Building Automation System Plumbing Integrations

Presented by
Brendan Cox, Siemens
Jason Nelson, Tekmar Control Systems Ltd.
Thad Rice, New England Sale Group
Bianca Greene – Area Sales Manager Northeast
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ASPE American Society of Plumbing Engineers CONNECTICUT

ASHRAE Connecticut Chapter

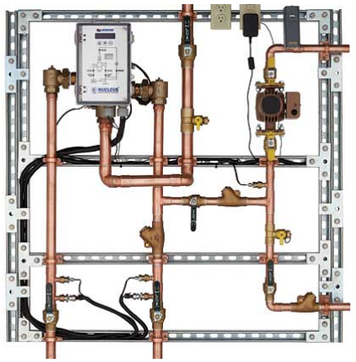
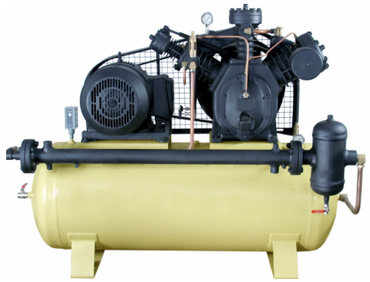
Defining a Building Automation System (BAS)

Building Automation System

A built combination of electronic hardware, instrumentation, low-voltage cabling, data, and software that control and monitor a building's systems to keep the building functioning optimally, and ensure occupant comfort, health, and safety.

Division 23 → **Division 25**

Potentially Integrated Plumbing Equipment

Equipment	Example integration points	Advantages
Water heaters 	• Tank temperatures • Temperature setpoint • Burner/heater hours • On/off command • Unit status • Solar collector status • Flow rate • kW/kWh usage/total • Circulator start/stop • Circulator status • Cleaning mode enable/times	• Temp, flow, power values can be trended and enable predictive maintenance
Mixing valve packages 	• Mixed outlet temperature • Valve position • Mixed outlet high/low temperature • High/low temperature differential • High/low temperature alert counts • Error code or specific alarm cause	• Granular visibility into system operation and data points – no costly multipoint connections required
Pumps, compressors heat trace, oil/water separators … 	• Varies depending on equipment	• More equipment on the BAS “front end” means more insight into building and more predictable maintenance schedule

Digital Mixing Valve / Station

Jason Nelson, Tekmar
Control Systems Ltd.

Integration into BMS

Physical Layer

- RS485
- Ethernet (RJ45)

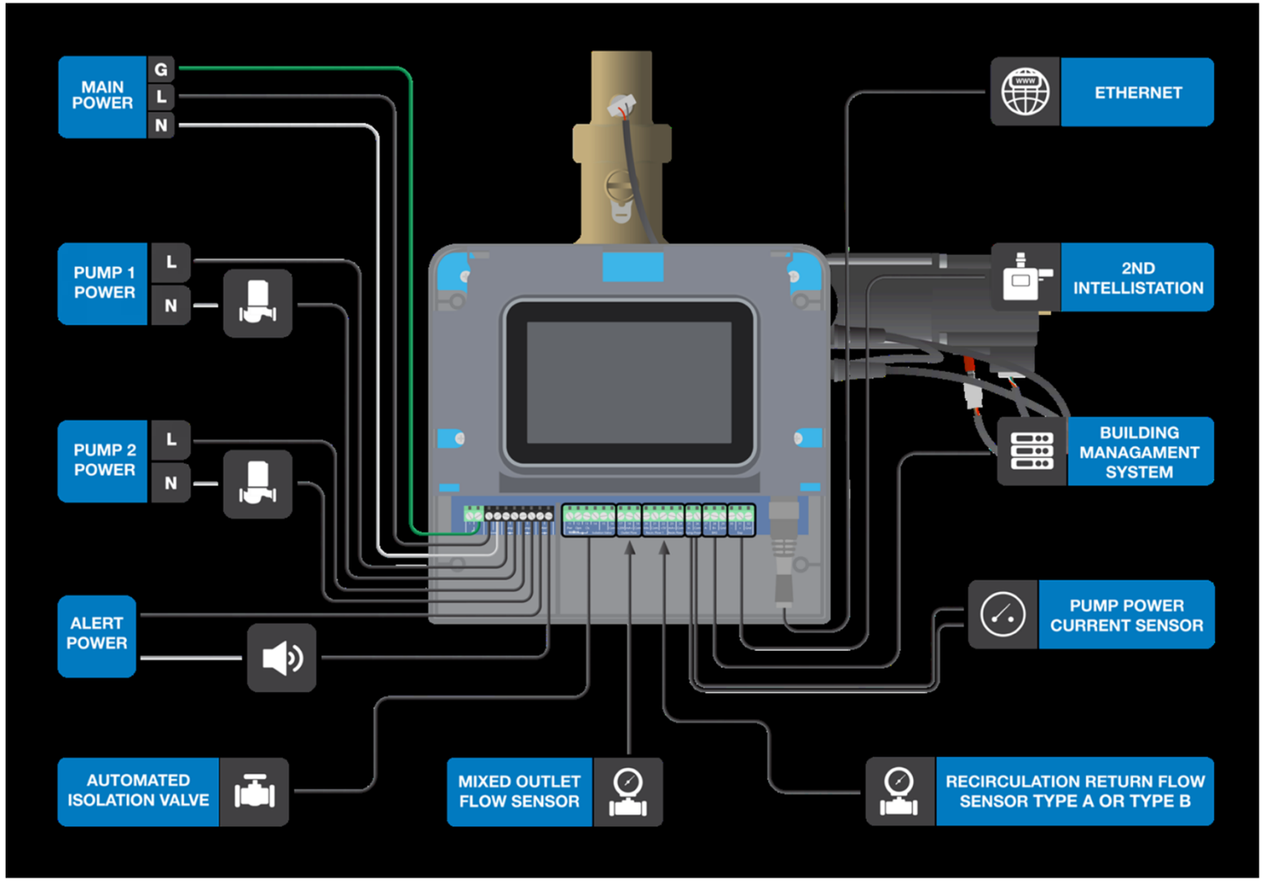
Protocols Directly Supported

- Modbus RTU
- BACnet MS/TP
- BACnet IP

How to support other protocols?

- LonTalk, JCI Metasys N2, etc.
- Interface a gateway

Monitoring Points



Inputs / Sensors
- Temperature
- Pressure
- Flow

Outputs
- Pumps
- Mixing Valve
- Isolation Valve

Calculated / Status
- Energy Usage
- Error Codes
- Product Information

BAS Monitoring Benefits

- Increase energy efficiency, allowing for cost savings
- Remote access capability, allowing for efficient facility management
  - Enable proactive measures preventing downtime
- Enhance safety through real time monitoring
  - Potential hazards can be detected in advance
- Improved occupant comfort and productivity
- Support long-term data storage for documenting and monitoring system performance
- Automate building temperatures to work on specific schedules and in specific ranges
- Elimination of redundant accessories (e.g. Tridicator)
  - Cost / labor savings

Modbus Registers

Modbus Registers

Read = R Read/Write = R/W

System Status Registers

Register	Parameter Name	Read/Write	Units	Type	Format	Range
0	Mixed Outlet Temperature	R	°F	Input	U16	-31 to 266
1	Recirc Return Temperature	R	°F	Input	U16	32 to 212
2	Hot Inlet Temperature	R	°F	Input	U16	32 to 212
3	Cold Inlet Temperature	R	°F	Input	U16	32 to 212
4	Mixed Outlet Pressure	R	PSI x 10	Input	U16	0 to 232 PSI
5	Recirc Return Pressure	R	PSI x 10	Input	U16	0 to 232 PSI
6	Hot Inlet Pressure	R	PSI x 10	Input	U16	0 to 232 PSI
7	Cold Inlet Pressure	R	PSI x 10	Input	U16	0 to 232 PSI
8	Mixed Outlet Flow	R	GPM	Input	U16	0 to 1000
9	Recirc Return Flow	R	GPM	Input	U16	0 to 1000
10	Remote Setpoint Max	R	°F	Input	U16	60 to 180
11	Valve Position	R	%	Input	U16	0 to 100
12	Energy Usage	R	Therms	Input	U16	0 to 65535
13	Pump 1 Status	R	N/A	Input	U16	0=Off, 1=On
14	Pump 2 Status	R	N/A	Input	U16	0=Off, 1=On
15	Isolation Valve Status	R	N/A	Input	U16	0=Closed, 1=Open
16	Error Code	R	Enum	Input	U16	See error code list

System Parameter Register

Register	Parameter Name	Read/Write	Units	Type	Format	Range
0	Mixed Outlet Setpoint	R/W	°F	Holding	U16	60 to Remote Setpoint Max

Product Information

Register	Parameter Name	Read/Write	Units	Type	Format	Range
1	Model	R	Num	Input	U16	Product model "116401"
2	Firmware Revision	R	Num	Input	U16	SV revision

BACnet Objects

BACnet Objects

BACnet Analog Parameters

Analog Input Object = AI Analog Value Object = AV Read = R Read/Write = R/W

Analog Input Objects

ID	Data Type	Name	Description	Read/ Write	Units	Range / Value
0	AI	Mixed Outlet Temperature	Mixed Outlet Temperature	R	°F	-31 to 266
1	AI	Recirc Return Temperature	Recirculation Return Temperature	R	°F	32 to 212
2	AI	Hot Inlet Temperature	Hot Inlet Temperature	R	°F	32 to 212
3	AI	Cold Inlet Temperature	Cold Inlet Temperature	R	°F	32 to 212
4	AI	Mixed Outlet Pressure	Mixed Outlet Pressure	R	PSI	0 to 232
5	AI	Recirc Return Pressure	Recirculation Return Pressure	R	PSI	0 to 232
6	AI	Hot Inlet Pressure	Hot Inlet Pressure	R	PSI	0 to 232
7	AI	Cold Inlet Pressure	Cold Inlet Pressure	R	PSI	0 to 232
8	AI	Mixed Outlet Flow	Mixed Outlet Flow	R	GPM	0 to 1000
9	AI	Recirc Return Flow	Recirculation Return Flow	R	GPM	0 to 1000
10	AI	Remote Setpoint Max	Mixed Outlet Target	R	°F	60 to 180
11	AI	Valve Position	Valve Position	R	%	0 to 100
12	AI	Energy Usage	Totalized Energy	R	Therms	0 to 65535
13	AI	Error Code	Error or Alert Code	R	Enum	See error code list

Analog Value Objects

ID	Data Type	Name	Description	Read/ Write	Units	Range / Value
0	AV	Mixed Outlet Setpoint	Mixed Outlet Setpoint	R/W	°F	60 to Remote Setpoint Max

BACnet Binary Parameters

ID	Data Type	Name	Description	Read/ Write	Units	Range / Value
0	BI	Recirc Pump 1	Recirculation Pump 1 Status	R	N/A	0=Off, 1=On
1	BI	Recirc Pump 2	Recirculation Pump 2 Status	R	N/A	0=Off, 1=On
2	BI	Isolation Valve	Isolation Valve Status	R	N/A	0=Closed, 1=Open

Modbus / BACnet Error Codes

Error/Alert Codes

Code	Description
1	Control Memory Error
2	Hardware Fault
3	Firmware Fault
4	Configuration Fault
5	Mixed Outlet Sensor Short Error
6	Mixed Outlet Sensor Open Error
7	Outlet Sensor Lost Error
8	Outlet Temperature Error
9	Outlet Pressure Error
10	Hot Inlet Sensor Lost Error
11	Hot Inlet Temperature Error
12	Hot Inlet Pressure Error
13	Cold Inlet Sensor Lost Error
14	Cold Inlet Temperature Error
15	Cold Inlet Pressure Error
16	Recirc Return Sensor Lost Error
17	Recirc Return Temperature Error
18	Recirc Return Pressure Error
19	Mixed Outlet Flow Error
20	Recirc Return Flow Error
21	Expansion Valve Control Lost Error
22	Modbus Network Error
23	BACnet MS/TP Network Error

Code	Description
24	Ethernet Disconnected Error
25	Wi-Fi Disconnected Error
26	Wi-Fi Invalid Password Error
27	DHCP Address Error
28	Internet Unavailable Error
29	Nexa Error
30	Mixed Outlet High Temp Alert
31	Mixed Outlet Low Temp Alert
32	Hot Inlet High Temp Alert
33	Hot Inlet Low Temp Alert
34	Hot Inlet High Pressure Alert
35	Hot Inlet Low Pressure Alert
36	Cold Inlet High Pressure Alert
37	Cold Inlet Low Pressure Alert
38	Inlet Pressure Differential Alert
39	Encoder Error
40	Stall Detected (Hot) Error
41	Stall Detected (Cold) Error
42	Pump 1 Flow Proof Error
43	Pump 2 Flow Proof Error
44	Pump 1 & 2 Flow Proof Error
45	Pump False Flow Error
46	Isolation Valve End Switch Error

Smart Pump Technology

Ron Sloane,
Armstrong Pump

Integrated Variable Speed Drive with Onboard Controls and Permanent Magnet Motors (DEPM)

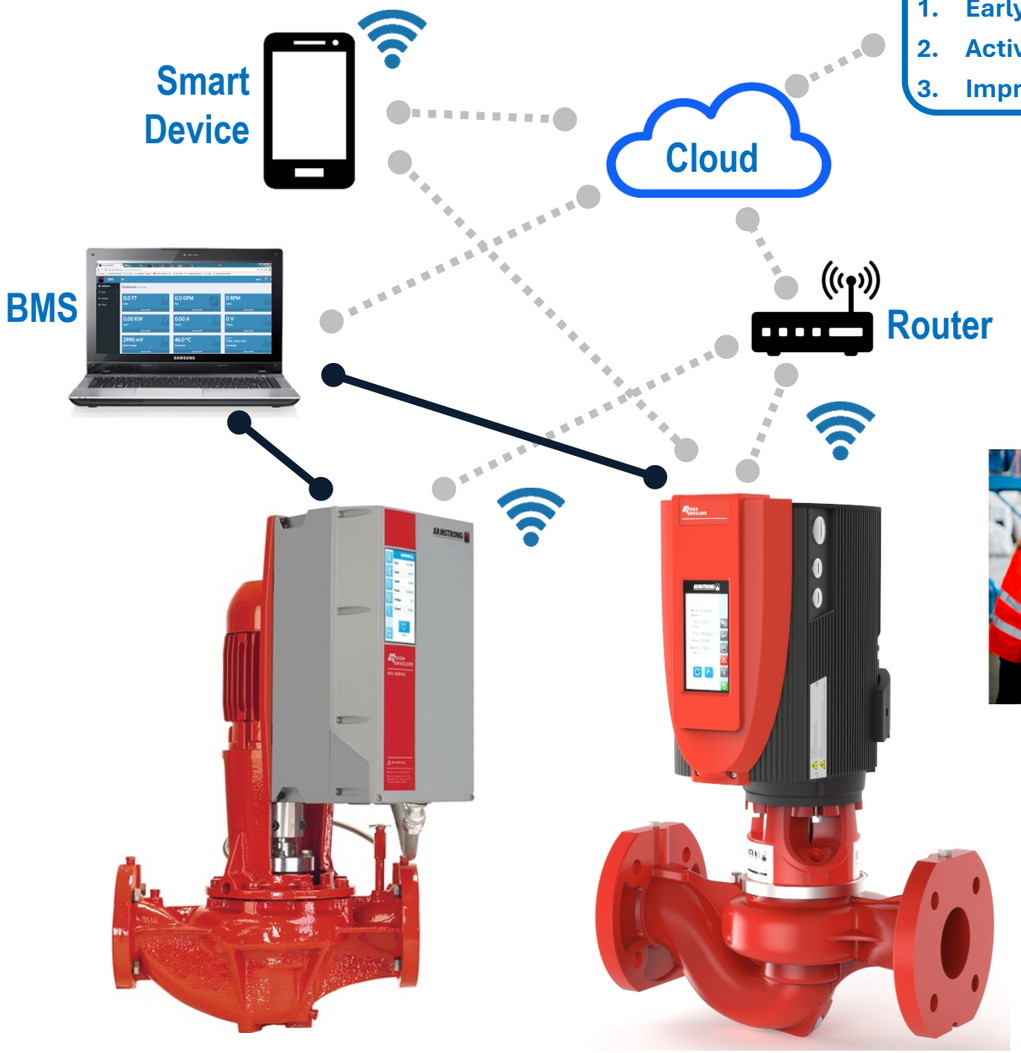
Preprogrammed Sensorless Technology, Wireless Connectivity, and BAS Integration

Flow
Head
Power
Speed

Advantage - Smart Pump Connectivity

Performance Management Services

1. Early detection & warnings
2. Active, real-time management
3. Improved response time



Real Time Flow, Head & Power Tracking

Real Time Vibration Tracking

Aggregated Flow Profiles

Advantage – Savings, Savings, Savings

Criteria	Existing Pump	DEPM IVS	Savings
Power consumption	1.66 kW	0.66 kW	**~60% reduction**
Weight	670 lbs	347 lbs	**~48% reduction**
Installed Power	20hp	15hp	**5 hp reduction (1 power size)**

8 Preprogrammed Control Modes!!

Controls and BMS

Controls

BMS Connectivity Capabilities

8 Preprogrammed Control Modes!!

Constant Flow

Linear Pressure Control

Quadratic Control

Quadratic Control w/ Min Flow

BACnet MS/TP, BACne… Modbus RTU, Modbus …

Quadratic Control w/ Max Flow

21 Writab… Points

Quadratic Control w/ Min and Max Flow

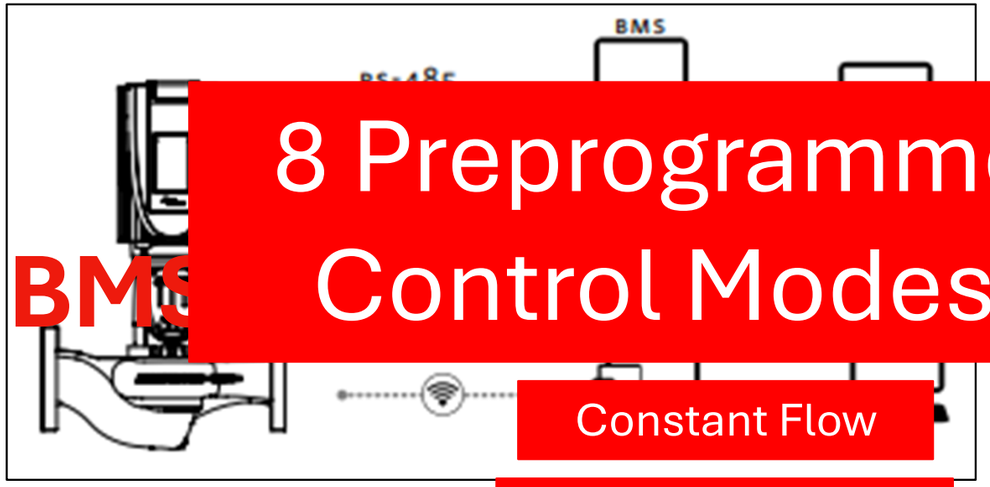
Parallel Sensorless Best Efficiency Control

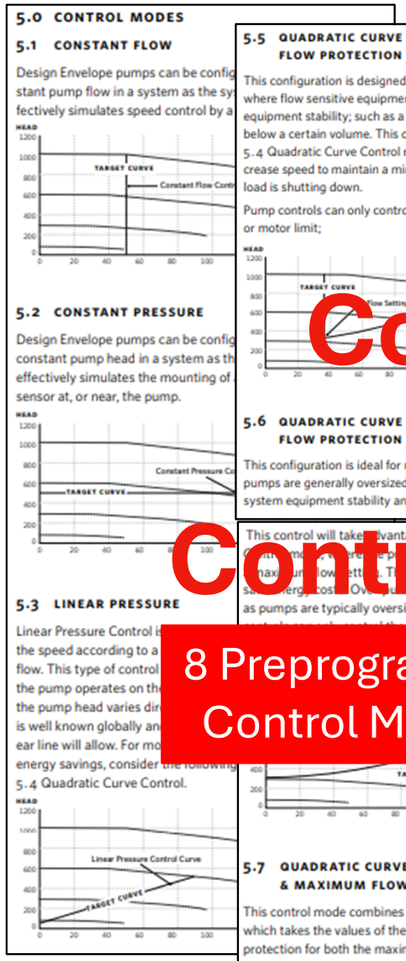
…igital Inputs & …utputs

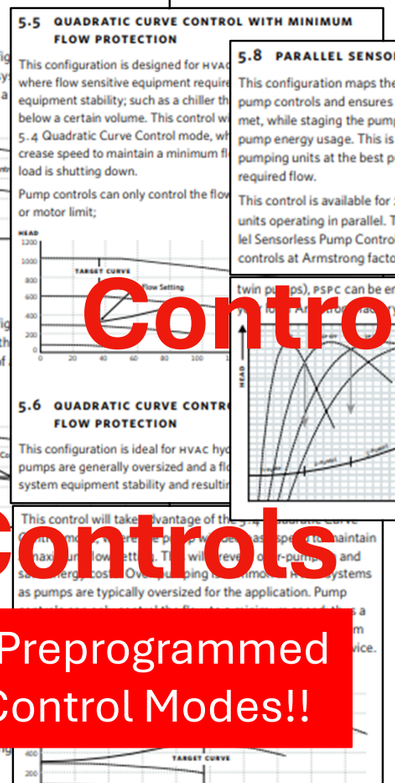
…et, Can Bus, …485, Web …terface

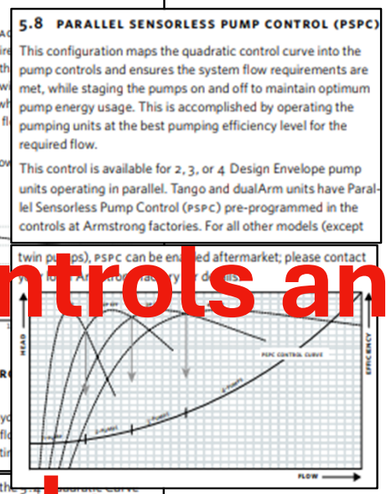
…ities

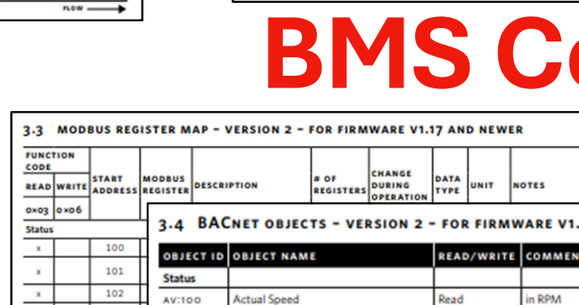
…ump creates a unique wifi signal

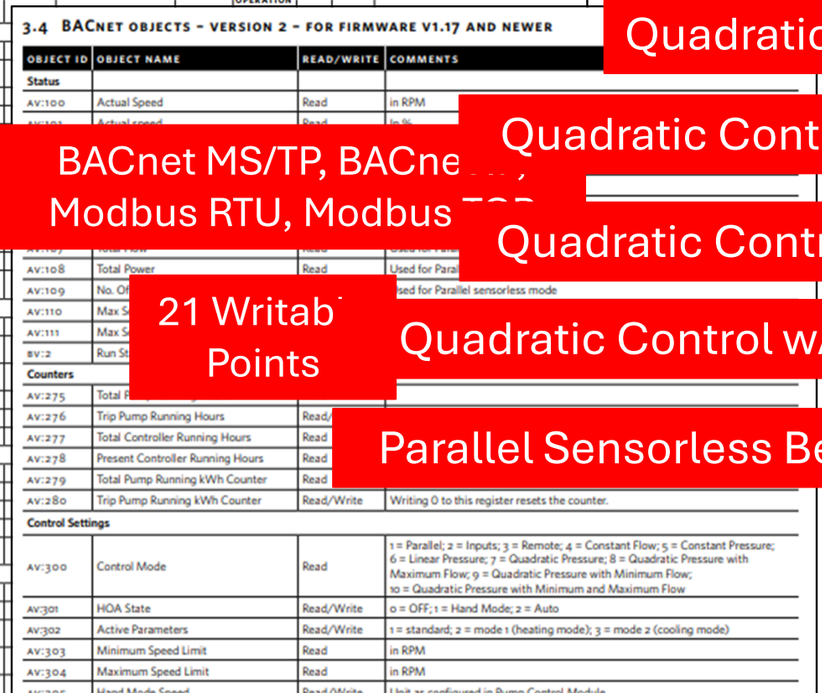


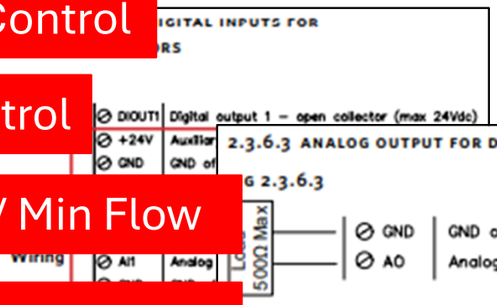


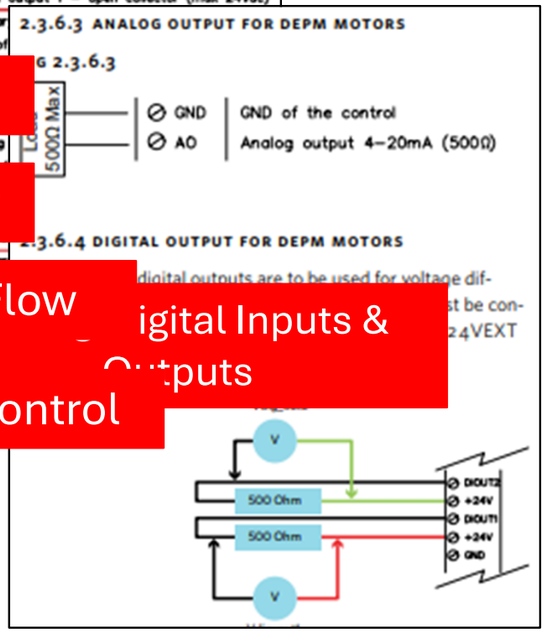


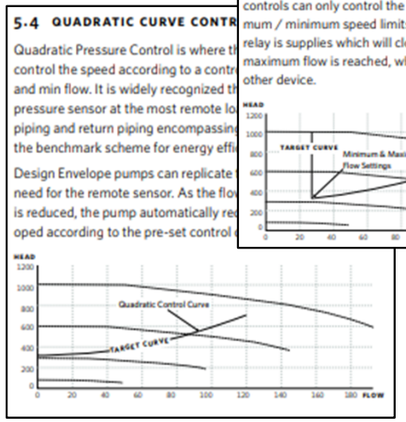












BACnet objects – version 2 – for firmware v1.17 and newer

3.4 BACnet objects – version 2 – for firmware v1.17 and newer

OBJECT ID	OBJECT NAME	READ/WRITE	COMMENTS
Status			
AV:100	Actual Speed	Read	in RPM
AV:101	Actual speed	Read	In %
AV:102	Motor Power	Read	Unit as configured in Pump Control Module
AV:103	Motor Input Voltage	Read	In Volts
AV:104	Motor Input Current	Read	In Amps
AV:105	Sensorless Head	Read	Unit as configured in Pump Control Module
AV:106	Sensorless Flow	Read	Unit as configured in Pump Control Module
AV:107	Total Flow	Read	Used for Parallel sensorless mode
AV:108	Total Power	Read	Used for Parallel sensorless mode
AV:109	No. Of Running Pumps	Read	Used for Parallel sensorless mode
AV:110	Max Sensorless Flow	Read	Unit as configured in Pump Control Module
AV:111	Max Sensorless Head	Read	Unit as configured in Pump Control Module
BV:2	Run Status	Read	1 → pump is running
Counters			
AV:275	Total Pump Running Hours	Read	
AV:276	Trip Pump Running Hours	Read/Write	Writing 0 to this register resets the counter.
AV:277	Total Controller Running Hours	Read	
AV:278	Present Controller Running Hours	Read	The running hours since the controller was powered on.
AV:279	Total Pump Running kWh Counter	Read	
AV:280	Trip Pump Running kWh Counter	Read/Write	Writing 0 to this register resets the counter.
Control Settings			
AV:300	Control Mode	Read	1 = Parallel; 2 = Inputs; 3 = Remote; 4 = Constant Flow; 5 = Constant Pressu 6 = Linear Pressure; 7 = Quadratic Pressure; 8 = Quadratic Pressure with Maximum Flow; 9 = Quadratic Pressure with Minimum Flow; 10 = Quadratic Pressure with Minimum and Maximum Flow
AV:301	HOA State	Read/Write	0 = OFF; 1 = Hand Mode; 2 = Auto
AV:302	Active Parameters	Read/Write	1 = standard; 2 = mode 1 (heating mode); 3 = mode 2 (cooling mode)
AV:303	Minimum Speed Limit	Read	in RPM
AV:304	Maximum Speed Limit	Read	in RPM
AV:305	Hand Mode Speed	Read/Write	Unit as configured in Pump Control Module.
AV:306	BMS Set Speed	Read/Write	Unit as configured in Pump Control Module.
BV:14	Start/Stop	Read/Write	Start/stop of pump

OBJECT ID	OBJECT NAME	READ/WRITE	COMMENTS
Alarms and Warnings			
AV:400	Alarms	Read	Refer to Alarms Table for Bit Positions
AV:401	Warnings	Read	Refer to Warnings Table for Bit Positions
AV:402	Acknowledge Warnings	Read/Write	32-bit field corresponding to the warning field
Parameters			
AV:500	Standard Mode - Zero Flow Head	Read/Write	Value for standard active mode. Unit as configured in Pump Control Module
AV:501	Standard Mode - Design Head	Read/Write	Value for standard active mode. Unit as configured in Pump Control Module
AV:502	Standard Mode - Design Flow	Read/Write	Value for standard active mode. Unit as configured in Pump Control Module
AV:503	Standard Mode - Minimum Flow	Read/Write	Value for standard active mode. Unit as configured in Pump Control Module
AV:504	Mode 1 - Zero Flow Head	Read/Write	Value for active mode 1. Unit as configured in Pump Control Module
AV:505	Mode 1 - Design Head	Read/Write	Value for active mode 1. Unit as configured in Pump Control Module
AV:506	Mode 1 - Design Flow	Read/Write	Value for active mode 1. Unit as configured in Pump Control Module
AV:507	Mode 1 - Minimum Flow	Read/Write	Value for active mode 1. Unit as configured in Pump Control Module
AV:508	Mode 2 - Zero Flow Head	Read/Write	Value for active mode 2. Unit as configured in Pump Control Module
AV:509	Mode 2 - Design Head	Read/Write	Value for active mode 2. Unit as configured in Pump Control Module
AV:510	Mode 2 - Design Flow	Read/Write	Value for active mode 2. Unit as configured in Pump Control Module
AV:511	Mode 2 - Minimum Flow	Read/Write	Value for active mode 2. Unit as configured in Pump Control Module
AV:520	Control Setpoint	Read/Write	Value and unit as configured on pump control mode (constant pressure or constant flow)
INFORMATION			
AV:900	BMS BACnet Version	Read	Version of the Armstrong BACnet points used.
I/O			
AI:0	Analog In 1	Read	As configured in Pump Control Module
AI:1	Analog In 2	Read	As configured in Pump Control Module
AV:113	Analog Out 1	Read	As configured in Pump Control Module
BI:0	Digital In 1	Read	As configured in Pump Control Module
BI:1	Digital In 2	Read	As configured in Pump Control Module
BV:15	Digital Out 1	Read	As configured in Pump Control Module
BV:16	Digital Out 2	Read	As configured in Pump Control Module
BV:0	Relay 1	Read	As configured in Pump Control Module
BV:1	Relay 2	Read	As configured in Pump Control Module

Alarms & Warnings

7.1 ALARM SUMMARY FOR INTERFACES

ALARM NUMBER	NAME	ALARM DESCRIPTION
1	VSD over temperature	The temperature of a VSD or motor component is exceeding the thermal alarm limit. Turn off the power to the pump and verify that the motor, fan and VSD cooling is functioning correctly. Verify that the pump is not overloaded. Wait until hot components have cooled before returning to service and if the alarm persists after powering up contact an Armstrong Technical Service representative.
2	VSD over current	The VSD has detected current exceeding the safe limit. Turn the pump off. (If there is a discharge from the output phases to earth it can be verified by checking for any faults with a megohmmeter between ground and the motor leads). If a current limit has been exceeded in the VSD check that the motor can be turned. If the pump is being overloaded reduce the pump speed using hand mode control. If the alarm persists after powering up contact an Armstrong Technical Service representative.
3	External VSD voltage	The voltage into the VSD is out of range. Verify that the correct voltage required to operate the VSD is present by measuring each of the 3 phases. If the alarm persists after cycling power to the pump, contact an Armstrong Technical Service representative.
4	Internal VSD voltage	An internal voltage generated by VSD is out of range. If the alarm persists after cycling power to the pump, contact an Armstrong Technical Service representative.
5	Internal VSD	An internal error in the VSD has occurred. If the alarm persists after cycling power to the pump, contact an Armstrong Technical Service representative.
6	VSD parameter	One or more of the parameters to control the VSD are not correct. Check the settings on the control card. If the alarm persists after cycling power to the pump, contact an Armstrong Technical Service representative.
7	VSD startup	An error occurred during the startup of the motor. Turn off the power to the pump and verify that the motor can be turned by using hand mode control. If the alarm persists after powering up contact an Armstrong Technical Service representative.
8	Other VSD	There has been an unknown alarm condition generated by the VSD. If the alarm persists after cycling power to the pump, contact an Armstrong Technical Service representative.
9	VSD communication	There is a communication issue between the control card and VSD. Turn off the power to the pump and check the connections between the control card and the VSD.
10	VSD speed	The speed set by the VSD is not within tolerance. If the alarm persists after cycling power to the pump, contact an Armstrong Technical Service representative.
11	VSD initialization failure	The control card was not able to receive the initial parameters correctly. Please try to restart the pump. If the alarm persists after restart, contact an Armstrong Technical Service representative.

7.2 WARNING SUMMARY FOR INTERFACES

WARNING NUMBER	NAME	WARNING DESCRIPTION
1	VSD over temperature	The temperature of a VSD or motor component is near the thermal warning limit. Check that the motor, fan and VSD cooling is functioning correctly. Verify that the pump is not overloaded. If the warning persists, contact an Armstrong Technical Service representative.
2	VSD over current	The VSD has detected current exceeding the warning limit. Turn the pump off. (If there is a discharge from the output phases to earth it can be verified by checking for any faults with a megohmmeter between ground and the motor leads.) If a current limit has been exceeded in the VSD check that the motor can be turned. If the pump is being overloaded reduce the pump speed using hand mode control. If the warning persists after powering up contact an Armstrong Technical Service representative.
3	External VSD voltage	The voltage into the VSD is out of range. Verify that the correct voltage required to operate the VSD is present by measuring each of the 3 phases. If the warning persists, contact an Armstrong Technical Service representative.
4	Internal VSD voltage	An internal voltage generated by VSD is out of range. If the warning persists, contact an Armstrong Technical Service representative.
5	Internal VSD	An internal warning in the VSD has occurred. If the warning persists, contact an Armstrong Technical Service representative.
6	Reserved	
7	VSD startup	A warning occurred during the startup of the motor. Turn off the power to the pump and verify that the motor can be turned using hand mode control. If the warning persists after powering up contact an Armstrong Technical Service representative.
8	Other VSD	There has been an unknown warning condition generated by the VSD. If the alarm persists, contact an Armstrong Technical Service representative.
9	VSD communication	There is a communication issue between the control card and VSD.
10	VSD speed	The speed set by the VSD is not within tolerance. If the alarm persists, contact an Armstrong Technical Service representative.
11	VSD wiring	There is an issue in wiring to the VSD. Check the wiring to the motor from the VSD. If any I/O are used on the VSD, verify that there is continuity and no shorts for the connections.
12	System over temperature	The temperature measured by the control card is approaching the recommended operating conditions.
13	System under temperature	The temperature measured by the control card is approaching the recommended operating conditions.
14	Battery under voltage	The battery voltage is low. Replace the battery with CR2032 type cell.
15	BMS communication loss	BMS communication has been lost.
16	VSD communication loss	The communication with the VSD and the control card has stopped.
17	Invalid VSD parameter	The control card has specified an invalid VSD parameter.
18	VSD initialization failure	The initialization of the VSD through Modbus has failed. Cycle power to the pump to re-initialize.
19	VSD speed set failure	The speed could not be set by the controller. Check the connections between the VSD and control card.
20	VSD start set failure	The controller could not start the motor. Check the connections between the VSD and control card.
21	Sensorless error	The sensorless map that was entered has an error please refer to the I & O Manual for further details.
22	Hand mode timeout	The pump has been in hand mode too long. Consider setting to automatic mode to save energy.

FYI - Chilled Water Plant Optimization

EcoPulse Performance Management Services

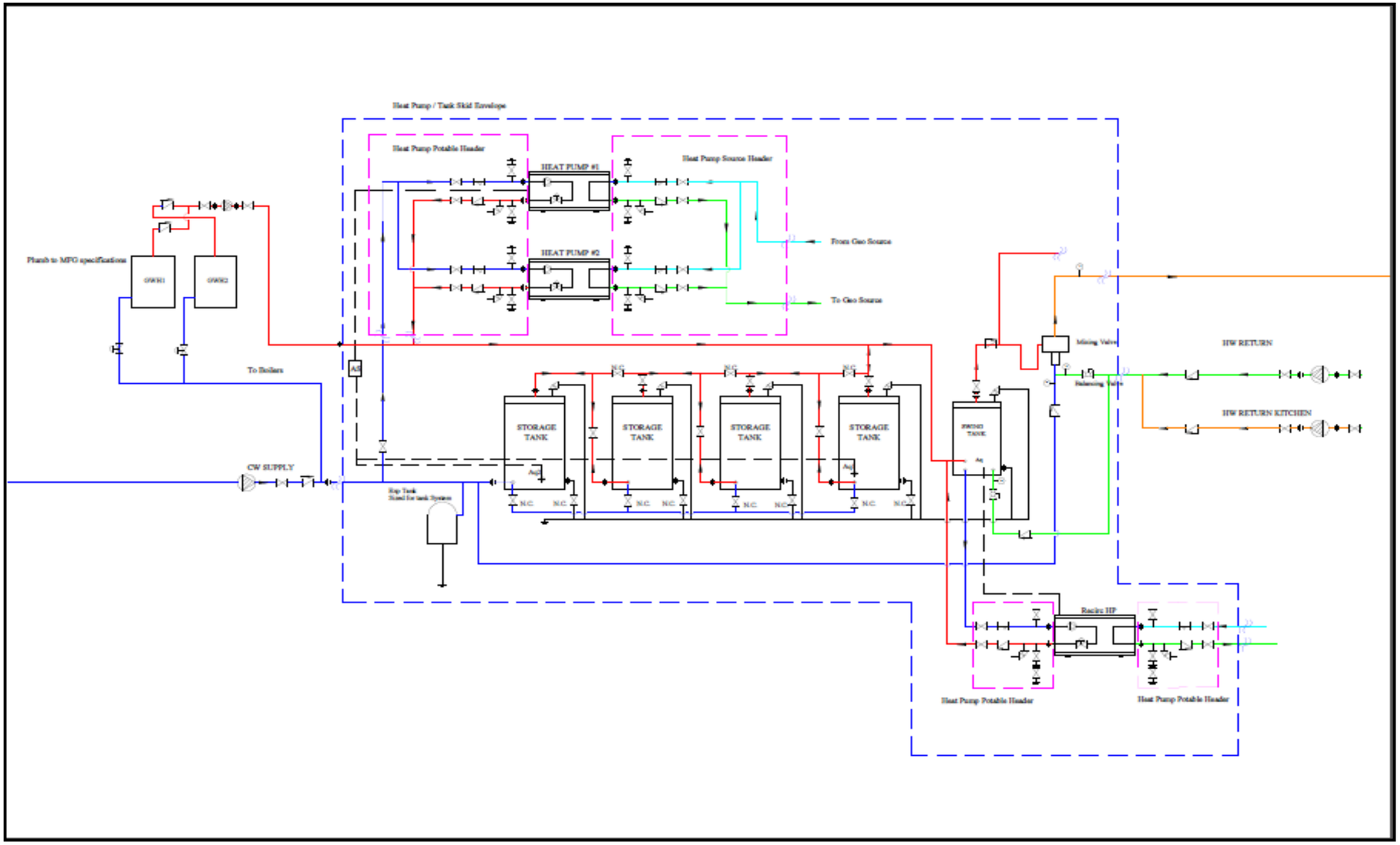
Cloud

OptiVisor

BMS

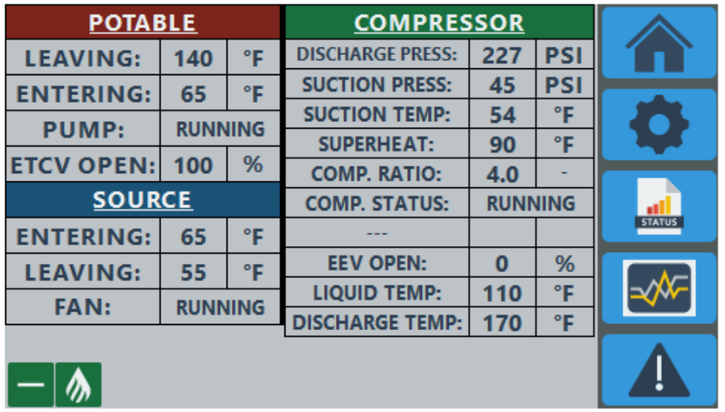
THE IMPACT OF THE DECARBONIZATION/ELECTRIFICATION REGULATIONS ON COMMERCIAL WATER HEATING CONTROLS

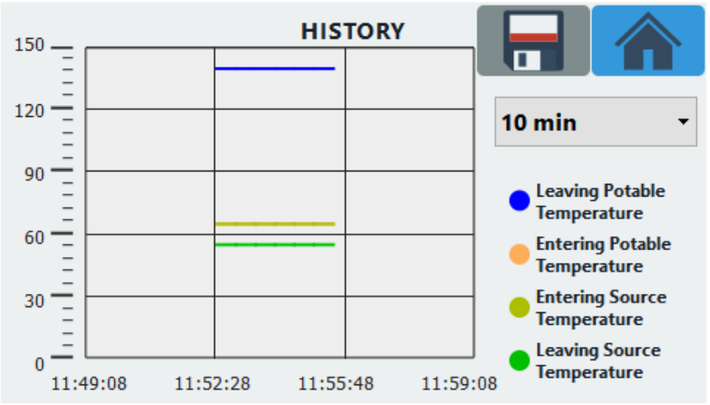
- JUST AS THE INDUSTRY HAS PERFECTED CONDENSING GAS TECHNOLOGY, ALL FUTURE INCENTIVES WILL BE GEARED TOWARD ELECTRIFICATION/CARBON NEUTRALITY
  - STATES, PRIVATE INDUSTRY, COLLEGES/UNIVERSITIES ARE ELIMINATING FOSSIL FUELS AND SETTING GOALS FOR 50% CARBON NEUTRALITY BY 2030 (ENGINEERS BEING TOLD NOT TO SPECIFY GAS)
  - THE WATER HEATER MARKET IS BEING HIT HARDER/FASTER DUE TO LOWER BTU REQUIREMENTS
- ELECTRIC WATER HEATERS MAY BE THE ANSWER FOR LITE COMMERCIAL APPLICATIONS
  - LARGE WATER HEATER APPLICATIONS ARE NOT ECONOMICALLY FEASIBLE AND NOT INCENTIVIZED … 1MBTU HEATERS DRAW 367 AMPS AT 460V
  - SOURCE CONDITIONS FOR SUSTAINABLE TECHNOLOGY ARE VARIABLE AND CONTROLLERS WILL BE REQUIRED TO LOAD PROFILE BUILDING TO STAGE UNITS
- DESIGNS WILL REQUIRE HYBRID SYSTEM CONTROLS AND HIGH-LEVEL CENTRAL WATER HEATER CONTROLLERS THAT INTEGRATE HEAT PUMP WATER HEATERS WITH OTHER ENERGY SOURCES
  - CAPABILITY TO INTERFACE WITH BMS SYSTEMS, UTILITY PROVIDERS AND INCORPORATE THE AVAILABILITY OF REMOTE WEB ACCESS AND ALARM NOTIFICATION

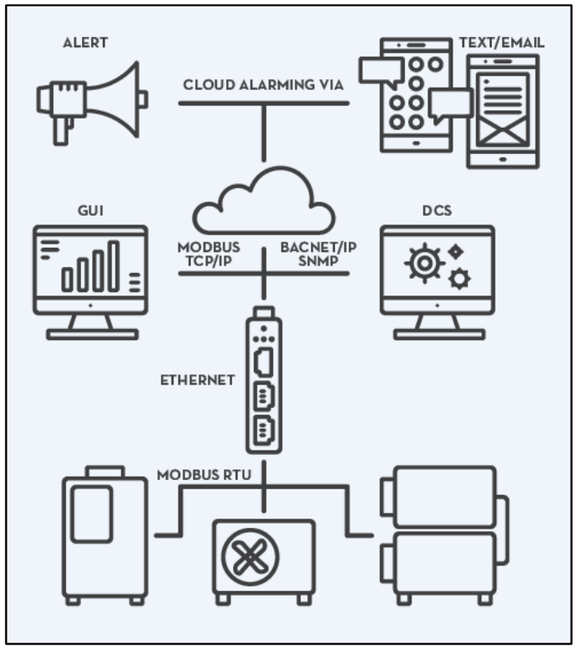

Heat Pump / Tank Skid Envelope
Heat Pump Potable Header
HEAT PUMP #1
HEAT PUMP #2
Heat Pump Source Header
From Geo Source
To Geo Source
Plumb to MFG specifications
To Boilers
CW SUPPLY
STORAGE TANK
STORAGE TANK
STORAGE TANK
STORAGE TANK
Mixing Valve
HW RETURN
HW RETURN KITCHEN
Recirc HP
Heat Pump Potable Header
Heat Pump Potable Header

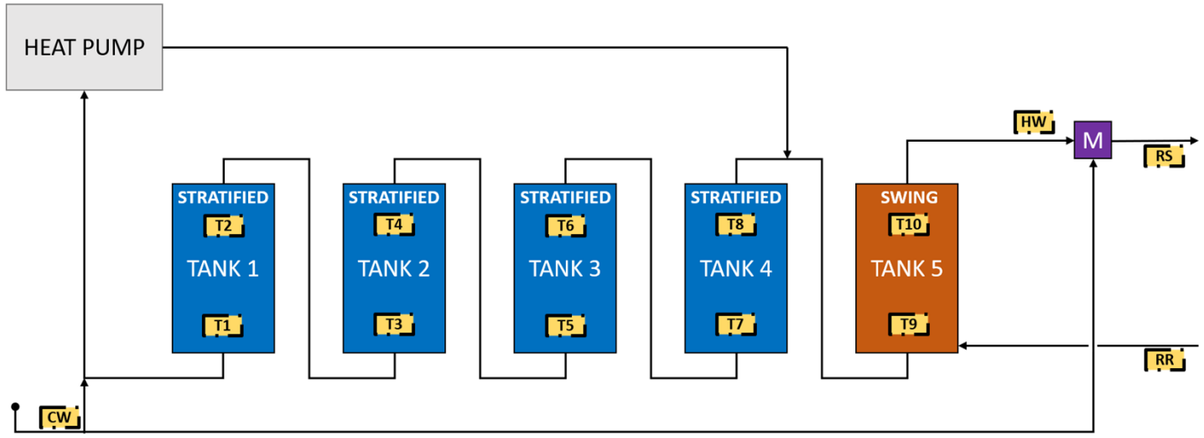
- ✓ Controls up to 48 units, and reports status
- ✓ PLC controls to integrate staging of units, and selection of various energy sources including solar, chilled water, hot water, condensate, condenser water, gas backup if available
- ✓ Predictive staging based on load profile (dynamic option)
- ✓ 24 unique temperature-based stages, 10 programable rules
- ✓ 8 user definable groups
- ✓ Tending data
- ✓ BMS interfaces, BACnet or Modbus using RS485 or Ethernet
- ✓ Separate Web interface with, free cloud data logging (1 year rolling), Email and text alerts, Remote monitoring and troubleshooting

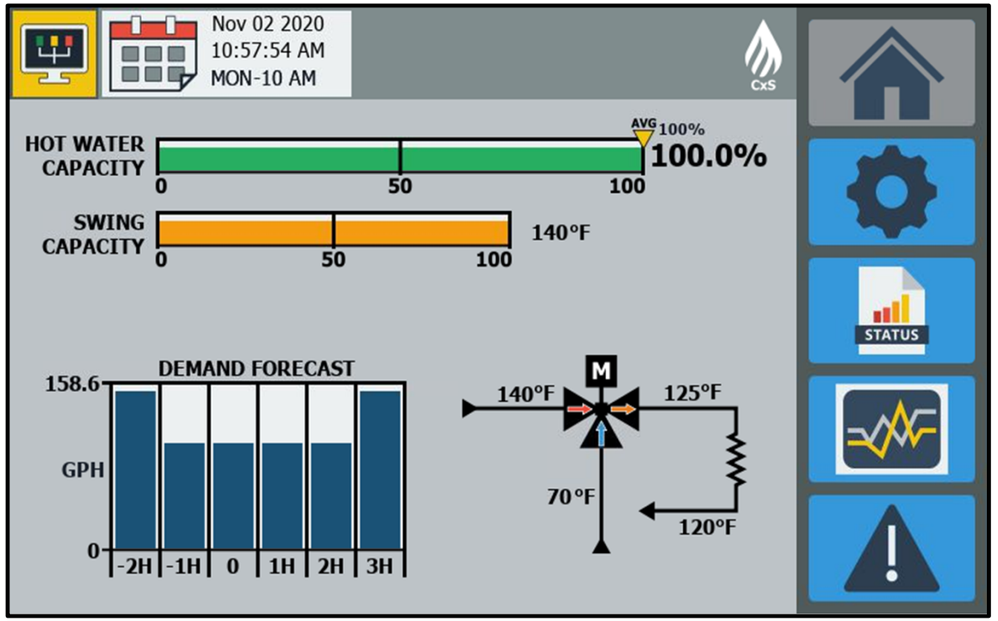
- ✓ Trends system parameter history for 10 days locally
- ✓ Download run data to USB
- ✓ Upload new code updates from USB also over the Web with Cloud monitoring option
- ✓ Free cloud data logging (1 year rolling)
- ✓ Email and text alerts
- ✓ Remote monitoring and troubleshooting
- ✓ One module required per array



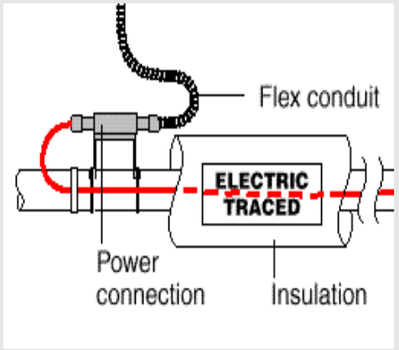




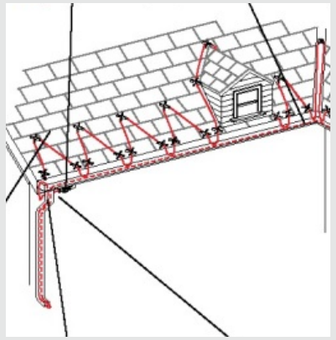

HEAT PUMP
STRATIFIED
T2
TANK 1
T1
STRATIFIED
T4
TANK 2
T3
STRATIFIED
T6
TANK 3
T5
STRATIFIED
T8
TANK 4
T7
SWING
T10
TANK 5
T9
HW
M
RS
RR
CW


Nov 02 2020
10:57:54 AM
MON-10 AM
CxS
HOT WATER CAPACITY
AVG 100%
100.0%
0
50
100
SWING CAPACITY
140°F
0
50
100
DEMAND FORECAST
158.6
GPH
0
-2H
-1H
0
1H
2H
3H
M
140°F
125°F
70°F
120°F
STATUS

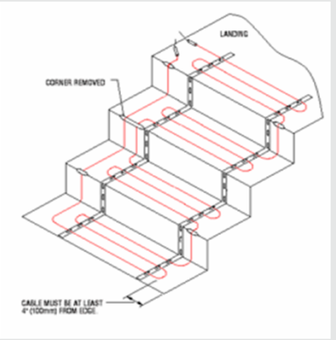
Pipe Trace:
Freeze Protection, Process Temperature Maintenance, Domestic Hot Water.



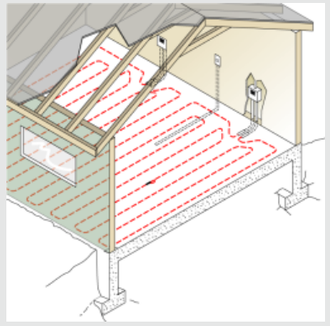
Roof & Gutter De-icing:
Maintain Flow Paths to Prevent Ice Dams.
Heating Cable only, or Concealed Systems.



Surface Snow Melting:
Maintain a Snow-Free Surface for Concrete, Asphalt, Pavers.

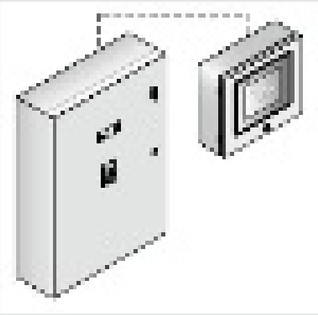


Floor Heating:
Embed Heat Trace Below the Floor for Comfort Heating. Frost Heave Prevention Below Cold Storage Rooms.



Leak Detection:
Detect Water and Fuel Leaks Before Significant Damage Occurs.

Control Technology:
- Single Point Control
- Smart Building Technology
- Controls for De-Icing and Snow Melting



Freeze Protection

Cooling Tower Piping

- Chill Water Supply
- Chill Water Return
- Equalizer line
- Make-up Water Line
- Drains

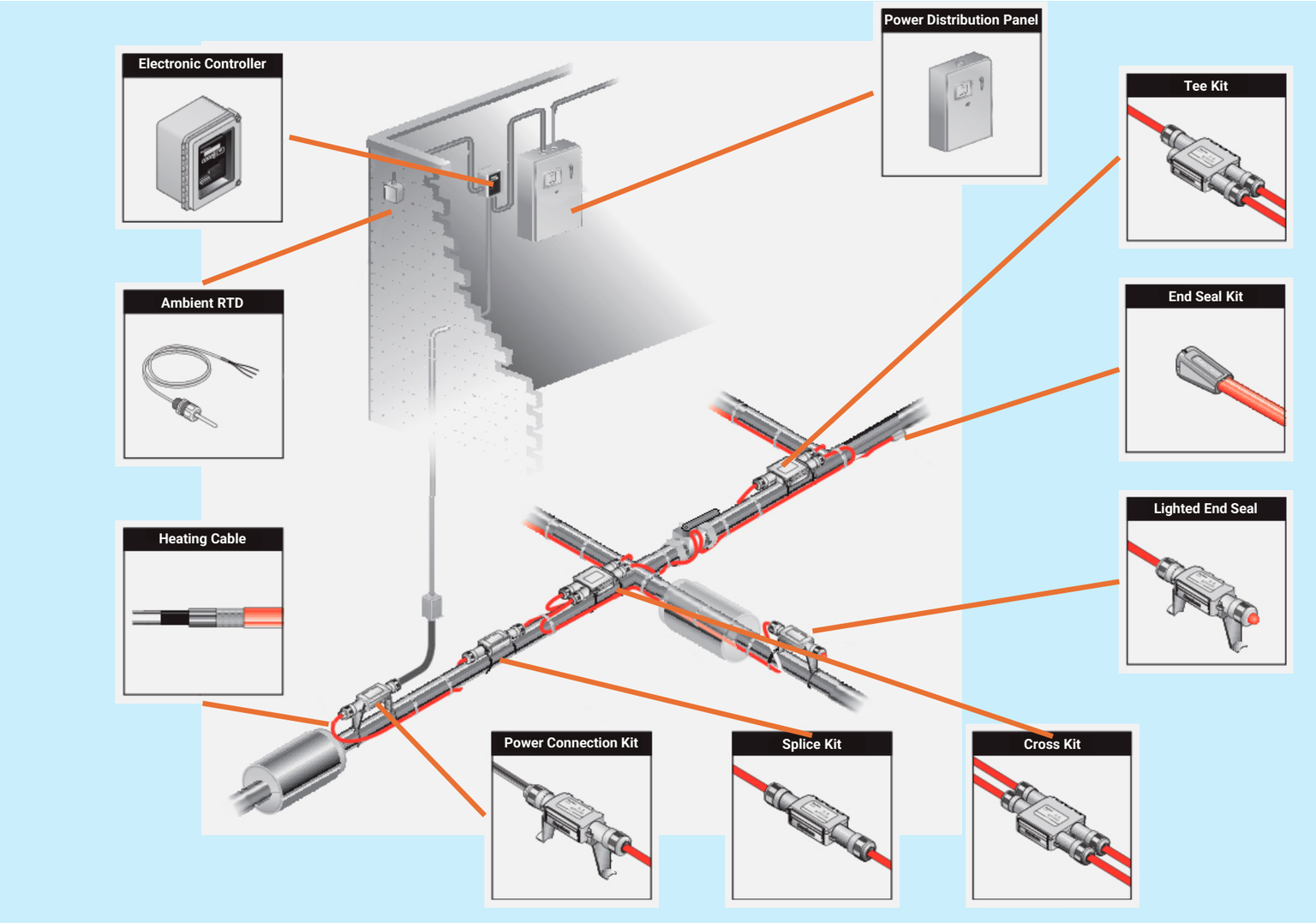
Mixed-Use buildings with a parking garage

- Trap Primer
- Sanitary
- General Water Piping

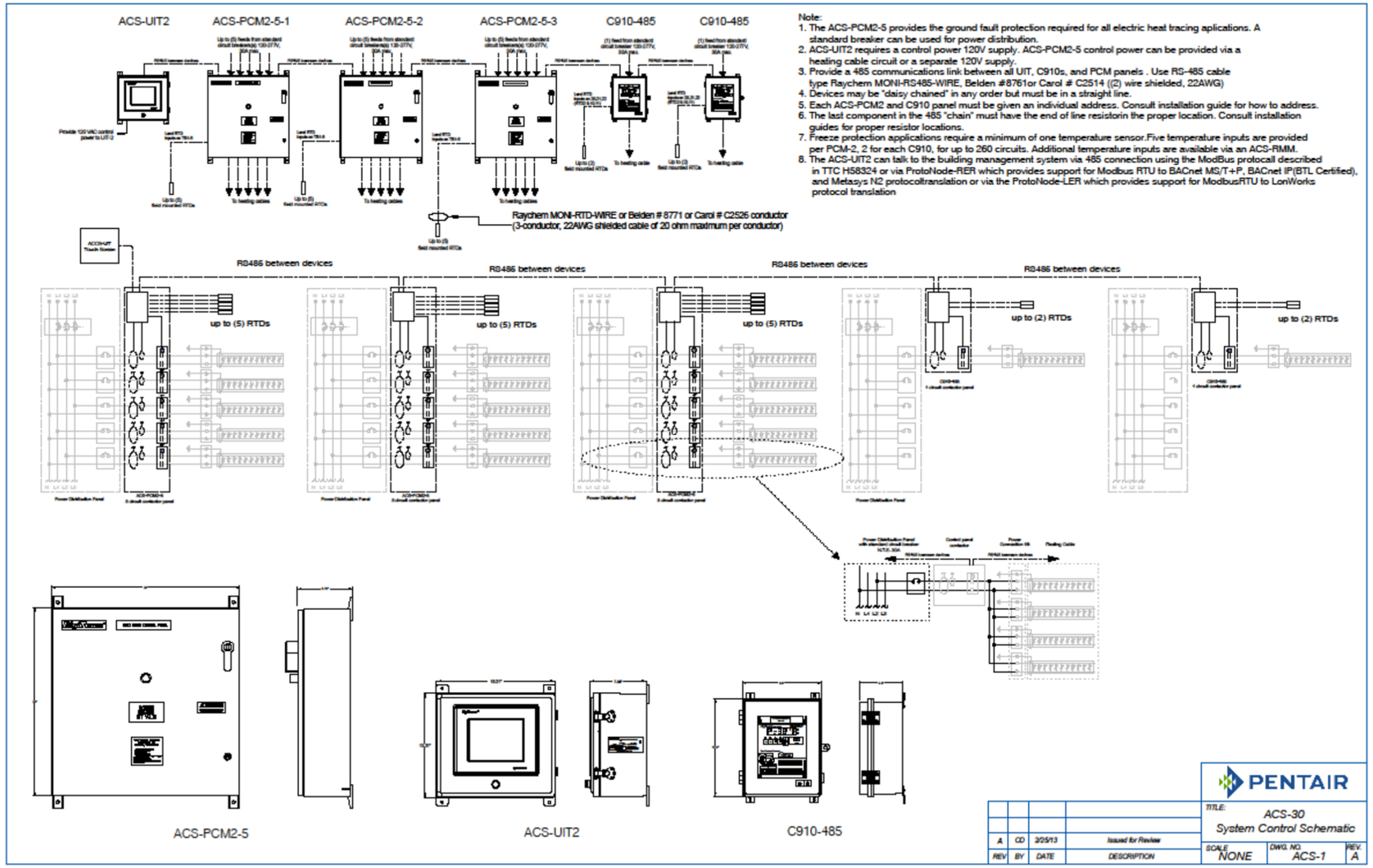
Condensate Lines

Fire Sprinkler/Standpipes

….and more!



Smart Building Control Platform



10. Digital controller will also supply an isolated triac alarm relay and a dry contact relay for alarm annunciation back to the BMS.
11. The following variables will be monitored by the digital controller and reported back to the BMS
    a. Temperature
    b. Ground-fault
    c. Current draw
    d. Power consumption
    e. Associated alarms

1.1.3. MONITORING AND ALARMING

The ACS-30 can monitor ground-fault, temperature, and current during system operation. Configurable alarm settings provide options for local or remote alarms. Dry contact relays are provided for alarm annunciation back to a local LAN, fire control panel or Building Management System (BMS).

Optional nVent RAYCHEM ProtoNode multi-protocol gateways are available for integrating the ACS-30 controller into a BACnet® or LonWorks® system.

2.2.4. SETUP|ALARM

The Setup|Alarms window lists all of the temperature alarm conditions for line control/monitoring. The minimum and maximum values for each alarm condition are included for each application control mode in Section 3.

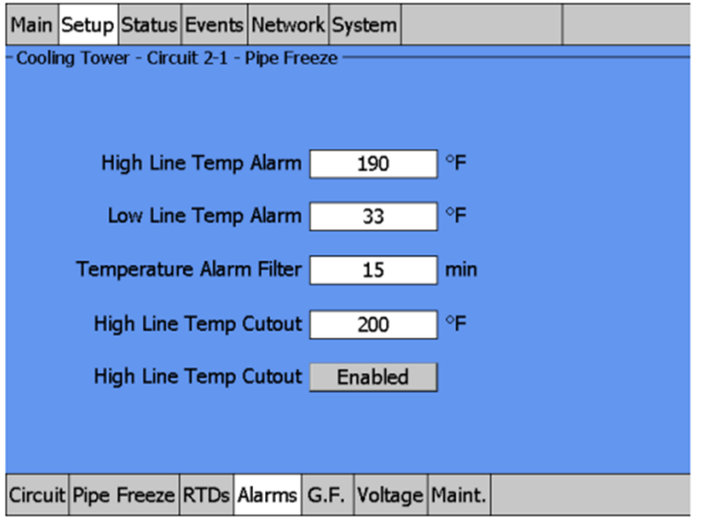


Fig. 2.19 Setup|Alarms window

Communications

The ACS-30 System supports the Modbus® protocol and is available with RS-232, RS-485 or 10/100Base-T Ethernet communication interface. nVent RAYCHEM ProtoNode multi-protocol gateways are available to integrate the ACS-30 into BACnet® and Metasys® N2 BMS systems.

Alarm conditions can be indicated via a Form C dry contact connected to a building management system. Status LEDs indicate whether the digital display is showing the set point or actual temperature or if the controller is in an alarm state.

Challenges and Opportunities

- Preconstruction considerations
  - Cross-division coordination
  - Equipment specifications
  - The emerging role of Division 25 for Smart Building vendors

- Looking into the future
  - Leveraging new technology to build smarter with less complexity and more value for all stakeholders
  - Solving the “basket of remotes” problem

The Big Picture – Why Integrate?

- **Controllability – “single pane of glass” for controlling building systems**
- **Visibility – know the status of equipment and key process parameters at all times**
- **Proactive maintenance, not reactive – get ahead of the curve and increase operational efficiency**

Contact

Brendan Cox
Sr. Sales Account Executive
Siemens | Smart Infrastructure
104 Sebethe Drive
Cromwell, CT 06416
USA

Mobile 860-262-2784
E-mail brendan.cox@siemens.com