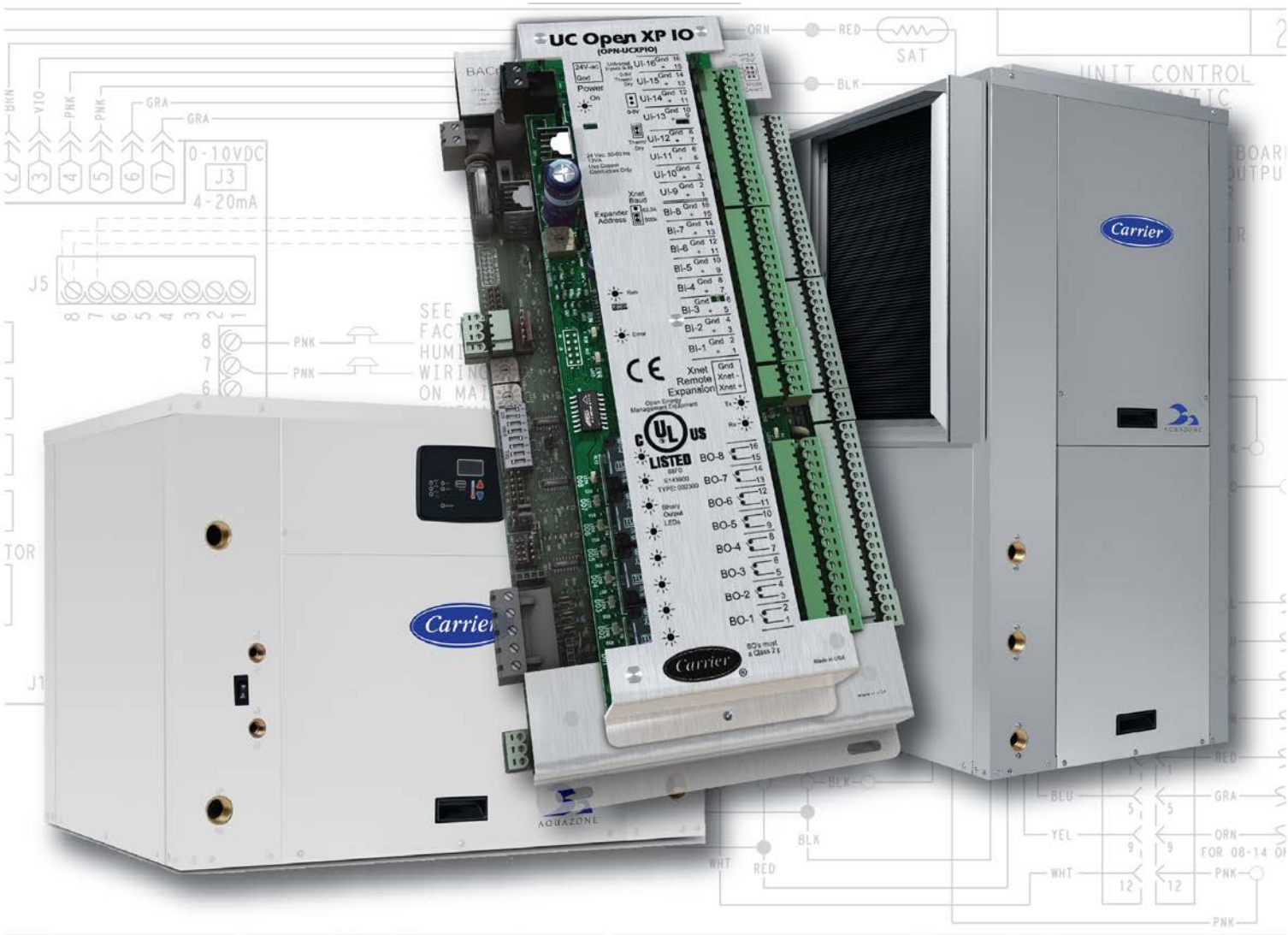
Source Water Loop Control for UC Open XP Installation and Start-up Guide



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Important changes are listed in **Document revision history** at the end of this document.

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Loop Control for UC Open XP overview and specifications

What is the Loop Control application?

The Loop Control application is designed to maintain the source supply water temperature at the control setpoint and provide source water flow as required. The Loop Control application supports up to 4 stages of boiler capacity and up to 4 cooling tower stages. The controller also provides the option to use 2 cascaded Analog Outputs for either, or both, the tower staging or boiler capacity staging. The Loop Control can control 1 or 2 pumps in a constant-flow application, or up to 2 pumps in a variable-flow source water application, maintaining the loop pressure differential setpoint. The internal application programming provides loop pump operation based on heat pump demand and/or scheduling. This controller can be used in stand-alone mode, communicate to an i-Vu® Control System, or a BACnet Third Party Building Automation System (BAS).

It can also be used in conjunction with Carrier WSHP Open controller as a complete system that utilizes Linkage to operate the loop pumps. The Linked system protects against individual heat pump lockouts by sending the loop status and loop temperature to each heat pump to insure proper operation. The Loop Control, when used with Carrier WSHP and Linkage, can optimize the water loop temperature for greater system energy savings over a simple fixed two-setpoint control system.

You can connect a Carrier Equipment Touch user interface with the UC Open XP, using the 5-pin Local Access port. The Equipment Touch is a touchscreen device with a 4.3 in. color LCD display that you can view or change property values, schedule equipment, view trends and alarms, and more, without having to access the system's server.

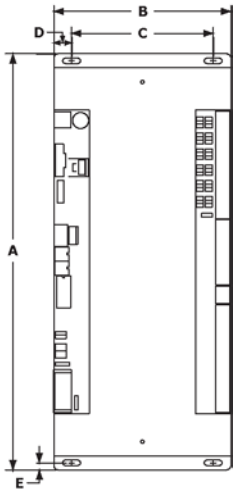
For more details about the Equipment Touch, see the *Equipment Touch Installation and Setup Guide*.

The Loop Control application supports detailed color graphics, status, properties, alarms, trends, performance, configuration, and Help on the Equipment Touch. In addition, the Startup Wizard facilitates configuring installation configuration. For details, see *Loop Control Points/Properties on the Equipment Touch* (page 59).

UC Open XP specifications

Power	24 Vac ±10%, 50–60 Hz 20 VA power consumption 26 Vdc (25 V min, 30 V max) Single Class 2 source only, 100 VA or less
BACnet MS/TP Port	For communication with the controller network using MS/TP (9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps)
BACnet ARC156 Port	For communication with the controller network using ARC156

Rnet port	Supports one Equipment Touch per Rnet. **NOTES** • Equipment Touch requires 24 Vac and cannot be powered by Rnet's 12 Vdc. For more details, see the *Equipment Touch Installation and Setup Guide*. • The Loop Control application does not support the SPT, ZS, or Wireless sensor. Only the Equipment Touch can be connected to the Rnet port.
Local Access port	For system start-up and troubleshooting using Field Assistant or an Equipment Touch device
Xnet Remote Expansion port	For communication with the UC Open XP IO expander.
Inputs	12 inputs configurable for 0-10 V, RTD Therm Dry, or 0-20mA. Inputs 1 and 2 may be used for pulse counting.
Input pulse frequency	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
Input resolution	12 bit A/D
Aux Power Output	5 Vdc or 24 Vdc input sensor power. Jumper selectable, limited to 200 mA. Available on input terminal 1.
Binary outputs	6 binary outputs, configured as dry contact, normally open or normally closed, must be powered from a Class 2 power source.
Analog outputs	6 analog outputs: • 1 and 2 are configurable for 0-10 V or 0-20 mA • 3 - 6 are 0-10 V only
Output resolution	8 bit D/A
Real time clock	Battery-backed real time clock keeps track of time in the event of a power failure
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: control programs, editable properties, schedules, and trends.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
Status indicators	LED's indicate status of communications, running, errors, and power. LED indicators for transmit/receive for the BACnet MS/TP and ARC156 ports and for each of the 12 outputs.
Environmental operating range	0 to 140° F (-18 to 60°C), 0 to 90% relative humidity, non-condensing
Storage temperature range	-24 to 140°F (-30 to 60°C), 0 to 90% relative humidity, non-condensing
Physical	Rugged aluminum housing with removable screw terminals



Overall dimensions	A: B:	11-13/16 in. (30 cm) 5 in. (12.7 cm)
Mounting dimensions	C: D: E:	4 in. (10.2 cm) 1/2 in. (1.3 cm) 13/64 in. (.5 cm)
Panel depth	2 in. (5.1 cm)	
Weight	1.1lb. (0.5 kg)	
BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9	
Listed by	UL-916, (Canadian Std C22.2 No. 205-M1983), CE, FCC Part 15-Subpart B-Class A	

Safety considerations

WARNING Disconnect electrical power to the UC Open XP before wiring it. Failure to follow this warning could cause electrical shock, personal injury, or damage to the controller.

Installing the UC Open XP

To install the UC Open XP:

1 *Mount the controller* (page 4).

2 *Wire the controller for power* (page 4).

3 *Set the controller's address* (page 5).

4 *Wire the controller to the BACnet MS/TP or BACnet ARC156 network* (page 6).

5 *Wire inputs and outputs* (page 7).

6 *Wire expanders to the controller* (page 14).

7 *Wire devices to the Rnet port* (page 18).

Mounting the UC Open XP

WARNING

When you handle the UC Open XP:
- Do not contaminate the printed circuit board with fingerprints, moisture, or any foreign material.
- Do not touch components or leads.
- Handle the board by its edges.
- Isolate from high voltage or electrostatic discharge.
- Ensure that you are properly grounded.

Screw the UC Open XP into an enclosed panel using the mounting slots on the cover plate. Leave about 2 in. (5 cm) on each side of the controller for wiring. See mounting dimensions in Specifications.

If using expanders, see *Installing an expander* (page 14) before mounting the controller.

Wiring the UC Open XP for power

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

CAUTIONS

- The UC Open XP is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Carrier controllers can share a power supply as long as you:
  - Maintain the same polarity.
  - Use the power supply only for Carrier controllers.

To wire for power

1. Turn off the UC Open XP's power switch to prevent it from powering up before you can verify the correct voltage.
2. Remove primary power from the 24 Vac transformer.
3. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
4. Connect the transformer wires to the screw terminal connector.
5. Apply primary power to the transformer.
6. Measure the voltage at the UC Open XP's power screw terminal connector to verify that the voltage is within the operating range of 21.6 - 26.4 Vac.
7. Insert the screw terminal connector into the UC Open XP's power terminals.
8. Turn on the UC Open XP's power switch.
9. Verify that the Power LED is on and the Run LED is blinking.

Addressing the UC Open XP

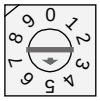
The UC Open XP's two rotary switches determine its MAC address when it is placed on a BACnet MS/TP network. The rotary switches define the MAC address portion of the device's BACnet address, which is composed of the network address and the MAC address.

1. Turn on the controller's power.
2. Using the rotary switches, set the controller's address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

   EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10's**) switch to 2 and the arrow on the **Ones** (**1's**) switch to 5.

   10's

   1's
3. Turn on the controller's power.

   NOTE The controller reads the address each time you apply power to it.

CAUTION The factory default setting is **00** and must be changed to successfully install your UC Open XP.

Wiring for communications

The UC Open XP communicates using BACnet on the following types of network segments:

- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps
- ARC156 communicating at 156 kbps

NOTE For more networking details, see the *Open Controller Network Wiring Installation Guide*.

Wiring specifications for BACnet MS/TP and ARC156

Cable:	22 AWG or 24 AWG, low-capacitance, twisted, stranded, shielded copper wire
Maximum length:	2000 feet (610 meters)

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the controller to the network

1. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
2. Check the communications wiring for shorts and grounds.
3. Connect the communications wiring to the BACnet MS/TP **or** to the BACnet ARC156 port.

   NOTE Use the same polarity throughout the network segment.
4. For MS/TP, verify the jumpers are set to 485-2w and EIA-485. They are not used for ARC156.
5. Set the communication type and baud rate.

For...	Set Communications Selection jumper to...	Set DIP switches 1 and 2 to...	Set DIP switches 3 and 4 to...
MS/TP	**MS/TP**	The appropriate baud rate. See the **MS/TP Baud** diagram on the controller.	Off/Off
ARC156	**ARC156**	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.	On/On

NOTE Use the same baud rate for all controllers on the network segment.

6 Wire the controllers on an MS/TP or ARC156 network segment in a daisy-chain configuration.

7 If the UC Open XP is at either end of a network segment, connect a BT485 to the UC Open XP.

8 Insert the power screw terminal connector into the UC Open XP's power terminals.

9 Verify communication with the network by viewing a Module Status report in the i-Vu® interface.

Wiring inputs and outputs

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

See *Appendix A* (page 37) to print a blank wire list.

Inputs and outputs table

Depending on the configuration of the Loop Control application, the I/O points change. For variable flow applications,such as the bypass valve control or VFD pump control, the function of Channel AO2 changes.

I/O	Type	Channel	Input Type	Object Name
Source Supply Water Temp	BAI	IN-1	10K Thermistor	sswt_sensor
Source Return Water Temp	BAI	IN-2	10K Thermistor	srwt_sensor
OAT sensor	BAI	IN-3	10K Thermistor	oatsens
RH sensor	BAI	IN-4	0-10 Vdc	rh_sensor
Source Water Diff. Pressure	BAI	IN-5	0-10 Vdc	src_diff_press
SW Pump 1 Amp sensor	BAI	IN-6	0-10 Vdc	swp1_amp_sensor
SW Pump 1 Status	BBI	IN-6	Dry Contact	sw_p1_status
SW Pump 2 Amp sensor	BAI	IN-7	0-10 Vdc	swp2_amp_sensor
SW Pump 2 Status	BBI	IN-7	Dry Contact	sw_p2_status
Remote Contact Input	BBI	IN-8	Dry Contact	rem_con
Source Water Flow	BBI	IN-9	Dry Contact	sw_flow
High Wtr Level	BBI	IN-10	Dry Contact	high_sump_lvl
Low Wtr Level	BBI	IN-11	Dry Contact	low_sump_lvl
Pump 1 VFD Output	BAO	AO-1	0-10 Vdc	pump1_vfd_output
Bypass Valve/Pump 2 VFD Output	BAO	AO-2	0-10 Vdc	chw_bypass_valve_vfd
Boiler Output 1	BAO	AO-3	0-10 Vdc	boiler_output1
Boiler Output 2	BAO	AO-4	0-10 Vdc	boiler_output2
Tower Output 1	BAO	AO-5	0-10 Vdc	tower_output1
Tower Output 2	BAO	AO-6	0-10 Vdc	tower_output2
CW Pump1 S/S	BBO	BO-1		cw_pump1

I/O	Type	Channel	Input Type	Object Name
CW Pump2 S/S	BBO	BO-2		cw_pump2
WSHP Comp Command	BBO	BO-3		wshp_ok
Alarm	BBO	BO-4		alm
Makeup Valve	BBO	BO-5		makeup
Boiler Output Stage 1	BBO	EXP BO-1		m1128
Boiler Output Stage 2	BBO	EXP BO-2		m1141
Boiler Output Stage 3	BBO	EXP BO-3		m1142
Boiler Output Stage 4	BBO	EXP BO-4		m1143
Tower Output Stage 1	BBO	EXP BO-5		m1144
Tower Output Stage 2	BBO	EXP BO-6		m1145
Tower Output Stage 3	BBO	EXP BO-7		m1146
Tower Output Stage 4	BBO	EXP BO-8		m1147
Legend **AI** - Analog Input **BI** - Binary Input		**AO** - Analog Output **BO** - Binary Output		
*Channel use is determined by specific application configuration.				

Input wiring specifications

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	500 feet (152 meters)	22 AWG	100 feet (30.4 meters) unshielded 100 - 500 feet shielded
Thermistor Dry contact Pulse counter TLO	500 feet (152 meters)	22 AWG	100 feet (30.4 meters) unshielded 100 - 500 feet shielded
Equipment Touch device	500 feet (152 meters)	22 AWG (7x0096) bare copper	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire

Inputs

The UC Open XP has inputs that accept the following signal types.

Signal Type	Description
Thermistor	Precon type 2 (10 kOhm at 77°F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors.
Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
0–5 Vdc 0–10 Vdc	The input impedance of the UC Open XP is approximately 20 kOhm.
0–20 mA	The input resistance on the positive (+) terminal is 250 Ohms. The **Aux Power Out** connector is capable of supplying 24 Vdc to multiple 4–20 mA transducers, but the total current demanded must not exceed 200 mA. If the voltage measured from the **Aux Power Out** connector to **Gnd** is less than 18 Vdc, you need to use an external power supply.
RTD	Platinum - 1 kOhm at 32°F (0°C) Nickel/Iron - 1 kOhm at 70°F (21°C) Balco TS8000 - 1 kOhm at 70°F (21°C) Input voltages should be from 0.6–1.2 V
Pulse counter*	UI-1 and UI-2 only: Maximum of pulses per second. Minimum pulse width required for each pulse: • ON to OFF time (half cycle) is msec • ON to OFF to ON time (full cycle) is msec

* The UC Open XP can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock.

Binary outputs

The UC Open XP has 6 binary outputs. Each output is a dry contact that must be powered from a Class 2 power source.

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device

  NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

Analog outputs

The UC Open XP has analog outputs:

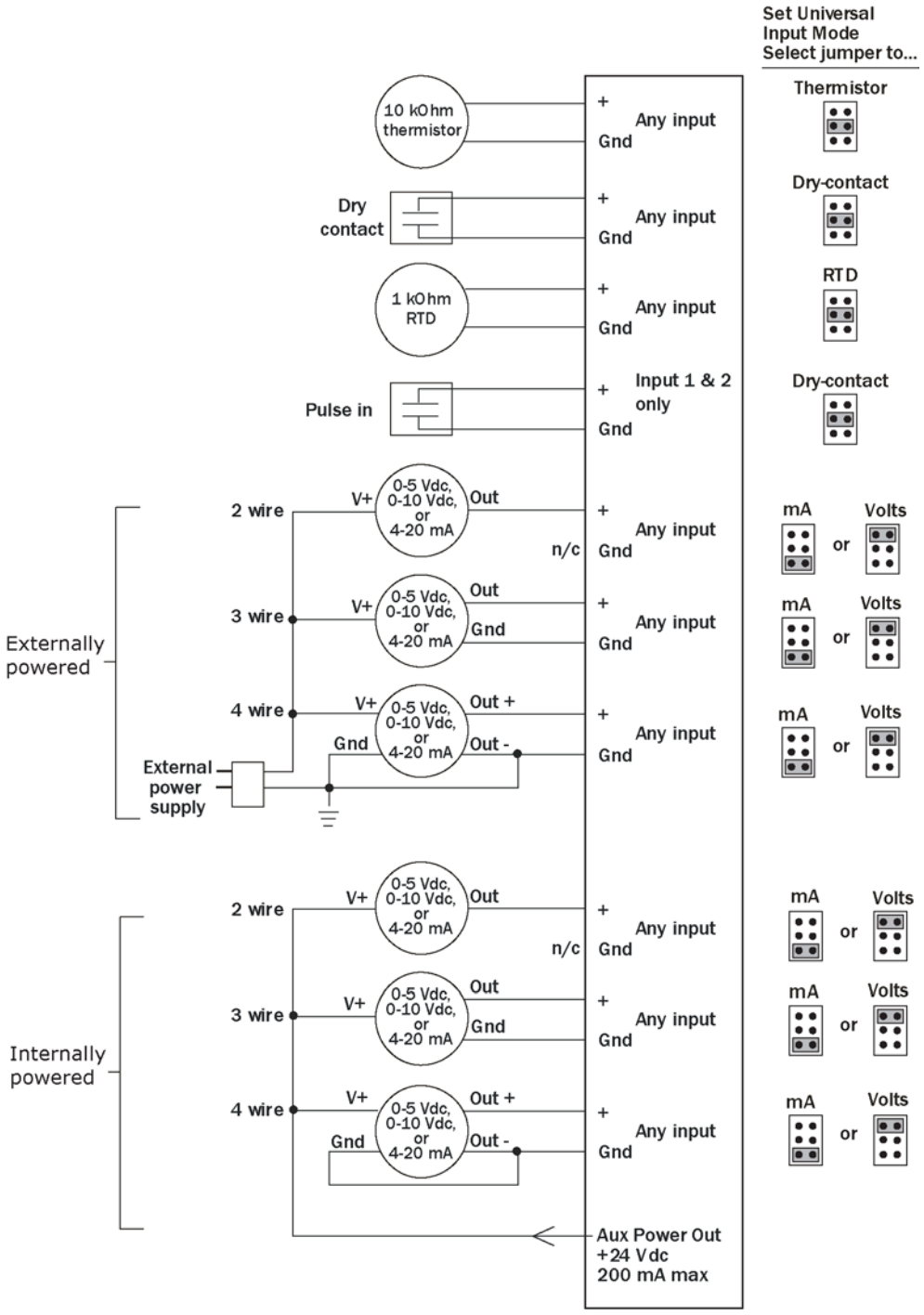
- 1 and 2 are configurable for 0-10 V or 0-20 mA
- 3, 4, 5, and 6 are 0-10 V only

The controlled device must share the same ground as the UC Open XP and have the following input impedance:

0–10 Vdc	min 500 Ohms
0–20 mA	max 800 Ohms

To wire inputs and outputs on the UC Open XP

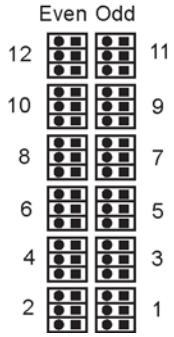
1. Turn **off** the UC Open XP's power.
2. Connect the input wiring to the screw terminals on the UC Open XP.



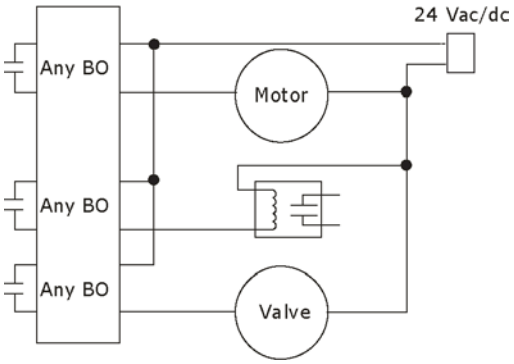
NOTES

- If using shielded wire, connect the shield to the GND terminal with the ground wire. Tape off the shield wire at the sensor end.
- Connect the shield wire to the **GND** terminal with the ground wire.
- Use only UI-1 or UI-2 for pulse counter or timed local override.
- For an internally-powered 4-20 mA sensor, wire the sensor's positive terminal to the **+** terminal on the UC Open XP's **Aux Power Out** port. Wire the sensor's negative terminal to an input's **+** terminal.

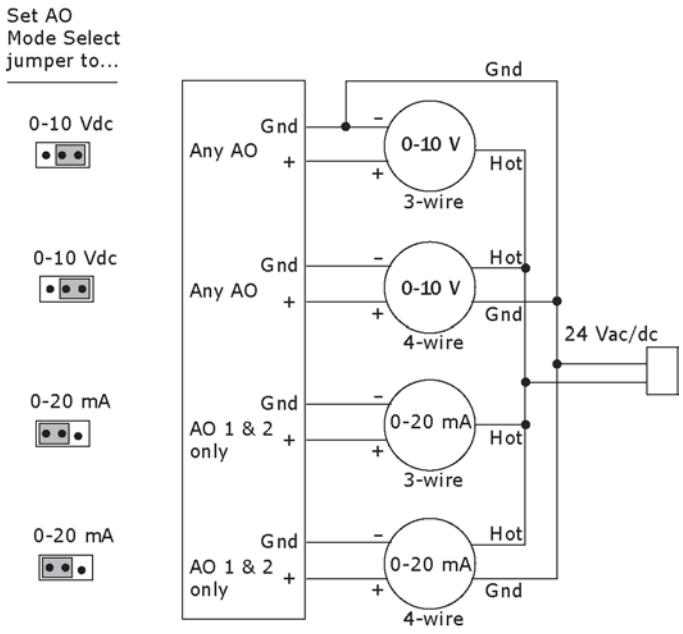
3 Set the appropriate jumpers on the UC Open XP.

To use...	For...		
Any input	Thermistor Dry contract 0–5 Vdc 0-10 Vdc 0–20 mA RTD	Set each input's **Universal Input Mode Select** jumper to the type of signal the input will receive.	
Aux Power Out port	Internally-powered 4-20 mA	Set the **Select** jumper to **+5V** or **+24V** as required by the sensor.	

4 Connect the binary output wiring to the screw terminals on the UC Open XP and to the controlled device.



5 Connect the analog output wiring to the screw terminals on the UC Open XP and to the controlled device.



6 Set the **AO Mode Select** jumper to the type of device you are wiring the output to.

7 Turn **on** the UC Open XP's power.

Installing the UC Open XP IO expander

1 *Mount the expander.* (page 14)

2 *Wire the expander for power.* (page 15)

3 *Wire inputs and outputs.* (page 17)

CAUTION Do not change the rotary switch address from the default setting of 1.

To mount and attach the UC Open XP IO

WARNING

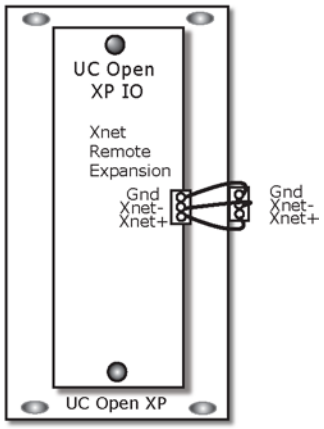
When you handle the UC Open XP IO:
- Do not contaminate the printed circuit board with fingerprints, moisture, or any foreign material.
- Do not touch components or leads.
- Handle the board by its edges.
- Isolate from high voltage or electrostatic discharge.
- Ensure that you are properly grounded.

Wiring restrictions for connecting the UC Open XP IO to the UC Open XP

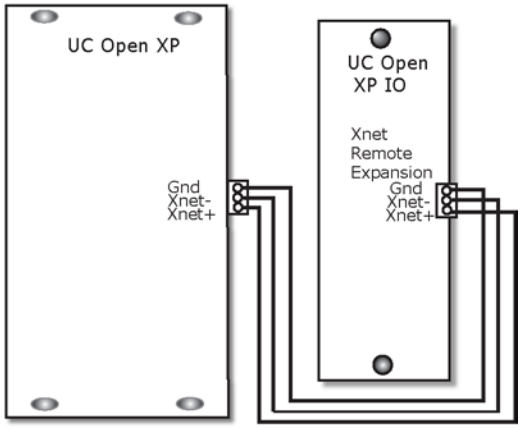
- Maximum length: 100 feet (30 meters)
- 22 or 24 AWG, low-capacitance, twisted, stranded, shielded copper wire

You can mount the UC Open XP IO in one of the following locations:

- On top of a UC Open XP, using the two allen cap screws provided. Connect Gnd to Gnd, Xnet- to Xnet-, Xnet+ to Xnet+.



- Beside the UC Open XP, by screwing the UC Open XP IO into an enclosed panel using the mounting slots on the cover plate. Leave about 2 in. (5 cm) on each side of the expander for wiring. Mounting hole dimensions 1.5" from the left (width) by 10.2" (height). Connect Gnd to Gnd, Xnet- to Xnet-, Xnet+ to Xnet+. You can mount the UC Open XP IO up to 100 ft away from the UC Open XP.



To wire for power

Older models of the UC Open XP IO have a power jumper that you must set to turn the expander on and off.

CAUTIONS

- The UC Open XP IO expander is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- For the UC Open XP to recognize an attached expander, you must turn on the expander before you turn on the UC Open XP.

1. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
2. Ground shielded wire to the UC Open XP IO's ground terminal.
3. Set the configuration jumpers for inputs 9 through 16 for thermistor/dry contact or 0-5 Vdc.
4. Insert the power screw terminal connector into the UC Open XP's power terminals.
5. Verify that the **Power** LED is on and the **Run** LED is blinking.

Wiring inputs and outputs

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

See *Appendix A* (page 37) to print a blank wire list.

Input wiring specifications

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	500 feet (152 meters)	22 AWG	100 feet Unshielded 100 - 500 feet Shielded
Thermistor Dry contact Pulse counter TLO	500 feet (152 meters)	22 AWG	100 feet Unshielded 100 - 500 feet Shielded

Inputs on the UC Open XP IO

The UC Open XP IO has 16 inputs that accept the following signal types:

Signal Type	Description
Thermistor	Precon type 2 (10 kOhm at 77 °F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors.
Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
0–5 Vdc	The input impedance of the UC Open XP IO is approximately 20 kOhm.
Pulse counter	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.

Binary outputs

The UC Open XP IO has 8 binary outputs. Each output is a dry contact that must be powered from a Class 2 power source.

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device

  NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

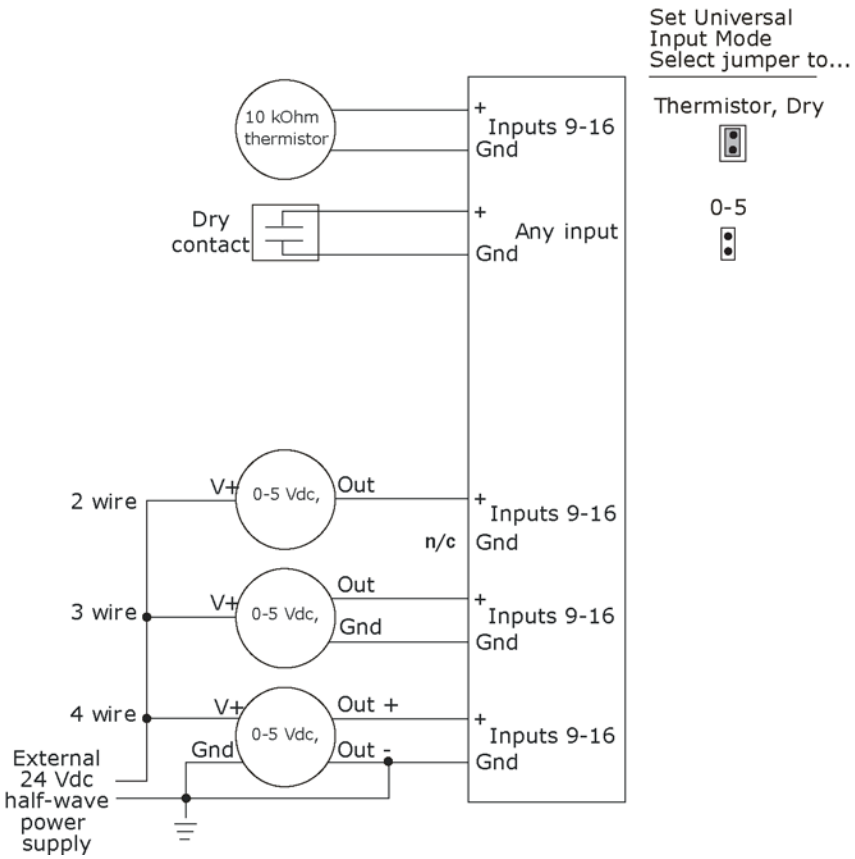
To wire inputs and outputs on UC Open XP IO

1 Verify that the UC Open XP IO's power and communications connections work properly.

2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.

3 Connect the input wiring to the screw terminals on the UC Open XP IO.

NOTE Connect the shield wire to the **GND** terminal with the ground wire.

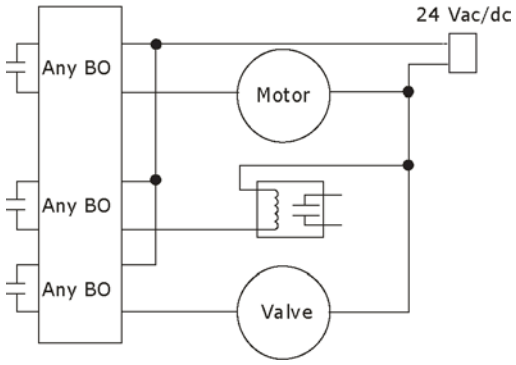


4 Set each input's **Universal Input Mode Select** jumper to indicate the type of input.

WARNING Do not apply 24 Vac to these universal inputs.

5 Connect binary output wiring to the **BO** screw terminals on the UC Open XP IO and to the controlled device.

6 Wire **GND** for each binary output to its even-numbered terminal.



7 Insert the power screw terminal connector into the UC Open XP's power terminals.

Wiring an Equipment Touch to the UC Open XP's Rnet port

Only the Equipment Touch can be connected to the Rnet port. The Loop Control application does not support the SPT sensor, ZS sensor, or Wireless Adapter for wireless sensor.

The Rnet communicates at a rate of 115 kbps.

CAUTION The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.

Wiring Specifications

NOTE If you wire the Equipment Touch directly to the controller's Rnet port, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable.

Description	4-conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167°F (0–75°C)

Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

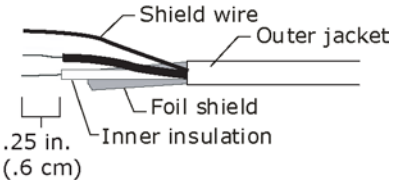
To wire an Equipment Touch to the UC Open XP

CAUTION The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.

CAUTION Carrier controllers can share a power supply as long as you:

- Maintain the same polarity.
- Use the power supply only for Carrier controllers.

1. Turn **off** the UC Open XP's power.
2. Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



3. Strip about .25 inch (.6 cm) of the inner insulation from each wire.
4. Wire the UC Open XP's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.

   NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
5. Turn **on** the UC Open XP's power.
6. Turn on the Equipment Touch.

For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide.*

Start-up

Use one of the following interfaces to start up, access information, read sensor values, and test the controller.

This interface...	Provides a...
Field Assistant application - Runs on a laptop that connects to controller's Local Access port [1]	Temporary interface
Equipment Touch device - Connects to controller's Rnet port [2]	Temporary or permanent interface
i-Vu® application Available for BACnet systems only	Permanent interface
System Touch device Available only for BACnet MS/TP systems. Wire to a BACnet MS/TP network connector and a 24 Vac power supply [3]	Temporary or permanent interface

[1] Requires a USB Link (Part #USB-L).
[2] See the *Equipment Touch Installation and Setup Guide* for detailed instructions.
[3] See the *System Touch Installation and Setup Guide* for detailed instructions.

CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link. Purchase a USB isolator online from a third-party manufacturer.

Select the Loop Control control program and graphic

The field-installed UC Open XP does not come from the factory with a control program or graphic. You must load a control program and graphic as part of the installation and commissioning. You can select the Loop Control control program and graphic from EquipmentBuilder. All the configurations that are currently available for the Loop Control are included in a single download file for both the equipment and graphic.

After selecting the control program and graphic files, save and download them to the controller. If desired, you can create a custom graphic using ViewBuilder. See ViewBuilder Help for details.

Configure the points and properties

You must configure certain points and properties.

Appendix B (page 41) is a complete list of all the points and properties, with descriptions, defaults, and ranges. These properties affect the unit operation and/or control. Review and understand the meaning and purpose of each property before changing it.

Appendix C (page 59) show the points and properties you can configure using the Equipment Touch.

To start up the controller, configure your necessary points/properties in the following:

- *Unit Configuration* (page 42)
- *Setpoints* (page 44)
- *Service Configuration* (page 46)

Examples of some settings that you need to configure for start-up are the **Number of Pumps**, **Pump Control**, and **Pump Staging**, found in the **Service Configuration** (page 46) section of *Appendix B* (page 41).

Sequence of Operation

The Loop Control Source Loop Control is an application that is designed to control the pumps, towers, and boiler operation in a heat pump system. The pumps provide water loop circulation, while the towers and boilers supply or remove energy from the source water loop for the heat pumps. The Loop Control can control one or two pumps in a constant-flow application, or up to 2 pumps in a variable-flow source water application, maintaining the loop pressure differential setpoint

The Loop Control supports Carrier Condenser Water Linkage between Carrier Open WSHP units and the loop controller. When Linkage is active, the loop controller responds to the demands for heating or cooling from the Open WSHPs and will operate the pump(s) when required. The system provides closed loop feedback to the individual WSHPs by confirming source water availability prior to operating any compressors in the Carrier Open WSHPs. Also, the Loop Control receives the acceptable range of the source water temperature from the Carrier Open WSHPs and verifies that the water provided is within the required operating temperature range.

The Loop Control may be used as a standalone loop control without Carrier Linkage and utilize a third party BACnet system for control, or operate in a standalone mode providing a hardwired binary input to command the loop pump operation and a hardwired binary output (WSHP Comp Command) to confirm successful loop operation.

The following sections describe the Loop Control's functionality. All points in this sequence of operation refer to the Equipment Touch, Field Assistant, or i-Vu® interface.

Scheduling without Condenser Water Linkage

Scheduling

The Loop Control MUST be occupied for loop pump operation. The occupied time periods define when the pump(s) operate. The Loop Control operates the pumps continuously during the occupied period.

You must provide a source for occupancy by:

- configuring a **Time Schedule**
- mapping **System Occupancy** to a BACnet point
- utilizing the **Remote Contact Input**
- using a third party control system that **Enables/Disables** the **BAS On/Off** point
- setting the local time and date for the schedule to function and operate properly

You can change the occupancy source to one of the following:

- **Occupancy Schedules**

  The controller is occupied 24/7 until you configure a time schedule using the Equipment Touch, Field Assistant, the i-Vu® application, or until a third party control system **Enables/Disables** the **BAS On/Off** point. You can disable the local occupancy default operation by going to **Configuration** > **Unit Configuration** > **Occupancy Schedules** and changing the point from **Enable** to **Disable** and clicking **OK**.

  NOTE You must **Enable** this point in order for the Equipment Touch, Field Assistant, or the i-Vu® application to assign a time schedule to the controller.

- **Schedule**

  The unit operates according to the schedule configured and stored in the unit. The schedule is accessible in the Equipment Touch, Field Assistant, or the i-Vu® application. The daily schedule consists of a start and stop time (standard or 24-hour mode) and 7 days of the week, starting with Monday and ending on Sunday. Enable the **Occupancy Schedules** to use the occupancy scheduling.

- **Occupancy Input Contact** (optional)

  If configured for remote occupancy control (default), the controller can use an external dry contact closure to determine the occupancy status of the Loop Control. Disable the **Occupancy Schedules** to use the occupancy contact input.

  NOTE Scheduling can only be controlled from one source.

- **BAS (Building Automation System) On/Off**

  For use with a Building Automation System that supports network scheduling, you must disable the **Occupancy Schedules** so the BAS can control the unit through a network communication and the BAS scheduling function.

  NOTE Scheduling can either be controlled from the unit or the BAS, but not both.

- **System Occupancy**

  Uses the network to obtain an occupancy status value from another controller, which is read over the network and used by this controller. **Occupancy Schedules** MUST be set to **Disable** to use this function. See Device Address Binding to configure the **System Occupancy** point.

  NOTE Scheduling can only be controlled from one source.

Scheduling with Condenser Water Linkage

When the Loop Control is part of a Carrier Open WSHP system and **Condenser Water Linkage** is active, you can configure how the loop pumps operate. The system can be configured to start the pumps only on a heating or cooling demand from any of the Carrier WSHPs linked to the Loop Control by setting the **Pump Start** to **Demand**.

You can configure it to operate the loop pumps on any demand and/or continuously during the occupied period, as defined by the Open WSHPs' schedules that are connected through Linkage. No local occupancy scheduling is available when Linkage is active.

Constant flow pump control

You can configure the Loop Control to operate 1 or 2 constant speed loop pumps.

When power is reapplied after a power outage, there is a user-configurable delay of 5 - 600 seconds (default 5) before starting any pump. You must configure **Power Fail Restart Delay** to define the delay time (0 - 600 seconds, default 5) before the pump begins to operate after power has been restored to the controller.

If the **Shutdown** input is active, the pump is shut down after the **Pump Stop Delay** expires, regardless of occupancy state. Otherwise, the pump will operate whenever the occupancy state is determined to be occupied.

Pump Status (**Option**) - An optional hardware input is available for each pump. You can configure it as either an analog input to detect pump status by measuring the pump current or as a binary input to measure pump state as a discrete input (on/off). Configure each pump separately. Also, there is a Network Status input to read the pump status, if available (See Device Address Binding).

Pump status options include:

- **Switch**
- **Amperage**
- **Network**
- **None**

If the pump status is not configured as None, the controller compares the status of the pump to the desired commanded state. When the pump is commanded to run (ON), the pump status is checked and verified to match the commanded state. If the pump status is not on, then a **Pump 'n' Fail** Alarm ('n' indicates the pump number) is generated after 30 seconds. When the pump is commanded OFF, if the pump status is still on, then a **Pump 'n' In Hand Alarm** is generated after 30 seconds.

Loop pump(s) constant flow

The Loop Control operates one or two pumps in constant flow mode to provide source water for the water source heat pumps. For a single pump application, the pump operates as a lead pump whenever the Loop Control is in an occupied mode. For two-pump systems, the Loop Control is automatically configured to operate the pumps as lead/standby, where the second pump is available as a spare if the lead pump fails.

The following conditions must be true in order for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The Shutdown input is not active

If the above conditions are met, the pump is energized, otherwise it is disabled. After the pump output is enabled, if a pump status type is configured, then the pump status will be checked to verify that the actual pump operation matches the commanded state. For two-pump systems, if a pump failure is detected, the Loop Control energizes the standby pump and verifies its operation if a pump status type has been selected. An alarm is generated for any pump that has failed.

Loop Pump(s) with bypass valve differential pressure control

The Loop Control operates 1 or 2 constant speed pumps in variable flow mode using a bypass valve to control the loop differential pressure and provide source water for the water source heat pumps. For a single pump application, the pump operates as a lead pump whenever the Loop Control is in an occupied mode. For 2-pump systems, the Loop Control is automatically configured to operate the pumps as lead/standby, where the second pump is available as a spare if the lead pump fails. When the pumps are required to operate, the Loop Control monitors the differential loop pressure input and adjusts the bypass valve position to maintain the required loop pressure to meet the desired setpoint.

The following conditions must be true in order for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage.
- The **Shutdown** input is not active
- The loop differential pressure input is valid

If the above conditions are met, the pump is energized, otherwise it is disabled. After the pump output is enabled, if a pump status type is configured, then the pump status will be checked to verify that the actual pump operation matches the commanded state. For 2-pump systems, if a pump failure is detected, the Loop Control will energize the standby pump and verify its operation if a pump status type has been selected. An alarm is generated for any pump that has failed.

After enabling the pump, the bypass is commanded to the full bypass position. The loop differential pressure is then compared to the desired loop pressure setpoint and a PID calculates the bypass valve position required to meet the loop pressure setpoint.

Loop Pump(s) with VFD loop differential pressure control

The Loop Control operates 1 or 2 pumps in variable flow mode using a VFD to control pump speed and provide source water for the water source heat pumps. For a single pump application, the pump operates as a lead pump whenever the Loop Control is in an occupied mode. For 2-pump systems, when the Loop Control is configured to operate the pumps as lead/standby, the second pump is available as a spare if the lead pump fails. When the pumps are required to operate, the Loop Control monitors the differential loop pressure input and adjusts the speed of the lead pump to provide the required loop pressure to meet the desired setpoint.

The following conditions must be true in order for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The **Shutdown** input is not active
- The loop differential pressure input is valid

If the above conditions are met, the pump is energized. Otherwise, it is disabled. After the pump output is enabled, if a pump status type is configured, then the pump status is checked to verify that the actual pump operation matches the commanded state. For 2-pump systems, if a pump failure is detected, the Loop Control energizes the standby pump and verifies its operation, if a pump status type has been selected. An alarm is generated for any pump that has failed.

After enabling the pump, the VFD is commanded to the user-configured **Min VFD Output** speed. The loop differential pressure is then compared to the desired loop pressure setpoint and a PID calculates the required pump speed to meet the setpoint.

Two loop pumps with VFDs, lead/lag operation for loop differential pressure control

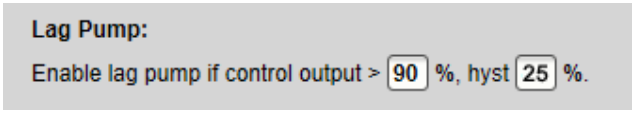
The Loop Control operates 2-staged pumps in variable flow mode using a VFD to control pump speed and provide source water for the water source heat pumps. For staged operation, the Loop Control Pump Staging must be set to lead/lag, which uses the second pump as a lag pump for additional flow capacity. When the pumps are required to operate, the Loop Control monitors the differential loop pressure input and adjusts the number of operating pumps and the speed of the pumps to provide the required loop pressure to meet the desired setpoint.

The following conditions must be true in order for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The **Shutdown** input is not active
- The loop differential pressure input is valid

If the above conditions are met, the lead pump is energized, otherwise all pumps are disabled. After the lead pump output is enabled, if a pump status type is configured, then the pump status will be checked to verify the actual pump operation matches the commanded state. If a pump failure is detected, the Loop Control will energize the lag pump and verify its operation if a pump status type has been selected. An alarm is generated for any pump that has failed.

After enabling the lead pump, the VFD is commanded to the user-configured **Min VFD Output** speed. The loop differential pressure is then compared to the desired loop pressure setpoint and a PID calculates the required pump speed to meet the setpoint. If the lead pump speed increases above the user-configured setpoint to enable the lag pump (90% default), then the lag pump starts and slowly begins to ramp up to the current VFD commanded output speed. The PID monitors the loop pressure and, as the lag pump increases speed and the loop pressure increases, the PID output is reduced, as necessary, until both pumps achieve the same operating speed.



If the loop flow requirement is reduced, and if both pumps are operating and the VFD speed drops below 65% (the user-configured setpoint minus the configured hysteresis), then the lag pump is disabled.

Pump rotation

The ability to rotate pumps is available for any application with 2 pumps. Pump rotation is user-configured. The following options are available:

- Daily
- Weekly
- Monthly
- Manual Rotation
- Runtime
- Never Rotate

If you select daily, weekly, or monthly, the lead and standby or lag pump rotates as scheduled and on the configured day and time. If you select manual rotation, you must rotate the pumps manually by selecting **Rotate** from the drop-down menu. If you select **Runtime**, the pumps automatically rotate after the lead pump operating hours reach the configured number of hours.

Tower fan control

The Loop Control has the ability to directly control up to 2 stages of variable speed (VFD-controlled) tower fans through 2 cascade, staged, analog outputs or up to 4 stages of tower fans (on/off) using 4 binary outputs. The first stage analog out may also be used alone or in conjunction with an external field-supplied staging controller to convert the analog signal to the desired number of staged binary outputs.

Whenever the pumps are commanded to run, flow has been proven, and if the source water temperature is greater than the loop's configured **Maximum Source Water Temp Setpoint** minus 5°F, or if Linkage is active, above the **Max Allowable Loop Temperature** minus 5°F (loop cooling setpoint), a PID loop calculates the desired tower fan output.

See **Loop Optimization** (page 30) for details on loop setpoint optimization when Linkage is used and **Loop Optimization** is set to **Enable**.

Analog (2-stage modulating) tower fan control

When configured for **Modulating**, the Loop Control provides 2 analog outputs to directly control up to 2 stages of variable speed (VFD-controlled) tower fans. 2 binary outputs are also provided to control the tower dampers or diverting valve, if required.

If the PID output is greater than 0, the binary output **Tower Output Stage 1** is energized to allow for tower operation and the analog output **Tower Ouput 1** is set to the PID output value.

If the PID output exceeds the user-configurable lag tower enable setpoint, the second binary output **Tower Output Stage 2**, is energized to allow for the second tower operation and the second analog output **Tower Output 2** is set to the PID output value.

If the tower fan's speed decreases below the user-configured lag tower enable setpoint, minus the hysteresis value, the second tower is disabled.

The following conditions must be true for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The Shutdown input is not active
- The loop flow must be proven

CAUTION The source water temp must be greater than the loop cooling setpoint to start and stay above the setpoint minus the hysteresis value.

If the above conditions are met, the PID is activated and calculates a value required to maintain the loop cooling setpoint. If the PID output value is greater than 0, the first stage binary tower output is enabled and the first stage tower fan operates at the calculated output speed.

After enabling the lead tower, if the tower fan speed increases above the user-configured setpoint, to enable the lag tower output (71% default), then the lag tower is empowered by enabling the **Tower Output Stage 2**, while slowly ramping up **Tower Output 2 VFD**-commanded output speed until both achieve the same operating speed.

If the tower fan speed decreases below the user-configured setpoint, minus the hysteresis (default 50%), the lag tower output **Tower Output Stage 2** is disabled and the **Tower Output 2 VFD** is commanded to 0%.

Staged tower fan control

The Loop Control provides the capability to control from 1 to 4 stages of tower fans. When configured for staged control, the user must select the number of tower stages. The Loop Control provides 4 dedicated binary outputs that can directly control up to 4 stages of tower fans.

The following conditions must be true for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The **Shutdown** input is not active
- The loop flow must be proven

CAUTION The source water temp must be greater than the loop cooling setpoint to start and stay above the setpoint minus the hysteresis value.

If the above conditions are met, the PID is activated and calculates a value required to maintain the desired setpoint. The PID output value is compared to the calculated Enable % based on the number of tower stages configured and, if it is greater than that value, the appropriate stages are energized.

The formula below determines the stage enable point:

Enable % = 100 / [Number of stages +1]

Each stage number is multiplied by the Enable % to determine when that stage is enabled.

EXAMPLE In a 3 stage application, the Enable % equals 100 / 3+1 or 25%.

Therefore, Stage 1 is energized when the PID output > 25%, Stage 2 at > 50%, and stage 3 at > 75%.

Once a stage is energized, a user-configurable hysteresis prevents short cycling (defaults: Stage 1 hysteresis is 10%, all others are 20%). As the loop temperature is satisfied and falls below the setpoint, the PID output decreases and stages are disabled in sequential order from highest to lowest.

Boiler control

The Loop Control can directly control up to 2 stages of variable fire boilers using 2 cascade, staged, analog outputs, or up to 4 stages of boilers (on/off) using 4 binary outputs.

The first stage analog output may be used alone, or in conjunction with an external field-supplied staging controller, to convert the analog signal to the desired number of staged binary outputs.

Whenever the pumps are commanded to run, flow has been proven, and if the source water temperature is less than the loop's configured **Minimum Source Water Temp Setpoint** plus 5°F, or if Linkage is active, below the **Min Allowable Loop Temperature** plus 5°F (loop heating setpoint), a PID loop calculates the desired tower fan output.

See **Loop Optimization** (page 30) for details on loop setpoint optimization when Linkage is used and **Loop Optimization** is set to **Enable**.

Analog (2-stage modulating) boiler/valve control

When configured for **Modulating**, the Loop Control provides 2 analog outputs to directly control up to 2 stages of variable fire boilers or a hot water mixing valve.

If the PID output is greater than 0, the analog output, Boiler Output 1, is set to the PID output value.

If the PID output exceeds the user configurable lag boiler enable setpoint, the second analog output, Boiler Output 2, will ramp up to the PID output value.

If the PID output decreases below the user-configured lag boiler enable setpoint, minus the hysteresis value, the second boiler is disabled.

The following conditions must be true for the boiler algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The Shutdown input is not active
- The loop flow must be proven

CAUTION The source water temp must be less than the loop heating setpoint to start and stay below the setpoint plus the hysteresis value

If the above conditions are met, the PID is activated and calculates a value required to maintain the loop heating setpoint. If the PID output value is greater than 0, the first stage boiler output is set to the PID value.

If the PID output increases above the user-configured setpoint to enable the lag boiler (99% default), then the lag boiler is enabled and slowly ramps Boiler Output 2, until both achieve the same output value.

If the boiler output PID decreases below the user-configured setpoint, minus the hysteresis (default 5%), the lag boiler output Boiler Output 2, is commanded to 0%.

Staged boiler control

The Loop Control provides the capability to control from 1 to 4 stages of boilers. When configured for staged control, the user must select the number of boiler stages. The Loop Control provides 4 dedicated binary outputs that can directly control up to 4 stages.

The following conditions must be true for the cooling algorithm to run:

- Loop Control is occupied (standalone) or a pump requirement is received from Linkage
- The **Shutdown** input is not active
- The loop flow must be proven

CAUTION The source water temp must be less than the loop heating setpoint to start and stay below the setpoint plus the hysteresis value.

If the above conditions are met, the PID is activated and calculates a value required to maintain the desired setpoint. The PID output value is compared to the calculated Enable % based on the number of boiler stages configured and, if it is greater than that value, the appropriate stages are energized.

The formula below determines the stage enable point:

Enable % = 100 / [Number of stages +1]

Each stage number is multiplied by the Enable % to determine when that stage is enabled.

EXAMPLE In a 3 stage application, the Enable % equals 100 / 3+1 or 25%.

Therefore, Stage 1 is energized when the PID output > 25%, Stage 2 at > 50%, and stage 3 at > 75%.

Once a stage is energized, a user-configurable hysteresis prevents short cycling (defaults: Stage 1 hysteresis is 10%, all others are 20%). As the loop temperature is satisfied and falls below the setpoint, the PID output decreases and stages are disabled in sequential order from highest to lowest.

Condenser Water Linkage

The Loop Control receives and sends information from any linked Carrier WSHP Open controllers through Condenser Water Linkage. When required to operate, the source water loop pumps supply water for all the connected water source heat pumps. The Loop Control receives the composite heat pump's operating water temperature limits, occupancy status, and the total demand for both heating and cooling from all the connected WSHP Open equipment. In return, the Loop Control sends the loop pump status and loop temperature to each heat pump so each WSHP Open can verify it is capable to operate its compressors safely without causing a lockout condition to occur.

NOTE The minimum and maximum loop temperatures for heating and cooling are configured separately in each WSHP Open controller. Refer to the specific requirements for acceptable loop temperatures in the Product Data for each individual heat pump.

Loop optimization

The UC Open XP has the ability to provide loop optimization for system utilizing WSHP Open controllers and Linkage. Loop optimization provides a more efficient operating system by adjusting the loop temperature up or down, based on the number of heat pumps operating in the heating or cooling mode. Loop Optimization must be set to **Enable** to use this feature.

Loop optimization provides two optimization methods. If **Loop Calculation Type** is set to 15 day average (default), the calculation takes into effect 15 days of rolling data to determine the optimum loop temperature. This seasonally adjusts to building operating conditions and filters out one-day event occurrences. If **Loop Calculation Type** is set to **Daily**, only the last 24 hours of data is used. All data is accumulated every hour to record how many heat pumps were operating in heating mode and how many were operating in cooling mode.

Loop Calculation determines how the data is used to determine the optimum loop temperature. If it is set to **Weighted Average** (default), the actual number of heat pumps operating each hour, in each mode, are taken into account to ensure the loop is optimized for the largest heat pump energy usage. If it is set to **Equally Weighted**, then each hour is treated the same, regardless of the total number of heat pumps operating during that hour.

Finally, **Loop differential** ensures sufficient hysteresis between the setpoint used for loop heating control and the setpoint used for loop cooling control. The individual setpoints are determined from the calculated ideal loop setpoint and the position of that setpoint between the allowable minimum and maximum loop temperatures.

The default **Loop differential** is set to 10°F but is user-adjustable and must be set to at least 5°F or higher.

WSHP compressor enable command output

The Loop Control has a binary output and a network-accessible BACnet BV that can be used to interlock the operation of the connected WSHP equipment in standalone application without Linkage. The output determines when the individual WSHP units can safely operate.

The output is activated whenever the pumps are commanded to run and flow has been detected via the Source Water Flow binary input or the Network Flow input and the loop temperature is between the configured **Min Source Water Temp Alarm Limit** and **Max Source Water Temp Alarm Limit**.

Alarm lamp output

The UC Open XP has a binary output that can be connected to a local alarm lamp to indicate a problem with loop flow, the loop pumps, or the source water supply temperature.

If Linkage is inactive, the alarm output is activated whenever the source water supply temperature exceeds the configured **Maximum Source Water Temp** or drops below the configured **Minimum Source Water Temp**. It will also be activated whenever the pumps are commanded to operate and loop flow is not detected or if any pump fails.

If Linkage is active, the alarm output is activated using the same criteria as above, except the source water supply temperature is compared to the minimum and maximum allowable source water temperature limits received from the Open WSHPs through Linkage, rather than the configured values.

Troubleshooting

If you have problems mounting, wiring, or addressing the UC Open XP or the UC Open XP IO, contact Carrier Control Systems Support.

NOTE To help you troubleshoot, obtain a Module Status (Modstat) from the controller and review the System Error and Warning details.

UC Open XP LED's

The LED's indicate if the controller is speaking to the devices on the network. The LED's should reflect communication traffic based on the baud rate set. The higher the baud rate the more solid the LED's become.

Verify the LED patterns by cycling power to the controller and noting the lights and flashes.

LEDs	Status
Power	Lights when power is being supplied to the controller. **NOTE** The UC Open XP is protected by internal solid state Polyswitches on the incoming power and network connections. These Polyswitches are not replaceable, but they will reset themselves if the condition that caused the fault returns to normal.
Rx	Lights when the controller receives data from the network segment; there is an Rx LED for Ports 1 and 2.
Tx	Lights when the controller transmits data from the network segment; there is an Rx LED for Ports 1 and 2.
Run	Lights based on controller health.
Error	Lights based on controller health.

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
1 flash per second	1 flash per second, alternating with the **Run** LED	The controller files are archiving. Archive is complete when **Error** LED stops flashing.
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with **Run** LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	On	Exec halted after frequent system errors, due to: • Controller halted • Program memory corrupted • One or more programs stopped
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with **Run** LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with **Run** LED	Brownout
On	On	Failure. Try the following solutions: • Turn the UC Open XP off, then on. • Download memory to the UC Open XP. • Replace the UC Open XP.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

Expander LED's

The LED's indicate if the controller is speaking to the devices on the network. The LED's should reflect communication traffic based on the baud rate set. The higher the baud rate the more solid the LED's become.

LEDs	Status
Power	Lights when power is being supplied to the controller. **NOTE** The UC Open XP is protected by internal solid state Polyswitches on the incoming power and network connections. These Polyswitches are not replaceable and will reset themselves if the condition that caused the fault returns to normal.
Rx	Lights when the controller receives data from the network segment; there is an Rx LED for Ports 1 and 2.
Tx	Lights when the controller transmits data from the network segment; there is an Rx LED for Ports 1 and 2.
Run	Lights based on controller health. See table below.
Error	Lights based on controller health. See table below.

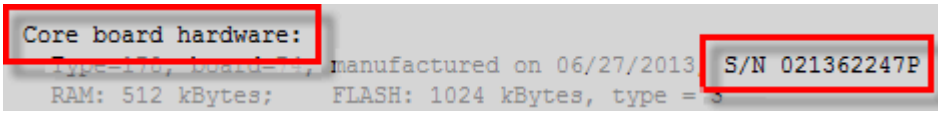
The **Run** and **Error** LED's indicate expander and network status.

If Run LED shows...	And Error LED shows...	Status is..
2 flashes per second	Off	Normal
5 flashes per second	2 flashes per second	Boot is running or driver is updating
5 flashes per second	On	Fatal error. Replace expander or return for repair.

To get the serial number

If you need the UC Open XP's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



To obtain a modstat in the i-Vu® interface:

1 Select the UC Open XP in the navigation tree.

2 Right-click and select **Module Status**.

To restore defaults

CAUTION This erases all archived information and user-configuration settings. You will have to reconfigure all custom settings. It is recommended to restore the factory defaults only under the guidance of Carrier Control Systems Support.

To erase volatile memory data and restore factory default configuration settings:

1 Turn off the UC Open XP's power switch.

2 Put the **Factory Defaults** jumper on.

3 Turn on the UC Open XP's power switch.

4 Remove the **Factory Defaults** jumper.

To replace the UC Open XP's battery

To determine when to replace the battery, remove power and measure the voltage. If the voltage is below 2.9 volts, you need to replace the battery.

CAUTION Power must be **ON** to the UC Open XP when replacing the battery, or your date, time, and trend data will be lost.

1. Remove the battery from the controller, making note of the battery's polarity.
2. Insert the new battery, matching the battery's polarity with the polarity indicated on the UC Open XP.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix A: UC Open XP and UC Open XP IO wire lists

These wire lists represent all the possible points for this application. The points that are actually used in your application depend on the equipment options you select in EquipmentBuilder.

UC Open XP wire list

Open System Network

UC Open XP Universal Controller

Project Name: **Location:**	**Controller:** **Network Number:** **MAC Address:**

Aux power	1		5V	Jumper right 2				
	1		24V	Jumper left 2				
	2		GND					

Universal Input Mode Select (Jumper Position of Pins)

Point/ Cable#	Inputs (+)	(G)	Input Type	Jumper Position of Pins	I/O	Sensor code	Equipment Name	Point Name
	3	5	0-10	Upper	UI-1			
	3	5	Pulse/Other	Middle				
	3	5	4-20	Lower				
	4	5	0-10	Upper	UI-2			
	4	5	Pulse/Other	Middle				
	4	5	4-20	Lower				
	6	8	0-10	Upper	UI-3			
	6	8	Other	Middle				
	6	8	4-20	Lower				
	7	8	0-10	Upper	UI-4			
	7	8	Other	Middle				
	7	8	4-20	Lower				
	9	11	0-10	Upper	UI-5			
	9	11	Other	Middle				
	9	11	4-20	Lower				
	10	11	0-10	Upper	UI-6			
	10	11	Other	Middle				
	10	11	4-20	Lower				
	12	14	0-10	Upper	UI-7			
	12	14	Other	Middle				
	12	14	4-20	Lower				

	13	14	0-10	Upper	UI-8			
	13	14	Other	Middle				
	13	14	4-20	Lower				
	15	17	0-10	Upper	UI-9			
	15	17	Other	Middle				
	15	17	4-20	Lower				
	16	17	0-10	Upper	UI-10			
	16	17	Other	Middle				
	16	17	4-20	Lower				
	18	20	0-10	Upper	UI-11			
	18	20	Other	Middle				
	18	20	4-20	Lower				
	19	20	0-10	Upper	UI-12			
	19	20	Other	Middle				
	19	20	4-20	Lower				

Point/ Cable#	Analog Outs (+)	(G)	A-Output Type	Jumper Position of Pins	I/O	Sensor code	Equipment Name	Point Name
	1	2	mA	Left 2 pins	AO-1			
			Volt	Right 2 pins				
	3	4	mA	Left 2 pins	AO-2			
			Volt	Right 2 pins				
	5	6	0-10	N/A	AO-3			
	7	8	0-10	N/A	AO-4			
	9	10	0-10	N/A	AO-5			
	11	12	0-10	N/A	AO-6			

Point/ Cable#	Binary Outs (+)	(G)	B-Output Type	Jumper Position of Pins	I/O	Sensor code	Equipment Name	Point Name
	1	2	N.C.	N/A	BO-1			
	3	2	N.O.					
	4	5	N.C.	N/A	BO-2			
	6	5	N.O.					
	7	8	N.C.	N/A	BO-3			
	9	8	N.O.					
	10	11	N.C.	N/A	BO-4			
	12	11	N.O.					
	13	14	N.C.	N/A	BO-5			
	15	14	N.O.					
	16	17	N.C.	N/A	BO-6			
	18	17	N.O.					

NOTE Only UI-1 and UI-2 have Pulse Count Ability (meter).

UC Open XP IO wire list

Open System Network UC Open XP IO Universal Controller Expander								
Project Name: **Location:**				**Controller:** **Network Number:** **MAC Address:**				
Point/ Cable#	**Inputs (+)**	**(G)**	**Input Type**	**Jumper Position of Pins**		**Sensor code**	**Equipment Name**	**Point Name**
	1	2	BI		BI-1			
	3	4	BI		BI-2			
	5	6	BI		BI-3			
	7	8	BI		BI-4			
	9	10	BI		BI-5			
	11	12	BI		BI-6			
	13	14	BI		BI-7			
	15	16	BI		BI-8			
	1	2	0-5V	No Jumper	UI-9			
	1	2	Therm/Dry Contact	Jumper				
	3	4	0-5V	No Jumper	UI-10			
	3	4	Therm/Dry Contact	Jumper				
	5	6	0-5V	No Jumper	UI-11			
	5	6	Therm/Dry Contact	Jumper				
	7	8	0-5V	No Jumper	UI-12			
	7	8	Therm/Dry Contact	Jumper				
	9	10	0-5V	No Jumper	UI-13			
	9	10	Therm/Dry Contact	Jumper				
	11	12	0-5V	No Jumper	UI-14			
	11	12	Therm/Dry Contact	Jumper				
	13	14	0-5V	No Jumper	UI-15			
	13	14	Therm/Dry Contact	Jumper				
	15	16	0-5V	No Jumper	UI-16			
	15	16	Therm/Dry Contact	Jumper				

Point/ Cable#	Binary Outs (+)	(G)	B-Output Type	Jumper Position of Pins		Sensor code	Equipment Name	Point Name
	1	2	N.O.	N/A	BO-1			
	3	4	N.O	N/A	BO-2			
	5	6	N.O.	N/A	BO-3			
	7	8	N.O.	N/A	BO-4			
	9	10	N.O.	N/A	BO-5			
	11	12	N.O.	N/A	BO-6			
	13	14	N.O.	N/A	BO-7			
	15	16	N.O.	N/A	BO-8			

NOTE All inputs can be pulse inputs.

Appendix B: Loop Control Points/Properties

The following tables describe all of the possible settings for your controller on the i-Vu® or Field Assistant **Properties** tab.

See Loop Control Points/Properties on the Equipment Touch for the points and properties available on the Equipment Touch interface.

Status

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Status**

Point Name/Description	Range
Run Status – The current operational status of the loop control system.	R: Off/Running
Source Water Supply Temp – The water temperature being supplied to the WSHPs.	R: -56 to 245°F
Source Water Return Temp – The water temperature returning from the WSHPs.	R: -56 to 245°F
Pump 1 Operation Status – Pump 1's status.	R: Off - OK to Run On as Lead Waiting in Standby On as Replacement Running as Lag Failed
Pump 1 VFD Speed – The current commanded speed of the VFD.	R: 0 to 100%
Pump 2 Operation Status – Pump 2's status.	R: Off - OK to Run On as Lead Waiting in Standby On as Replacement Running as Lag Failed
Pump 2 VFD Speed – The current commanded speed of the VFD.	R: 0 to 100%
Delta Pressure – The differential pressure between the supply and return source water.	R: -45 to 145 psi
Bypass Valve Percent – The percent the bypass value is open or closed.	R: 0 to 100%
Boiler Output 1 – The Boiler Output 1 analog output's current commanded state.	R: 0 to 100%
Boiler Output 2 – The Boiler Output 2 analog output's current commanded state.	R: 0 to 100%
Tower Output 1 – The Tower Output 1 analog output's current commanded state.	R: 0 to 100%
Tower Output 2 – The Tower Output 2 analog output's current commanded state.	R: 0 to 100%
Loop Optimization – The status of the Loop Optimization routine.	R: Disabled/Enabled
Current Tower Setpoint – The current tower setpoint.	R: 40 to 120°F

Point Name/Description	Range
Current Loop Setpoint – The current loop setpoint.	R: 40 to 120°F
Current Boiler Setpoint – The current boiler's setpoint.	R: 45 to 140°F
Outdoor Air Temperature – The outdoor air temperature used for control.	R: -56 to 245°F
OA Relative Humidity – The outdoor air relative humidity sensor's current value.	R: 0 to 100%
Wet Bulb Temperature – The calculated wet bulb's current value.	R: -56 to 245°F
Shutdown – When **Active**, provides a means to stop heating and cooling in an orderly manner. All alarms are reset and current active alarms are displayed.	R: Inactive/Active

Unit Configuration

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Configuration** > **Unit Configuration**

Point Name/Description	Range
On – **Off** – **Auto** – HOA switch **Auto** – The pumps cycle on and off based on demand or occupancy **Locked** – Unit is locked on or off	D: Auto R: Auto Locked (ON/OFF)
Pump Start – Enables or disables the pumps based on demand only or on occupancy-or-demand.	D: Demand Only R: Demand Only Occ or Demand
Minimum Heat Pump Demand – Number of requests required to start the loop pumps when the pumps are being controlled by heat pump demand.	D: 0 R: 0 - 100
Power Fail Restart Delay – How long the controller delays normal operation after the power is restored. Typically used to prevent excessive demand when recovering from a power failure.	D: 60 seconds R: 0 to 600 seconds
Pump Stop Delay – How long the pump continues to run after the application no longer requires pump operation.	D: 15 minutes R: 0 to 9999 minutes
Occupancy Schedules – If enabled, the unit follows the occupancy schedule as configured.	D: Disable R: Disable/Enable
Rotation Method	

<table>
<tr><th>Point Name/Description</th><th>Range</th></tr>
<tr><td>Rotation Method

Daily – Rotates the pumps daily at a specified time.
Weekly – Rotates the pumps weekly on a specified day and time.
Monthly – Rotates the pumps monthly on a specified day and time.
Manual Rotation – Manually rotates the pumps when the operator commands it.
Runtime – Rotates the pumps after the lead pump reaches a specified number of runtime hours.
Never Rotate – Does not allow the pumps to rotate.</td><td>D: Daily

R: Daily
Weekly
Monthly
Manual Rotation
Runtime
Never Rotate</td></tr>
<tr><td>Rotation Method Parameters – Specify further details of the selected method.

<table>
<tr><th>Method</th><th>Enter...</th><th></th><th></th></tr>
<tr><td>Daily</td><td>time of the day to rotate the lead pump
NOTE Enter the time of day in Defined Time for Rotation. The time of day you specify is used during a weekly or monthly rotation.</td><td>D:
R:</td><td>13:00
00:00 to 23:59</td></tr>
<tr><td>Weekly</td><td>day of the week to rotate the lead pump performed at the time of day specified in Defined Time for Rotation</td><td>D:
R:</td><td>3 (Wednesday)
1 to 7 (Monday to Sunday)</td></tr>
<tr><td>Monthly</td><td>day of the month to rotate the lead pump performed at the time of day specified in Defined Time for Rotation</td><td>D:
R:</td><td>1
1 to 31</td></tr>
<tr><td>Manual Rotation</td><td>manually rotate the lead pump</td><td>D:
R:</td><td>Do not Rotate
Rotate
Do Not Rotate</td></tr>
<tr><td>Runtime</td><td>number of runtime hours before rotating the lead pump</td><td>D:
R:</td><td>360 hrs
24 - 9999 hrs</td></tr>
<tr><td></td><td>Runtime since last rotation:
- Pump 1
- Pump 2</td><td>
R:
R:</td><td>
0 - 360 hrs
0 - 360 hrs</td></tr>
</table>
</td><td></td></tr>
<tr><td>Defined Time for Rotation – Specify the time of day (24 hour format) for automatic rotation based on the method and schedule you selected.
(Not applicable to Runtime Equalization.)</td><td>D: 13:00

R: 00:01 to 23:99</td></tr>
</table>

Setpoints

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Configuration** > **Setpoints**

Point Name/Description	Range
Maximum Source Water Temp Setpoint – The maximum allowable source water temperature. This is the upper limit setpoint when Linkage is not active.	D: 90°F R: 55 to 115°F
Max Source Water Temp Alarm Limit – The source water temperature must exceed this value to generate a **High Source Water Temperature** alarm. This is the lower limit setpoint when Linkage is not active.	D: 125°F R: 75 to 140°F
Minimum Source Water Temp Setpoint – The minimum allowable source water temperature.	D: 60°F R: 20 to 70°F
Min Source Water Temp Alarm Limit – The source water temperature must be lower than this value to generate a **Low Source Water Temperature** alarm.	D: 40°F R: 15 to 70°F
Tower Approach – The temperature in degrees above the outdoor air's wet bulb temperature that is used to limit the lowest loop setpoint, when Loop Optimization is active.	D: 12°F R: 5 to 25°F
Source Loop Diff Press. Setpoint – The differential pressure setpoint maintained by the loop system.	D: 15 psi R: 5 to 50 psi
Lag Pump – Enables lag pump if PID control output is greater than XX%, hyst X%.	D: 90%, 25% R: 50 to 99% 5 to 75%
Lag Boiler – Enables lag boiler if PID control output is greater than XX%, hyst X%.	D: 99%, 50% R: 50 to 99% 5 to 75%
Lag Tower – Enables lag tower if PID control output is greater than XX%, hyst XX.	D: 71%, 21% R: 50 to 99% 5 to 50%
Loop Setpoint Optimization*	
Enable Loop Optimization – Determines if loop optimization is enabled or disabled.	D: Enable R: Disable/Enable
Loop Calculation Type – You can choose between 15 Day Average (generally a better choice for larger buildings which are less subject to weather changes) and a Daily Average.	D: 15 day Average R: 15 day Average Daily

Point Name/Description	Range
Loop Calculation – When using the 15 day rolling average loop calculation type (described above), the: **Weighted Average -** weights the actual number of heat pumps in heating or cooling mode every day when calculating the average setpoint **Equally Weighted -** gives equal weight to the daily averages (percentage of heat pumps in heating or cooling mode) when calculating the average setpoint	D: Weighted Average R: Weighted Average Equally Weighted
Loop Differential – The difference between the heating (boiler) and cooling (tower) setpoints.	D: 10°F R: 5 to 50°F

* Loop Optimization requires Linkage to Carrier Open WSHPs.

Alarm Configuration

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Configuration** > **Alarm Configuration**

Point Name/Description	Range
Differential Pressure Alarm Hysteresis – The value that the differential pressure must change from the alarm setpoint to release a **High or Low Differential Pressure Alarm**.	D: 5 psi R: 2 to 25 psi
Pump 1 Status Alarm(s) – Generates a **Pump Fail Alarm** if the feedback status of pump 1 has not turned on after it has been enabled. If the status is on, and the pump has not been enabled, it will enable the **Pump in Hand Alarm**.	D: 30 seconds R: 0 to 9999 seconds
Pump 1 Runtime Alarm – The value that the runtime must exceed to generate a Runtime Alarm.	D: 10000 hr R: 0 to 99999 hr
Pump 2 Status Alarm(s) – Generates a **Pump Fail Alarm** if the feedback status of pump 2 has not turned on after it has been enabled. If the status is on and the pump has not been enabled, it will enable the **Pump in Hand Alarm**.	D: 30 seconds R: 0 to 9999 seconds
Pump 2 Runtime Alarm – The value that the runtime must exceed to generate a Runtime Alarm.	D: 10000 hr R: 0 to 99999 hr
Pump Lockout on Catastrophic Loss of Water	
Main Loop Flow Status Alarm(s) – Generates a **Main Loop Flow Status Alarm** if the feedback status of loop pumps has not turned on after it has been enabled.	D: 180 seconds R: 0 to 9999 seconds
Catastrophic Pump Lockout – Shows status of pumps.	R: OK Locked Out
Disable pumps should the loop lose main CW Flow – Disables all pumps if there is no flow. Bypasses any lead/standby routines. You must manually reset the system.	D: No R: No/Yes

Service Configuration

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Configuration** > **Service Configuration**

Point Name/Description	Range
Number Of Pumps – The number of pumps in the system.	D: One R: One Two
Pump Status Type – The type of status that the pumps deliver to the loop controller to indicate they are on.	D: Switch R: Switch Amperage Network None
Pump Control – This is the type of pump/water loop system being controlled. **Constant Volume** – Turns the pump on and leaves it on until scheduled to turn off or the demand has been satisfied. **Constant Vol w/Bypass** – Turns the pump on and then maintains a differential pressure with the bypass valve. **Vfd** – Turns the pump on and maintains a differential pressure by modulating the speed of the Vfd.	D: Constant Volume R: Constant Volume Constant Vol w/Bypass Vfd
Pump Staging – If there are 2 pumps controlled by a Vfd, this setting is adjustable. For other combinations, it defaults to Lead/Standby. It determines the type of pump sequencing. **Lead/Standby** - One pump runs as the lead pump and the other pump waits in standby. **Lead/Lag** – One pump runs as the lead pump and, if the additional capacity is required, brings the second pump on as the lag pump. (Only available if **Pump Control** is set to **Vfd**.)	D: Lead/Standby R: Lead/Standby Lead/Lag
Cooling Type – The cooling tower /_fan control configuration.	D: Modulating R: Modulating 1 - Stage 2 - Stage 3 - Stage 4 - Stage
Heat Type – The boiler output control configuration.	D: Modulating R: Modulating 1 - Stage 2 - Stage 3 - Stage 4 - Stage

Point Name/Description	Range
Sump Level Control – Enable or disable sump level control.	D: Disable R: Disable/Enable
Remote Contact Unocc Logic State – Sets the remote contact's normal logic state.	D: Open R: Open/Closed
Flow Type – Sets the Source Water Flow switch's flow type. When set to **Normal**, the flow switch contact closes when water flow is detected.	D: Normal R: Normal Inverted
Outdoor Air Sensor Type – The location of the source of the OAT input value.	D: Local OAT Sensor R: None Local OAT Sensor Network OAT
Outdoor Air Temp Calibration – A calibration offset value allows the local outdoor air temperature sensor to be adjusted to match a calibrated standard measuring the temperature in the same location.	D: 0.00 R: -9.9 to 10°F
Outdoor Air Temperature – The outdoor air temperature value being used for control.	R: -56 to 245°F
OA Relative Humidity Sensor Type - The location of the source of the Outdoor Air Relative Humidity input value.	D: Local RH Sensor R: None Local RH Sensor Network RH
OA Relative Humidity Calibration – A calibration offset value allows the local relative humidity sensor to be adjusted to match a calibrated standard measuring the space relative humidity in the same location.	D: 0%rh R: -15 to 15%rh
OA Relative Humidity – The current value of the local relative humidity sensor.	R: 0 to 100%rh
Differential Pressure Sensor Type – The location of the source of the differential pressure input value.	D: Local DP Sensor R: Local DP Sensor Network DP
Pump 1 Trip Point – Determines when Pump 1 is on. **Configuration** > **Service Configuration** > **Pump Status Type** must be set to **Amperage**.	D: 3.00 A R: 0 to 9999.00 A
Pump 2 Trip Point – Determines when Pump 2 is on. **Configuration** > **Service Configuration** > **Pump Status Type** must be set to **Amperage**.	D: 3.00 A R: 0 to 9999.00 A
System Outdoor Air Temperature – Allows the controller to use an outdoor air temperature value from the network. The remote controller must have a network-accessible outdoor air temperature sensor value.	R: N/A
System Outdoor Air RH – Allows the controller to use an outdoor air relative humidity value from the network. The remote controller must have a network-accessible OA relative humidity sensor value.	R: N/A
Source Water Diff. Pressure – Allows using another controller's differential pressure sensor from the network. The remote controller must have a network-accessible differential pressure sensor value.	R: N/A

Point Name/Description	Range
System Occupancy – Allows reading and using another controller's occupancy status value over the network. The remote controller must have a network-accessible Occupancy Status point.	R: Unoccupied/Occupied
Network Flow Input – Allows using another controller's flow sensor value over the network. The remote controller must have a network-accessible flow sensor value.	R: No Flow/Flow
SW Pump 1 Network Status – Allows the ability to get SW Pump 1 status over the network. The remote point must be a network-accessible value.	R: Off/On
SW Pump 2 Network Status – Allows the ability to get SW Pump 2 status over the network. The remote point must be network-accessible.	R: Off/On
Pump1 Network S/S – Allows starting Pump 1 over the network. The remote Start/Stop point must be network-accessible.	R: Off/On
Pump2 Network S/S – Allows starting Pump 2 over the network. The remote Start/Stop point must be network-accessible.	R: Off/On
Pump 1 VFD Network Output – Allows managing the Pump 1 VFD speed over the network. The remote device must have a network-accessible VFD control point.	R: 0 to 100%
Pump 2 VFD Network Output – Allows managing the Pump 2 VFD speed over the network. The remote device must have a network-accessible VFD control point.	R: 0 to 100%
CHW Byp Vlv Network Output – Allows managing the bypass valve position over the network. The remote device must have a network-accessible Bypass Valve control point.	R: 0 to 100%
Boiler Output 1 – Allows managing the Boiler 1 output over the network. The remote point must be network-accessible.	R: 0 to 100%
Boiler Output 2 – Allows managing the Boiler 2 output over the network. The remote point must be network-accessible.	R: 0 to 100%
Tower Output 1 – Allows managing the Tower 1 output over the network. The remote point must be network-accessible.	R: 0 to 100%
Tower Output 2 – Allows managing the Tower 2 output over the network. The remote point must be network-accessible.	R: 0 to 100%

Lockout	
Lockout – If disabled, allows pumps to continue to cycle until either pump status is attained. If enabled it will lockout out the pumps after they have failed 3 (default value) consecutive times	D: Disabled R: Disabled/Enabled
Lock out both pumps if both have failed "#" consecutive times. - Set the number of pump failures.	D: 3 R: 1 to 5
Manually release lockout? – If the pump lockout is enabled and the pumps are locked out, you can manually release the lockout.	D: Off R: Off/Release

Lockout	
Pump Control	
Loop Bypass Valve VFD PID (BPID) – This Bacnet Object determines what the variable frequency drive output should be. **NOTE** The following default values should be changed only by a technician trained in PID Loop algorithms **Action** reverse **Update Interval** 1:00 (mm:ss) **Proportional** 10 **Integral** 2.0 **Derivative** 0 **Deadband** 0 **Bias** 30	
Bypass Valve Type – Defines the normal position of the Bypass valve with no signal.	D: Normally Closed R: Normally Closed Normally Open
VFD PID (BPID) – This Bacnet Object determines what the variable frequency drive target output should be. **NOTE** The following default values should be changed only by a technician trained in PID Loop algorithms **Action** reverse **Update Interval** 1:00 (mm:ss) **Proportional** 10 **Integral** 5.0 **Derivative** 0 **Deadband** 0 **Bias** 30	
Minimum VFD Output – The minimum output signal the control supplies to the VFD as a percentage of its range. The balancer can set this to adjust the unit's minimum flow.	D: 20% R: 10 to 50%

The following values for Boiler Control are factory defaults or typical values.

Lockout	
Boiler Control	
Enable Boiler if Source Water Temp xx deg < Minimum Source Temp Setpoint xx deg + __ deg,	D: 5 deg R: 2 to 15°F
hysterisis __. Unless Loop Optimization is enabled.	D: 3 deg R: 1 to 10°F
Boiler Setpoint is ___ deg.	D: 60°F R: 40 to 80°F
Heat stage 1 is __.	R: On/Off
Heating Stage 1:	
Enable Heating Stage 1 if Heating output > _.__%. **NOTE** This value is automatically calculated based on number of stages configured.	R: 20 to 50%
hysterisis __.	D: 10%
Min heating stage #1 on time is _:__ (mm:ss)	R: 3:00 mm:ss
Min heating stage #1 off time is _:__ (mm:ss)	D: 0:00 mm:ss
Once disabled, delay Heating Stage 1 for _:__ (mm:ss) after Heating Stage 2 is off.	D: 2:00 mm:ss
Heat stage 2 is __.	R: On/Off
Heating Stage 2:	
Enable Heating Stage 2 _:__ (mm:ss) after Heating Stage 1 is enabled	D: 5:00 mm:ss
and if Heating output >__._%. **NOTE** This value is automatically calculated if number of stages configured > 1.	R: 40 to 66%
hysterisis __.	D: 20%
Min heating stage #2 on time is _:__ (mm:ss)	D: 3:00 mm:ss
Min heating stage #2 off time is _:__ (mm:ss)	D: 0:00 mm:ss
Once disabled, delay Heating Stage 2 for _:__ (mm:ss) after Heating Stage 3 is off.	D: 2:00 mm:ss
Heat stage 3 is __.	R: On/Off
Heating Stage 3:	
Enable Heating Stage 3 _:__ (mm:ss) after Heating Stage 2 is enabled	D: 5:00 mm:ss
and if Heating output > __%, **NOTE** This value is automatically calculated if number of stages configured > 2.	R: 60 to 75%

Lockout	
hysterisis __%	D: 20%
Min heating stage #3 on time is _:__ (mm:ss)	D: 3:00 mm:ss
Min heating stage #3 off time is _:__ (mm:ss)	D: 0:00 mm:ss
Once disabled, delay Heating Stage 3 for _:__ (mm:ss) after Heating Stage 4 is off.	D: 2:00 mm:ss
Heat stage 4 is __.	R: On/Off
Heating Stage 4:	
Enable Heating Stage 4 _:__ (mm:ss) after Heating Stage 3 is enabled and	D: 5:00 mm:ss
if Heating output > __%, **NOTE** This value is automatically calculated if the number of stages configured > 3.	D: 80%
hysterisis __.	D: 20%
Min heating stage #4 on time is _:__ (mm:ss)	D: 3:00 mm:ss
Min heating stage #4 off time is _:__ (mm:ss)	D: 0:00 mm:ss

The following values for Tower Control are factory defaults or typical values.

Tower Control	
Enable Tower if Source Water Temp xx deg > Minimum Source Temp Setpoint xx deg - __ deg,	D: 5 deg R: 2 to 15°F
hysterisis __. Unless Loop Optimization is enabled.	D: 3 deg R: 1 to 10°F
Tower setpoint is __ deg.	D: 90°F R: 75 to 110°F
Cooling Stage 1 is __.	R: On/Off
Cooling Stage 1:	
Enable Cooling Stage 1 if Cooling output > __% **NOTE** This value is automatically calculated based on number of stages configured.	R: 20 to 50%
hysterisis __.	D: 10%
Once disabled, delay Cooling Stage 1 for _:__ mm:ss after Cooling Stage 2 is off.	D: 5:00 mm:ss

Lockout	
Cooling Stage 2 is __.	R: On/Off
Cooling Stage 2:	
Enable Cooling Stage 2 _:__ mm:ss	D: 5:00 mm:ss
after Cooling Stage 1 is enabled and if Cooling output > __.__%, **NOTE** This value is automatically calculated if number of stages configured > 1.	R: 40 to 66%
hysterisis __.	D: 20%
Once disabled, delay Cooling Stage 2 for _:__ mm:ss after Cooling Stage 3 is off.	D: 5:00 mm:ss
Cooling Stage 3 is __.	R: On/Off
Cooling Stage 3:	
Enable Cooling Stage 3 _:__ mm:ss	D: 5:00 mm:ss
after Cooling Stage 2 is enabled and if Cooling output > __.__%, **NOTE** This value is automatically calculated if number of stages configured > 2.	R: 60 to 75%
hysterisis __.	D: 20%
Once disabled, delay Cooling Stage 3 for _:__ mm:ss after Cooling Stage 4 is off.	D: 5:00 mm:ss
Cooling Stage 4 is __.	R: On/Off
Cooling Stage 4:	
Enable Cooling Stage 4 _:__ mm:ss	D: 5:00 mm:ss
after Cooling Stage 3 is enabled and if Cooling output > __.__%, **NOTE** This value is automatically calculated if number of stages configured > 3.	D: 80%
hysterisis __.	D: 20%
Low Sump Water Level:	
Open makeup valve if switch is On for _:__ mm:ss.	D: 0:05 mm:ss

Maintenance

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Maintenance**

Point Name/Description	Default/Range
Unit	
Source Water Pump 1 Status – Pump 1's status.	R: On/Off
Source Water Pump 2 Status – Pump 2's status.	R: On/Off
Source Water Pump 1 Amps – The amps from pump 1.	R: 0.1 to 10 A
Source Water Pump 2 Amps – The amps from pump 2.	R: 0.1 to 10 A
WSHP Loop Conditions – Loop conditions are **OK** to run or **Not OK** to run, based on condenser water flow and temperature status.	R: OK to run Not OK
Outdoor Air Temperature	
Outdoor Air Temperature Source – The source of the OAT value. States: **N/A** – No sensor value associated with this device **Local** – A physical sensor is wired and connected to the appropriate input channel of this controller **Network** – A network sensor value provided to this controller **Linkage** – The sensor value from an active Linkage connection, such as Airside Linkage. **Locked Value** –The controller's sensor input is manually locked to a specific value	R: N/A Local Network Linkage Locked Value
System Outdoor Air Temperature – Allows the outdoor air temperature value to be received when enabled.	D: -999.00°F R: N/A
Outdoor Air Temp – Displays the outdoor air temperature value from your designated source.	R: -56 to 245°F
Outdoor Air Relative Humidity	
OA Relative Humidity Source – The source of the outdoor air relative humidity value. States: **N/A** - No sensor value associated with this device **Local** - A physical sensor is wired and connected to the appropriate input channel of this controller **Network** - A network sensor value provided to this controller **Linkage** - The sensor value from a linked device, obtained through air or water linkage **Locked Value** - The controller's sensor input is manually locked to a specific value	R: N/A Local Network Linkage Locked Value
System Outdoor Air RH – Allows the OA relative humidity value to be received from another Network device when enabled.	D: -999.00%rh R: N/A
OA Relative Humidity – The outdoor air relative humidity value used for control.	R: 0 to 100%rh

Point Name/Description	Default/Range
Occupancy	
Remote Contact Input – The status of the physical Remote Contact BI point.	R: Open/Closed
BAS On/Off – Determines the controller's occupancy state and can be set over the network by another device or third party BAS. Options: **Inactive** – Occupancy is determined by a configured schedule **Occupied** – The controller is always in the occupied mode **Unoccupied** – The controller is always in the unoccupied mode	D: Inactive R: Inactive Occupied Unoccupied
System Occupancy – The status of the **System Occupancy** network point.	R: Inactive Occupied Unoccupied
Occupancy Contact – The **Remote Occupancy Contact** input's current status.	R: Inactive Active Occupied
Schedules – The controller's occupancy status based on the local schedule.	R: Unoccupied/Occupied

Alarms

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Alarms**

Point Name/Description	Default/Range
Pump 1 in Hand – Pump 1's status on, but the commanded state is off.	R: Normal/Hand
Pump 1 Fail – Pump 1's commanded state is on, but the status is off and has exceeded the feedback delay timer.	R: Normal/Alarm
Pump 1 Runtime – The status of Pump 1's runtime.	R: Accumulating Exceeds Limit
Pump 2 in Hand – Pump 2's status is on, but the commanded state is off.	R: Normal/Hand
Pump 2 Fail – Pump 2's commanded state is on, but the status is off and has exceeded the feedback delay timer.	R: Normal/Alarm
Pump 2 Runtime – The status of Pump 2's runtime.	R: Accumulating Exceeds Limit
Pump 1 and 2 Failed – Pump 1 and 2 have been locked out by exceeding the attempts to start the pumps. You must manually reset them.	R: Normal/Alarm
Leaving Source Water Temp Sensor – Status of the leaving source water temperature sensor.	R: Normal/Alarm

Point Name/Description	Default/Range
High Source Water Temperature – Source water temperature has exceeded the high limit.	R: Normal/Alarm
Low Source Water Temperature – Source water temperature has dropped below the low limit.	R: Normal/Alarm
No Water Flow – Indicates there is no water flow detected in the system.	R: Normal/Alarm
High Differential Pressure – Differential pressure has exceeded the high limit.	R: Normal/Alarm
Low Differential Pressure – Differential pressure has dropped below the low limit.	R: Normal/Alarm
Outdoor Air Temp Sensor – Indicates if the controller is receiving a valid outdoor air temperature value.	R: Normal/Alarm
OA Relative Humidity – Indicates if the controller is receiving a valid outdoor air relative humidity value.	R: Normal/Alarm
Condenser Water Linkage – Indicates if **Condenser Water Linkage** is not updated from the Loop controller, after is a 5 minute alarm delay. **NOTE** Reset this alarm by re-establishing Linkage and correcting the condition that caused the Linkage failure, or by momentarily setting the Shutdown point to Active.	R: Normal/Alarm
SUMP_HI – The status of the sump high water level switch.	R: Normal/Alarm
SUMP_LO – The status of the sump low water level switch.	R: Normal/Alarm

Linkage

Navigation: i-Vu® / Field Assistant: **Properties** > **Control Program** > **Linkage**

Point Name/Description	Range
Linkage	
Linkage Equip – (Collector) Shows the linkage information that is being sent from the WSHP to the Loop Controller.	D: Application Instance = 1 Number of Providers = 0
Condenser Water Linkage – If **Active**, the controller is part of a linked system. If **Not Active**, the controller is a stand-alone device.	R: Not Active/Active
Min Allowable Loop Temperature – Used for setpoint optimization, the minimum allowable loop temperature.	R: 0.0 to 999.0°F
Max Allowable Loop Temperature – Used for setpoint optimization, the maximum allowable loop temperature.	R: 0.0 to 999.0°F
Water Loop Temp – The source water supply temperature of the loop.	R: 0.0 to 999.0°F
Loop Pump Status – The actual state of the source water loop pump(s).	R: Off/On
Heat Pumps in Cool Mode – The number of WSHP's that are currently calling for cooling operation.	R: 0 to 999
Heat Pumps in Heat Mode – The number of WSHP's that are currently calling for heating operation.	R: 0 to 999

I/O Points

The values shown on the **I/O Points Properties** page are the raw values at the I/O objects and may not match values shown on status displays that are affected by control program logic.

We strongly recommend that you leave these parameters at their defaults. I/O can only be used for the purpose designed in the equipment control program. Modifying these parameters may result in unpredictable equipment control.

The following Point List table shows the point names, point types, object ID's, and Object names for every input and output point. The default point addressing is designed to be used with the UC Open XP controller and UC Open XP IO expander.

Navigation: i-Vu® / Field Assistant: **Properties** > **I/O Points**

Point List				
Name	**Type**	**Channel**	**Input Type**	**Object Name**
OAT sensor	BAI	IN-3	Therm	oatsens
Outdoor Air RH Sensor	BAI	IN-4	0-10 vdc	oarh_sensor
Source Return Water Temp	BAI	IN-2	Therm	srwt_sensor
Source Supply Water Temp	BAI	IN-1	Therm	sswt_sensor
Source Water Diff. Pressure	BAI	IN-5	0-10 vdc	src_diff_press
SW Pump 1 Amp Sensor	BAI	IN-6	0-10 vdc	swp1_amp_sensor
SW Pump 1 Status	BBI	IN-6	Dry Contact	sw_p1_status
SW Pump 2 Amp Sensor	BAI	IN-7	0-10 vdc	swp2_amp_sensor
SW Pump 2 Status	BBI	IN-7	Dry Contact	sw_p2_status
High Wtr Level	BBI	IN-10	Dry Contact	high_sump_lvl
Low Wtr Level	BBI	IN-11	Dry Contact	low_sump_lvl
Remote Contact Input	BBI	IN-8	Dry Contact	rem_con
Source Water Flow	BBI	IN-9	Dry Contact	sw_flow
Boiler Output 1	BAO	AO-3		boiler_output1
Boiler Output 2	BAO	AO-4		boiler_output2
Bypass Valve/Pump 2 VFD Output	BAO	AO-2		chw_bypass_valve_vfd
Pump 1 VFD Output	BAO	AO-1		pump1_vfd_output
Tower Output 1	BAO	AO-5		tower_output1
Tower Output 2	BAO	AO-6		tower_output2
Alarm	BBO	BO-4		alm
Boiler Output Stage 1	BBO	EXP BO-1		m1128
Boiler Output Stage 2	BBO	EXP BO-2		m1141
Boiler Output Stage 3	BBO	EXP BO-3		m1142
Boiler Output Stage 4	BBO	EXP BO-4		m1143
CW Pump1 S/S	BBO	BO-1		cw_pump1
CW Pump2 S/S	BBO	BO-2		cw_pump2
Makeup Valve	BBO	BO-5		makeup
Tower Output Stage 1	BBO	EXP BO-5		m1144
Tower Output Stage 2	BBO	EXP BO-6		m1145
Tower Output Stage 3	BBO	EXP BO-7		m1146
Tower Output Stage 4	BBO	EXP BO-8		m1147
WSHP Comp Command	BBO	BO-3		wshp_ok

WARNINGS

- Do not change the **Value**, **Offset/Polarity**, **Exp:Num**, **I/O Type**, **Sensor/Actuator Type**, **Min/Max**, or **Resolution** I/O configuration parameter for the points listed below. Changing these parameters could cause improper control and/or equipment damage.
- Use extreme caution if locking a point as this may also cause improper control and/or equipment damage.

Point Name/Description	
Source Supply Water Temp – The value of the controller's leaving source supply water temperature sensor input, prior to configuring **Calibration Offset**.	R: -56 to 245°F
Source Return Water Temp – The value of the controller's source return water temperature sensor input, prior to configuring **Calibration Offset**.	R: -56 to 245°F
OAT Sensor – The value of the controller's outdoor air temperature sensor input, prior to any operator-configured **Calibration Offset**.	R: -56 to 245°F
Outdoor Air RH Sensor – The value of the controller's outdoor air relative humidity sensor input, prior to any operator-configured **Calibration Offset**.	R: 0 to 100%rh
Source Water Diff. Pressure – The current reading of the controller's differential pressure input.	R: 0 to 10 psi
SW Pump 1 Amp Sensor – The current voltage of the controller's pump 1 amp input.	R: 10 to 50 Amps
SW Pump 2 Amp Sensor – The current voltage of the controller's pump 2 amp input.	R: 0 to 5 Volt
SW Pump 1 Status – The current state of pump 1's status input.	R: Off/On
SW Pump 2 Status – The current state of pump 2's status input.	R: Off/On
Remote Contact Input – The current state of the input connected to the remote contact input.	R: Off/On
Source Water Flow – The current state of the flow input.	R: No Flow/Flow
High Wtr Level – The current state of the high water level switch's status input.	R: Off/On
Low Wtr Level – The current state of the low water level switch's status input.	R: Off/On
Pump 1 VFD Ouput – The current commanded output to the pump 1 VFD.	R: 0 to 100%
Bypass Valve / Pump 2 VFD Output – The current commanded output to the bypass valve or Pump 2 VFD.	R: 0 to 100%
Boiler Output 1 – The current commanded output to the Boiler Output 1.	R: 0 to 100%
Boiler Output 2 – The current commanded output to the Boiler Output 2.	R: 0 to 100%
Tower Output 1 – The current commanded output to the Tower Output 1.	R: Off/On
Tower Output 2 – The current commanded output to the Tower Output 2.	R: Off/On
CW Pump1 S/S – The current commanded output to start or stop pump 1.	R: Off/On
CW Pump2 S/S – The current commanded output to start or stop pump 2.	R: Off/On
WSHP Comp Command – The WSHP Compressor Command is enabled if the loop controller is running and has flow.	R: Off/On
Alarm – If an alarm is present in the loop controller, the alarm output is turned on.	R: Normal/Alarm

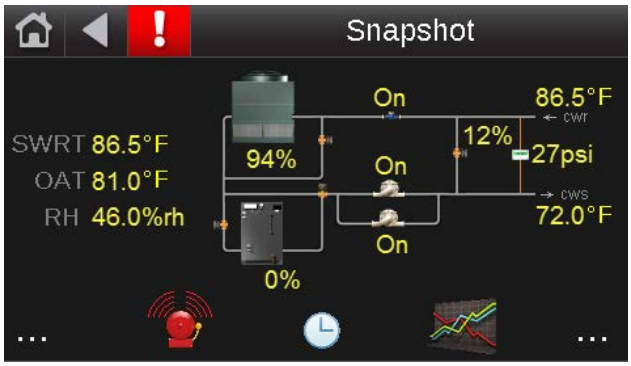
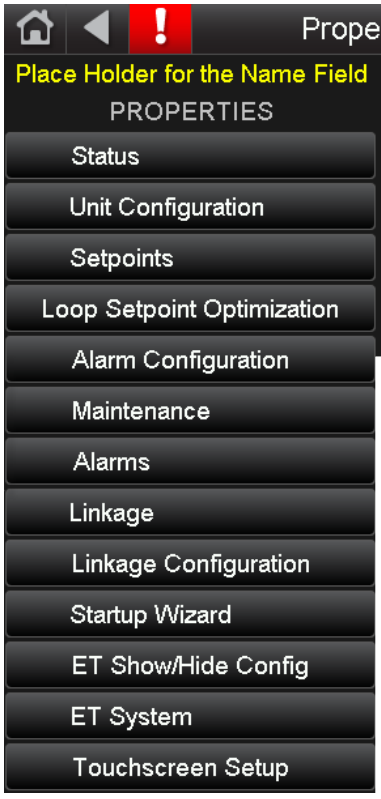
Makeup Valve – The current commanded output to the makeup valve.	R: Off/On
Boiler Output Stage 1 – The current commanded output to start or stop boiler output 1.	R: Off/On
Boiler Output Stage 2 – The current commanded output to start or stop boiler output 2.	R: Off/On
Boiler Output Stage 3 – The current commanded output to start or stop boiler output 3.	R: Off/On
Boiler Output Stage 4 – The current commanded output to start or stop boiler output 4.	R: Off/On
Tower Output Stage 1 – The current commanded output to start or stop tower output 1.	R: Off/On
Tower Output Stage 2 – The current commanded output to start or stop tower output 2.	R: Off/On
Tower Output Stage 3 – The current commanded output to start or stop tower output 3.	R: Off/On
Tower Output Stage 4 – The current commanded output to start or stop tower output 4.	R: Off/On

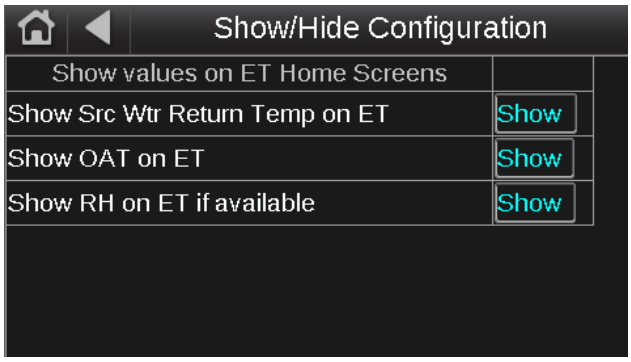
Appendix C: Loop Control Points/Properties on the Equipment Touch

NOTE Engineering units shown in this document in the defaults and ranges are strictly for reference. You must enter an integer only.

Navigation screens

Screen Names	Display	Details
Standby	 Not an interactive screen. Touch anywhere to advance to **Home** screen.	Screen displays after the **Inactivity Timer** expires (default is 5 minutes). Displays: • Source water supply temperature • Mode - Heating or Cooling • Occupancy
Home	 Click ... on the right to navigate to **Snapshot** screen.	Displays: • Source water supply temperature • Mode - Heating or Cooling • Occupancy

Screen Names	Display	Details
Snapshot	 Back to the **Home** screen - click ... on the left Forward to Loop Control **Properties Menu** screen - click ... on the right	Navigates to: • Equipment alarm indicator • SWS Temp, SWR Temp, Bypass Valve Status, Loop Diff Pressure, Boiler Status, and Tower Status, if applicable • Source pump status • OAT, if available and allowed • Alarms, if present Navigates to: • Alarm status • Schedules • Trends
Loop Control Properties		Navigates to **Property** pages Login with one of the following passwords: ○ User level - type `user` ○ Admin level - type `admin` ○ Factory level - type `Touch` **NOTE** Only the buttons that are authorized for a specific password level are visible.

Screen Names	Display	Details
Show/Hide Configuration		Configure Show/Hide conditions for values on the following screens: • Standby • Home • Snapshot **NOTE** Only displayed for the Factory or Admin password. (See above.)

Startup Wizard

Navigation: Equipment Touch: **Startup Wizard**

Point Name/Description	Range
Number Of Pumps – The number of pumps in the system.	D: One R: One Two
Pump Status Type – The type of status that the pumps deliver to the loop controller to indicate they are on.	D: Switch R: Switch Amperage Network None
Pump 1 Control – Pump control type for single pump system.	D: Constant Volume R: Constant Volume Constant Vol w/Bypass Single Vfd
Pump 2 Control – Pump control type for two-pump system.	D: Constant Volume R: Constant Volume Constant Vol w/Bypass Single Vfd Two VFDs

Point Name/Description	Range
Pump Staging – If there are 2 pumps, this type of staging enables or disables the pumps, based on **Demand Only** or **Occ or Demand** (set in **Unit Configuration**). **Lead/Standby** - One pump runs as the lead pump and the other pump waits in standby. **Lead/Lag** – One pump runs as the lead pump and, if the pressure is not maintained, brings the second pump on as the lag pump. (Only available if **Pump Control** is set to **Two VFDs**)	D: Lead/Standby R: Lead/Standby Lead/Lag
Cooling Type – The cooling tower /_fan control configuration.	D: Modulating R: Modulating 1 - Stage 2 - Stage 3 - Stage 4 - Stage
Heat Type – The boiler output control configuration.	D: Modulating R: Modulating 1 - Stage 2 - Stage 3 - Stage 4 - Stage
Sump Level Control – Enable or disable sump level control.	D: Disable R: Disable/Enable
Remote Contact Unocc Logic State – Sets the remote contact's normal logic state.	D: Open R: Open/Closed
Flow Type – Sets the Source Water Flow switch's flow type. When set to **Normal**, the flow switch contact closes when water flow is detected.	D: Normal R: Normal Inverted
Outdoor Air Sensor Type – The location of the source of the OAT input value.	D: Local OAT Sensor R: None Local OAT Sensor Network OAT
Outdoor Air Temp Calibration – A calibration offset value allows the outdoor air temperature sensor to be adjusted to match a calibrated standard measuring the temperature in the same location.	D: 0.00 R: -9.9 to 10°F
OA Relative Humidity Sensor Type - The location of the source of the Outdoor Air Relative Humidity input value.	D: Local RH Sensor R: None Local OAT Sensor Network OAT
Relative Humidity Calibration – A calibration offset value allows the local relative humidity sensor to be adjusted to match a calibrated standard measuring the space relative humidity in the same location.	D: 0%rh R: -15 to 15%rh
Differential Pressure Sensor Type – The location of the source of the differential pressure input value.	D: Local DP Sensor R: Local DP Sensor Network DP

Point Name/Description	Range
Pump 1 Trip Point – Determines when Pump 1 is on.	D: 3.00 A R: 0 to 9999.00 A
Pump 2 Trip Point – Determines when Pump 2 is on.	D: 3.00 A R: 0 to 9999.00 A
Lockout – If disabled, allows pumps to continue to cycle until either pump status is attained. If enabled it will lockout out the pumps after they have failed 3 (default value) consecutive times	D: Disabled R: Disabled/Enabled
Lock out both pumps if both have failed "#" consecutive times. - Set the number of pump failures.	D: 3 R: 1 to 5
Manually release lockout? – If the pump lockout is enabled and the pumps are locked out, you can manually release the lockout.	D: Off R: Off/Running

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
	New document		

* For internal use only

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