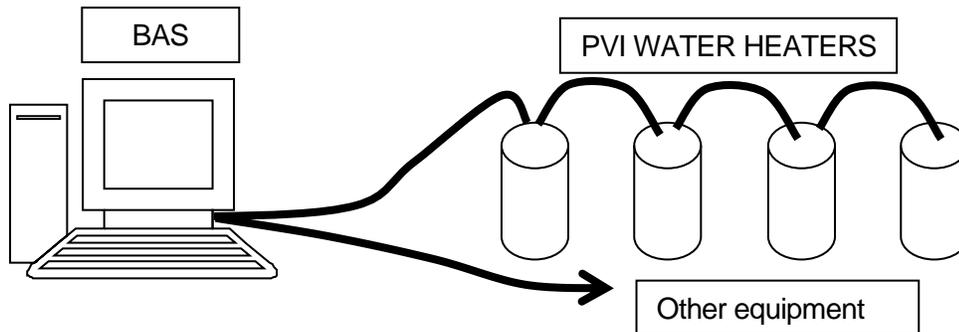
Building Automation System (BAS) connecting directly to water heaters using twisted pair wire. (Wiring is RS-485 physical layer.)

BAS to heaters using a Protocol Gateway or Router:
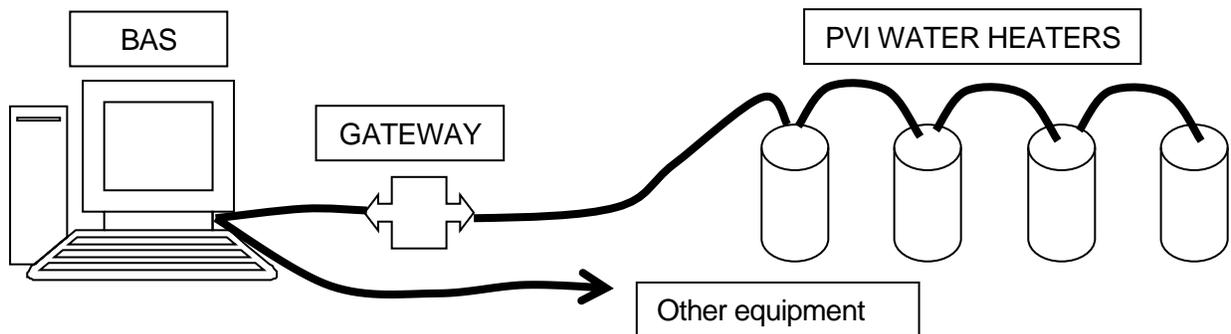
Building Automation System (BAS) connecting to a 3RD party gateway. This can provide interface to building automation system running other protocols. In order to interface with our heaters, the gateway will need to address our heaters using MODBUS RTU or BACNET MSTP.
(Wiring from our heaters to a gateway or router is RS-485 physical layer.)

BAS to heaters using discrete connections:

Discrete interface is the control and monitoring of the heater using dry contacts, and/or analog signals. Typical points: External ENABLE/DISABLE contacts, remote proving contacts, remote equipment contacts, and alarm contacts. Currently the EOS does not support analog input for setpoint for Water Heaters.

EOS USER INTERFACE:

The display (BTCII) is a touch screen interface that uses resistive touch (pressure) unlike your smart phone or tablets, light touches or swipes will not register on this display. You should use your finger with a positive pressure to actuate the indicated section of the screen.

HOME Button.
Return to the 'HOME'
Screen from any
menu. Press and hold
for 3 seconds to
access the
programming menu

CHECK FIRMWARE VERSION:

Confirm the firmware version you have before going any further in this interface guide.

- Enter the programming menus by holding the lower left button HOME
- Use the NEXT ITEM button to select the TOOL BOX menu
- Press the ENTER button in TOOL BOX menu
- Press NEXT ITEM button to show the SW version, after the SW will be the Major version, currently that is J1239D when this manual was written
- Press the ENTER button to display the minor version
- This manual is for Major version J1239D Minor 570 or newer. J1239D-570
  - If you have an older software version, you must obtain the interface guide for that version
- Hit HOME button to exit TOOLBOX menu
- Hit HOME button again to exit MENU

EOS HEATER MODBUS or BACNET SETTINGS:

The default (as it ships from factory) is for network communications to be disabled, you must Enable Modbus or BACNET.

HOME Button.
Return to the 'HOME' Screen from any menu. Press and hold for 3 seconds to access the programming menu

Steps to setup, change or confirm MODBUS settings on heater:

- Enter the programming menus by holding the lower left button HOME
- Use the NEXT ITEM button to select the TOOL BOX / MENU
- Press the ENTER button to enter the TOOL BOX menu
- Use the UP / DOWN arrows to change ACCESS level from USER to INST
- Hold the #4 button (On bottom next to ITEM BACK) until it changes the ACCESS level to ADV
- Press HOME button, it will show TOOLBOX / MENU
- Use the NEXT ITEM to get to NETWORK / MENU
- Press ENTER button, you will see MODE (BAS) / OFF
- Change MODE (BAS) / **OFF** to MODE (BAS) / **MODD** using the arrows
- Press NEXT ITEM, you will see ADDRESS (MODD) / 1, Using the Arrows adjust the Modbus address of the heater to the needed value from 1- 247
- Press NEXT ITEM, ensure DATA TYPE (MODD) / RTU is set to RTU. We do not provide details or support for the ASCI configuration.
- Press NEXT ITEM, you will see BAUD (MODD) / 9600, using the arrows; change the BAUD rate: 2400, 9600, 19k2, 38k4, 57k6, 115k
- Press NEXT ITEM, you will see PARITY (MODD) / EVEN, using the arrows, select EVEN, ODD, or NONE
  - o Note; EVEN & ODD have 1 stop bit, and NONE has 2 stop bits
- Press HOME Button to exit the NETWORK / MENU
- Press HOME Button again to exit the MENU selection and return to the VIEW screens

Steps to setup, change or confirm BACNET MSTP settings on heater:
- Enter the programming menus by holding the lower left button HOME
- Use the NEXT ITEM button to select the TOOL BOX / MENU
- Press the ENTER button to enter the TOOL BOX menu
- Use the UP / DOWN arrows to change ACCESS level from USER to INST
- Hold the #4 button (On bottom next to ITEM BACK) until it changes the ACCESS level to ADV
- Press HOME button, it will show TOOLBOX / MENU
- Use the NEXT ITEM to get to NETWORK / MENU
- Press ENTER button, you will see MODE (BAS) / OFF
- Change MODE (BAS) / **OFF** to MODE (BAS) / **BACN** using the arrows
- Press NEXT ITEM, you will see DEVICE ID (BACN) and at the bottom a 7 digit number broken into 4 sections.
- Using the arrows and NEXT ITEM, enter the DEVICE INSTANCE NUMBER. This number must be unique on the network and can range from 1 – 4194303
- After entering all 4 sections of the Instance number, press Next Item again
- You will see: MAC (BACN) / 3, using the arrows, adjust the device MAC address as required, the range is 1-127 or 1-MAX MSTR
- Press NEXT ITEM, you will see BAUD (BACN) / 38k4, using the arrows; change the BAUD rate: 2400, 9600, 19k2, 38k4, 57k6, 76k8, 115k
- Press NEXT ITEM, you will see MAX MAST (BACN) / 127, adjust this down only if the controls contractor requests a specific MAX MASTER. Range is 1-127 or MAC – 127, the default is 127
- Press NEXT ITEM, you will see MAX INFO (BACN) / 1, adjust this only if the controls contractor requests for a value other than 1 to be in the MAX INFOFRAMES. Default is 1
- Press HOME Button to exit the NETWORK / MENU
- Press HOME Button again to exit the MENU selection and return to the VIEW screens

EOS MODBUS RTU PROTOCOL

The MODBUS RTU protocol is an established industry protocol and technical references are readily available on the Internet.

Data Types Used

The BTCII EOS only uses two data types, Holding Registers (16 bits), and Input Registers (16 bits). Holding Registers can be read and written to. Input Registers can only be read. Example of a Holding Register would be a setpoint, and an example of a Input Register would be the temperature reading from a probe. They are addressed using the offset value from a base address.
- 5 Digit Modbus addressing:
  - Holding Registers (40001 – 49999) or (40001 + offset of 0 - 9998) Read/Write
  - Input Registers (30001 – 39999) or (30001 + offset of 0 - 9998) Read only
- 6 digit Modbus addressing:
  - Holding Registers (400001 – 465536 or 400001 + offset of 0 - 65535) Read/Write
  - Input Registers (300001 – 365536 or 500001 + offset of 0 - 65535) Read only

Other data types such as Coils are not implemented in the BTCII EOS control.
Only the data points in the POINTS LIST should be accessed.
MODBUS is a simple protocol, with no supporting information provided. It is a list of address offsets that you can read or write to, but no information such as units, data type, purpose, description, or name is contained in the protocol. Integration will always require a reference of the points, and the details of those points.

EOS BACNET MSTP PROTOCOL

The BACNET MSTP protocol an established industry protocol and technical references are readily available on the Internet. We only use 2 data types for the EOS control, AI (Analog Input) is a read only value like a temperature reading, and AV (Analog Value) is a value that can be read or written. Example of Analog Value would be the setpoint. Example of Analog Input would be the temperature reading of a probe.

The BACNET protocol is a high level protocol that contains additional information within the protocol to allow polling of points, and identification of details, such as point name, units, description.

This high level protocol greatly speeds up integration by allowing the controls contractor to poll and print in the points quickly and only referencing the Point List documentation minimally,

The RS-485 PORT, Physical Layer RS-485

MODBUS RTU and BACNET MSTP use the same PORT, or physical layer. This is a 3 pin screw connector on the back side of the BTCII Display.

RS-485 (EIA-485): A 2 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 tri-state. 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 2 wire connection is considered the PHYSICAL LAYER. (RS-485 is the same physical layer as used with BACNET MSTP.)

No provisions for biasing resistors or termination resistors are provided on the EOS BTCII control. If required, this will need to be provided externally.

WIRING OF EOS TO BAS:

On the back side of the touch screen is 3 position screw terminals.

Field connection for BAS		BTCII (#1) Back of display		BTCII (#2) Back of display		Testing VDC	Results for proper hookup
RS 485 +, D+		A(-)		A(-)		Positive lead	+ 0.100 To + 5.500
RS R85 -, D-		B(+)		B(+)		Negative lead	
GND		Gnd		Gnd			

To ensure the proper polarity, check with a Digital Volt Meter set to Volts DC. Take a reading at the back of the BTCII EOS display, from the A(-) Terminal to the B(+) Terminal. The A(-) should be the positive lead, when connected.

The RS-485 PORT: Both MODBUS RTU and BACNET MSTP connect to this port, selecting the protocol is done in the settings on the display.
Note that the A(-) connects to D+
and B(+) connects to D-.
This is very easy to get wrong.

Building Automation System Communication:
At this point you will need to confirm communication on the BAS end. Utilities such as FieldServers BACNET EXPLORER device or Polar Soft's BACnet Quick Test software can be used to confirm the BACNET MSTP is working. When the interface is MODBUS RTU, there are many MODBUS utilities that can be used to confirm the operation of the MODBUS side. The use and configuration of 3rd party software and devices is outside the scope of this manual. Please reference the instructions of the software and tools you are using and the POINT LIST in the back of this manual for testing.

APPLICATION SPECIFICS:
Each product that uses the BTCII EOS control may have subtle differences. The following products address the important information regarding each device. For details on each model or for models not listed, consult the I & O Manual for that product.

Conquest 100 Gallon (199 – 299) & 130 gallon 399:
Model Numbers: 20 L 100A-GCL, 25 L 100A-GCL, 30 L 100A-GCL, 40 L 130A-GCL
TH Input Status: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. You can monitor the state of this input. 1 = enabled.
PROBE OUTLET: is a temperature probe in the top of the tank.
PROBE INLET: Temperature of the mid-section of the tank, this sensor controls the agitator pump.
PROBE VENT: Temperature of the Flue gasses exiting the heater.
Modulation: Not used on this equipment.
PUMP1 Status: This is the agitator pump ON/OFF.
Discrete connections:
Enable/Disable: R1 – R2 (Input to heater) Closed = ENABLE.
Alarm: A1 & A2 (Output from Heater) Closed = ALARM.
Remote Equipment / Burner ON: P1 – P2 (Output from Heater) Closed – Heater is heating.
Remote Proving: C1 – C2 (Input to heater).
- Closed = Remote device is ready, it is OK to operate the burner.
- Open = Remote device is not ready. If the heater has a call for heat, this will cause an error if not resolved within a few minutes.

Conquest 130 Gallon (500 – 800):
Model Numbers: 50 L 130A-GCML, 60 L 130A-GCML, 70 L 130A-GCML, 80 L 130A-GCML
TH Input Status: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. You can monitor the state of this input. 1 = enabled.
PROBE OUTLET: is a temperature probe in the top of the tank.
PROBE INLET: Temperature of the mid-section of the tank, this sensor controls the agitator pump.
PROBE VENT: Temperature of the Flue gasses exiting the heater.
Modulation Represents signal sent to fan motor.
PUMP1 Status: This is the agitator pump ON/OFF.
Discrete connections:
Enable/Disable: R1 – R2 (Input to heater) Closed = ENABLE.
Alarm: A1 & A2 (Output from Heater) Closed = ALARM.
Remote Equipment / Burner ON: P1 – P2 (Output from Heater) Closed – Heater is heating.
Remote Proving: C1 – C2 (Input to heater).
- Closed = Remote device is ready, it is OK to operate the burner.
- Open = Remote device is not ready. If the heater has a call for heat, this will cause an error if not resolved within a few minutes.

Power VTX:

Model Numbers: 50 L 225A-PVX, 75 L 225A-PVX, 100 L 225A-PVX

TH Input Status: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. You can monitor the state of this input. 1 = enabled.

PROBE OUTLET: is a temperature probe in the top of the tank.

PROBE INLET: Temperature of the mid-section of the tank, this sensor controls the integral tank circulator pump.

PROBE VENT: Temperature of the Flue gasses exiting the heater.

Modulation: Represent signal sent to fan motor.

PUMP1 Status: This is the agitator pump ON/OFF.

Discrete connections:

Enable/Disable: R1 – R2 (Input to heater) Closed = ENABLE.

Alarm: A1 & A2 (Output from Heater) Closed = ALARM.

Remote Equipment / Burner ON: P1 – P2 (Output from Heater) Closed – Heater is heating.

Remote Proving: C1 – C2 (Input to heater).

- Closed = Remote device is ready, it is OK to operate the burner.
- Open = Remote device is not ready. If the heater has a call for heat, this will cause an error if not resolved within a few minutes.

TURBOPOWER 96:

Model Numbers: All TURBOPOWER 96 models.

TH Input Status: Terminals R1 – R2, Jumper to enable. Heater ships with jumper on this. An external enable/disable can be attached to this. You can monitor the state of this input. 1 = enabled.

PROBE OUTLET: is a temperature probe in the top of the tank.

PROBE INLET: Temperature of the mid-section of the tank, this sensor controls the integral tank circulator pump.

PROBE VENT: Temperature of the Flue gasses exiting the heater.

Modulation: Represent signal sent to fan motor.

PUMP1 Status: This is the agitator pump ON/OFF.

Discrete connections:

Enable/Disable: R1 – R2 (Input to heater) Closed = ENABLE.

Alarm: A1 & A2 (Output from Heater) Closed = ALARM.

Remote Equipment / Burner ON: P1 – P2 (Output from Heater) Closed – Heater is heating.

Remote Proving: C1 – C2 (Input to heater).

- Closed = Remote device is ready, it is OK to operate the burner.
- Open = Remote device is not ready. If the heater has a call for heat, this will cause an error if not resolved within a few minutes.

POINTS LIST:

Normal interface will only require the TYPICAL POINTS. For future expansion and custom applications, many points are provided designated as ADVANCED POINTS and not in normal integration. Look for the points you need in the TYPICAL POINTS SECTION. See the ADVANCED POINTS if you need additional points. We are showing the MODBUS and BACNET points together.

Discovery list of points:

Below is a list pulled from a heater configured for instance number 9002.with version J1239D-570
Saved by BACnet Quick Test v6.06 for Windows 7 x64
Device-9002 EOS Controller (9002 OPERATIONAL (0)

Analog Input-0 SYSTEM STATUS		Typical
Analog Input-1 SYSTEM DEMAND		Don't use / Future
Analog Input-2 SYSTEM ALERT		Advanced
Analog Input-3 SYSTEM TARGET		Advanced
Analog Input-4 SYSTEM TEMP		Advanced
Analog Input-5 CASCADE STATUS		Don't use / Future
Analog Input-6 CASCADE INSTALLED		Don't use / Future
Analog Input-7 CASCADE TALKING		Don't use / Future
Analog Input-8 CASCADE ENABLED		Don't use / Future
Analog Input-9 CASCADE OPERATING		Don't use / Future
Analog Input-10 CASCADE LEAD		Don't use / Future
Analog Input-1000 HEATER 1 STATUS		Don't use / Future
Analog Input-1001 HEATER 1 TH		Advanced
Analog Input-1002 HEATER 1 DHW		Don't use / Future
Analog Input-1003 HEATER 1 ALERT		Typical
Analog Input-1004 HEATER 1 IGNITION		Advanced
Analog Input-1005 HEATER 1 PROBE 1		Typical
Analog Input-1006 HEATER 1 PROBE 2		Typical
Analog Input-1007 HEATER 1 PROBE 3		Typical
Analog Input-1008 HEATER 1 PROBE 4		Advanced
Analog Input-1009 HEATER 1 PROBE 5		Advanced
Analog Input-1010 HEATER 1 PROBE 6		Advanced
Analog Input-1011 HEATER 1 MOD		Advanced
Analog Input-1012 HEATER 1 RELAY 1		Advanced
Analog Input-1013 HEATER 1 RELAY 2		Advanced
Analog Input-1014 HEATER 1 EMS VOLTAGE		Advanced
Analog Input-1015 HEATER 1 CURRENT		Advanced
Analog Input-1016 HEATER 1 RUNTIME		Advanced
Analog Input-1017 HEATER 1 CYCLES		Advanced
Analog Input-1018 HEATER 1 ERROR		Typical
Analog Value-0 SYSTEM ENABLE		Advanced
Analog Value-1 BAS TARGET		Don't use / Future
Analog Value-2 SETPOINT		Typical
Analog Value-3 ROTATION		Don't use / Future
Analog Value-1000 HEATER 1 ENABLE		Typical
Analog Value-1001 HEATER 1 DRIVE 1		Advanced
Analog Value-1002 HEATER 1 DRIVE 2		Advanced

DETAILS OF WATER HEATER POINTS:

The point list covers all reported points, many are not intended to be used with Water Heaters. Do not use the CASCADE or BOILER points. In the short description we have noted if it is a (T) Typical Point, (A) Advanced Point, (X) Don't Use point.

Key:

Use this key for reference of the below points. MODBUS Address is shown in 5 digit format. Six digit addressing is also valid. The Modbus Offset is valid for either 5 & 6 digit addresses.

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

The points that are typically used to interface with the heater.

DETAILS OF WATER HEATER TYPICAL POINTS:

System STATUS	Read Only (AI)	(T) Current system status	
MODBUS	Input Register	0	30001
BACNET	SYSTEM STATUS	0	
Note: 0 = Disabled, 1 = Idle, 2 = Heating Does not report errors, lockout is Idle.			

SYSTEM DEMAND	Read Only (AI)	(X) External enable, 1=ON, 0=OFF	
MOBUS	Input Register	1	30002
BACNET	SYSTEM DEMAN	1	
Note: DO NOT USE.			

System ALERT	Read Only (AI)	(A) System Alert 1=Alert, 2=Error	
MODBUS	Input Register	2	30003
BACNET	SYSTEM ALERT	2	
Note: System Alert, 0 = Off (System is operating normally), 1 = Alert (There is an issues with the system, but heating is continuing), 2 = Error (There is an issue with the system, and heating has been stopped).			

System TARGET	Read Only (AI)	(A) System Target	
MODBUS	Input Register	3	30004
BACNET	SYSTEM TARGET	3	Deg-F
Note: System Target is the actual target being used, Useful when features that affect setpoint are implemented.			

System Temperature	Read Only (AI)	(A) System Temperature	
MODBUS	Input Register	4	30005
BACNET	SYSTEM TEMP	4	Deg-F
Note: This will show the value of the operating sensor.			

System Temperature	Read Only (AI)	(X) CASCADE SYSTEM STATUS	
MODBUS	Input Register	4	30005
BACNET	SYSTEM TEMP	4	Deg-F
NOT IMPLAMENTED FOR WATER HEATERS **Note**: System Temperature, typically this is the SYSTEM PROBE on the MASTER boiler.			

DETAILS OF WATER HEATER TYPICAL POINTS:

CASCADE STATUS	Read Only (AI)	(X) System CASCADE Status	
MODBUS	Input Register	5	30006
BACNET	CASCADE STATUS	5	
NOT IMPLEMENTED FOR WATER HEATERS			
Note: Status of Cascade communication. 0 = Standalone, 1 = Working, 2 = Not All Talking, 3 = No Connection			

CASCADE INSTALLED	Read Only (AI)	(X) System Boiler Count	
MODBUS	Input Register	6	30007
BACNET	CASCADE INSTALLED	6	
NOT IMPLAMENTED FOR WATER HEATERS			
Note: Number of boilers configured to be present in Master.			

CASCADE TALKING	Read Only (AI)	(X) Number in CASCADE talking	
MODBUS	Input Register	7	30008
BACNET	CASCADE TALKING	7	
ALWAYS 1 FOR WATER HEATERS			
Note: Number of boilers talking on cascade network.			

CASCADE ENABLED	Read Only (AI)	(X) System Enabled Count	
MODBUS	Input Register	8	30009
BACNET	CASCADE ENABLED	8	
1 OR 0 FOR WATER HEATER			
Note: Total number of enabled Boilers in the system.			

CASCADE OPERATING	Read Only (AI)	(X) System CASCADE Mod Boiler	
MODBUS	Input Register	9	30010
BACNET	CASCADE OPERATING	9	
NOT IMPLAMENTED FOR WATER HEATERS			
Note: The Boiler currently being modulated.			

CASCADE LEAD	Read Only (AI)	(X) System CASCADE Lead Boiler #	
MODBUS	Input Register	10	30011
BACNET	CASCADE LEAD	10	
ALWAYS 1 FOR WATER HEATER			
Note: Current lead boiler #.			

HEATER # TALKING	Read Only (AI)	(X) Boiler CASCADE COM status	
MODBUS	Input Register	1000	31001
BACNET	HEATER # STATUS	1000	
NOT USED FOR WATER HEATERS			
Note: Communication status of boiler. 0 = No Communication, 1 = Communicating, 2 = Lost Communication. If not "1" then all other boiler points are not valid.			

TH Input Status	Read Only (AI)	(X) External enable, 1=ON, 0=OFF	
MOBUS	Input Register	1001	31002
BACNET	HEATER 1 TH	1001	
Note: Status of TH input J2-9. If open (0) then this heater is externally disabled. If closed (1) this heater is enabled. This is typically going to the R1 & R2 terminals.			

DETAILS OF WATER HEATER TYPICAL POINTS:

HEATER DHW Input	Read Only (AI)	(X) External DHW input, 1=ON, 0=OFF	
MOBUS	Input Register	1002	31003
BACNET	HEATER # DHW CALL	1002	
NOT USE FOR WATER HEATERS			
Note: Status of input J1-8 used with DHW feature.			

Alert Status	Read Only (AI)	(T) Alert Status 0=ok, 1=Alert, 2=Soft, 3=Hard	
MODBUS	Input Register	1003	31004
BACNET	HEATER 1 ALERT	1003	
Note: 0 = None (Heater is fully functional), 1 = Alert (BTCII has a local error), 2 = Auto (PIM1 is in a soft lockout and will reset itself after the specified timeout period), 3 = Manual (PIM1 is in a hard lockout and must be manually reset).			

IGNITION Status	Read Only (AI)	(A) Ignition 0=Idle 3=Burn 5=Fail	
MODBUS	Input Register	1004	31005
BACNET	HEATER 1 IGNITION	1004	
Note: This goes through the cycle of the burner. 0=IDLE, 1=PREPurge, 2=IGNition, 3=BURNer ON, 4=postPURG, 5=FAIL			

PROBE OUTLET	Read Only (AI)	(T) Top of Tank Temperature	
MOBUS	Input Register	1005	31006
BACNET	HEATER 1 PROBE 1	1005	Deg-F
Note: Probe at outlet of the heater J7-4 sensor, This probe has a 2nd sensor used as a limit.			

PROBE INLET	Read Only (AI)	(T) Top of Tank Temperature	
MOBUS	Input Register	1006	31007
BACNET	HEATER 1 PROBE 2	1006	Deg-F
Note: Typically installed mid tank. Terminal J9-1.			

PROBE VENT	Read Only (AI)	(T) Flue Temperature	
MOBUS	Input Register	1007	31008
BACNET	HEATER 1 PROBE 3	1007	Deg-F
Note: Typically this will be installed in the flue venting. Terminal J9-2.			

PROBE 4	Read Only (AI)	(A) PROBE 4	
MOBUS	Input Register	1008	31009
BACNET	HEATER 1 PROBE 4	1008	Deg-F
Note: Probe 4 not used with Water Heaters, J2-1/2 (DHW sensor) Future Expansion.			

PROBE 5	Read Only (AI)	(A) PROBE 5	
MOBUS	Input Register	1009	31010
BACNET	HEATER 1 PROBE 5	1009	Deg-F
Note: Probe 5 not used with Water Heaters, J2-3/4 (SUPPLY sensor) Future Expansion.			

PROBE 6	Read Only (AI)	(A) PROBE 6	
MOBUS	Input Register	1010	31011
BACNET	HEATER 1 PROBE 6	1010	Deg-F
Note: Probe 6 not used with Water Heaters, J2-5/6 (OUTDOOR sensor) Future Expansion.			

DETAILS OF WATER HEATER TYPICAL POINTS:

Modulation	Read Only (AI)	(A) Rate between 0-100 to represent modulation	
MODBUS	Input Register	1011	31012
BACNET	HEATER 1 MOD	1011	PERCENT
Note: Modulation rate 0-100%. Actual range is MIN MOD to MAX MOD located in the SOURCE / MENU. Low Fire = MIN MOD, High Fire = MAX MOD			

PUMP2 Status	Read Only (AI)	(A) Pump Status ON/OFF	
MODBUS	Input Register	1012	31013
BACNET	HEATER 1 RELAY 1	1012	
Note: Relay status. J14-1.(J14-5 Common) Typically 1= ON, 0 =OFF (Typically SANI).			

PUMP1 Status	Read Only (AI)	(A) Pump Status ON/OFF	
MODBUS	Input Register	1013	31014
BACNET	HEATER 1 RELAY 2	1013	
Note: Relay status. J14-2.(J14-5 Common) Typically 1= ON, 0 =OFF (Typically heater pump).			

EMS VOLTAGE	Read Only (AI)	(A) EMS Analog Voltage	
MOBUS	Input Register	1014	31015
BACNET	HEATER 1 EMS VOLTAGE	1014	Deg-F
Note: Analog input for PIM module J1-8/9, not implemented, for future expansion.			

Flame Current	Read Only (AI)	(A) Flame Current for proof of flame	
MODBUS	Input Register	1015	31016
BACNET	HEATER 1 CURRENT	1015	MILLIAMPERES
Note: Returns a number that represents approximate flame current. Flame current is used to verify a flame is present, or loss of flame. $10 = 1\mu A$, or 0.000001 Amps, $40 = 4\mu A$, or 0.000004 Amps. This is a rough approximation, not as accurate as an actual Micro Amp (uA) measurement. Unit type reported in BACNET is not correct, but BACNET does not have units for micro Amps.			

Burner Runtime	Read Only (AI)	(A) Burner Runtime Hours 0-65535	
MODBUS	Input Register	1016	31017
BACNET	HEATER 1 RUNTIME	1016	HOUR
Note: Number of hours the burner has been enabled. Once it reaches 65536 it rolls to zero. (65535 hours is about 7 ½ years of burner enabled time) Unsigned 16 bit integer.			

Burner Cycles	Read Only (AI)	(A) Number of burner cycles 0-65535	
MODBUS	Input Register	1017	31018
BACNET	HEAER 1 CYCLES	1017	
Note: Each time the control attempts to start the burner, this counter is incremented. Once the counter reaches 65535, it will roll over to zero on next attempt.			

Error Status	Read Only (AI)	(T) Current Error Code	
MODBUS	Input Register	1018	31019
BACNET	HEATER 1 ERROR	1018	
Note: Error code for the latest error. See error code list. 0 = No Error.			

DETAILS OF WATER HEATER TYPICAL POINTS:

SYSTEM ENABLE	Read/Write (AV)	(A) System Enable 1 = ENABLED, 0 = DISABLED	
MODBUS	Holding Register	0	40001
BACNET	SYSTEM ENABLE	0	
Note: This is a separate HEATER 1 ENABLE, represented in the SOURCE / MENU. This is located in the SETUP / MENU.			

BAS SETPOINT	Read/Write (AV)	(X) Setpoint from BAS system.	
MODBUS	Holding Register	1	40002
BACNET	BAS TARGET	1	Deg-F
NOT USED FOR WATER HEATERS			
Note: This setpoint is valid when not zero. If non-zero, it overrides SETPOINT. It is reset to zero when power is cycles. Purpose is to allow disconnect of BAS and cycle power on MASTER to allow setpoint control from the touch panel.			

SETPOINT	Read/Write (AV)	(T) Enable Heater 1=on 0 = off	
MODBUS	Holding Register	2	40003
BACNET	SETPOINT	2	Deg-F
Note: Setpoint for the heater. Write to this point to change the setpoint. Can be viewed at display VIEW>SETPOINT. Can be changed at display SETUP/MENU>SETPOINT(HTR).			

HEATER ENABLE	Read/Write (AV)	(T) Water Heater Enable / Disable	
MODBUS	Holding Register	1000	41001
BACNET	HEATER 1 ENABLE	1000	
Note: This is the ENABLE / DISABLE for the heaters ENABLE = 1, DISABLE = 0, Can be changed at the display: SOURCE/MENU>ENABLE(HTR) ON / OFF.			

PUMP2	Read/Write (AV)	(A) Force ON DHW/SANI Pump	
MODBUS	Holding Register	1001	41002
BACNET	HEATER 1 DRIVE 2	1001	
Note: Auto or FORCE ON output J14-1/5 Relay (DHW / SANI) PUMP. 0 = AUTO, 1 = FORCE ON.			

PUMP1	Read/Write (AV)	(A) Force ON HEATER PUMP	
MODBUS	Holding Register	1002	41003
BACNET	HEATER 1 DRIVE 1	1002	
Note: Auto or FORCE ON output J14-2/5 Relay HEATER PUMP. 0 = AUTO, 1 = FORCE ON.			

LIST OF ERRORS

Error Codes		
ERROR CODES:		
Code	Description	
0	No Error	
Control Display Errors (Errors generated from the control touch screen interface module)		
1	EEPROM	4 DHW Sensor
2	Outdoor Sensor	5 Software Error
3	Supply Sensor	6 FTBus Communication
PIM Errors (Errors generated by the PIM module)		
7	LWCO	17 Vent Hi-Limit
8	Remote Proving	18 Tank Hi-Limit
9	Air Pressure	19 False Flame
10	Low Gas Pressure	20 OEM Card
11	Outlet/Tank Top Sensor	21 Internal Failure
12	Inlet/Tank Bottom (mid) Sensor	22 Hi-Delta
13	Vent Sensor	23 Low HSI
14	Hi-Limit Sensor	24 Low Voltage
15	Ignition Failure	25 Blower Speed
16	Flame Loss	26 High Gas Pressure
tN4 Errors (Related to the communication links between multiple heaters in a linked system)		
27	Master Lost	30 Device Error
28	Device Lost	31 Version Error
29	Device Duplicate	