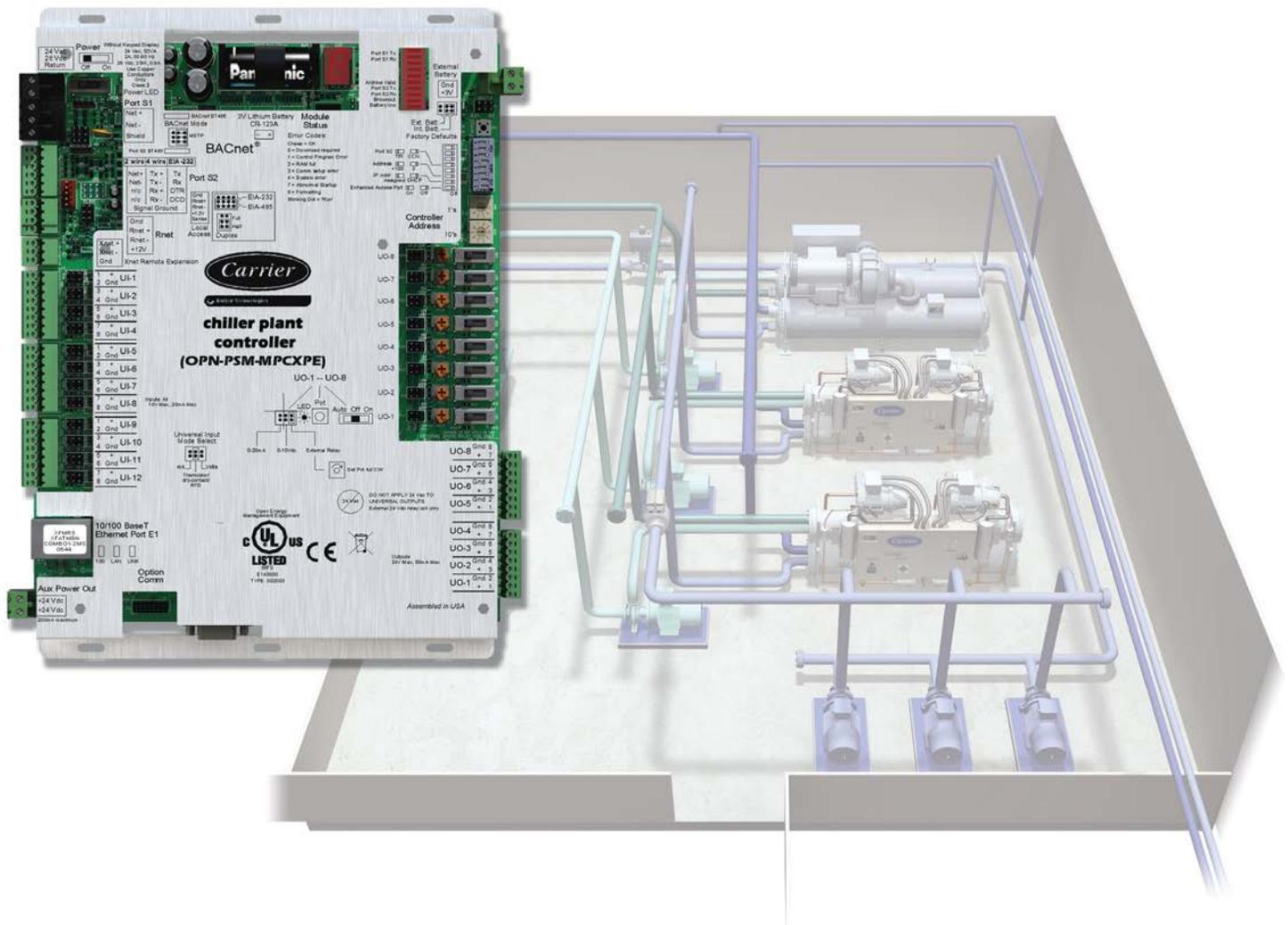


Carrier® ChillerVu™ Configuration Guide





Verify that you have the most current version of this document from www.hvacpartners.com or your local Carrier office.

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

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Introduction to the Carrier® ChillerVu™

The Carrier® ChillerVu™ provides full and advanced chiller plant management using an EquipmentBuilder library of validated algorithms and optimization strategies. You can apply the algorithms as designed or customize them in the Snap application. You can also integrate the Carrier® ChillerVu™ with third party equipment using open protocols.

 **CAUTION** You can only use the following applications and equipment files with the Carrier® ChillerVu™ controller.

Application library

The Carrier® ChillerVu™ application library provides tailored programs for general purpose chiller plant management, including:

- Chiller Manager with basic chiller staging sequences
- Chiller Manager with ACR/RCR staging
- Pump Manager with control sequences for the primary and secondary chilled water pumps
- Tower Manager with control sequences for the towers
- Open and Closed Cooling Tower programs for tower-specific control points, including condenser water pumps and other peripheral equipment

You can create a control program (.equip file) in EquipmentBuilder by selecting options and control features to match your mechanical system.

You must add several different control programs to the controller to build a complete system.

Carrier® ChillerVu™ Documentation

- *Carrier® ChillerVu™ Installation and Start-up Guide*
- An illustrated and detailed *Carrier® ChillerVu™ Application Guide*
- Properties pages in the i-Vu® interface
- A live Logic page in the i-Vu® interface for each application
- The sequences of operation created by EquipmentBuilder

Sal library applications

This document describes procedures to build a control program in EquipmentBuilder and then configure it on the **Properties** pages in the i-Vu® interface.

See the following sample applications:

- *Chiller Manager for 4 equal-sized chillers or 4 dissimilar-sized chillers* (page 3)
- *Chiller Manager with Supply Temp and kW Demand - (ACR - RCR Carrier Routine)* (page 19)
- *Pump Manager for 4 Constant Volume Primary/Equal-sized pumps* (page 33)
- *Pump Manager for 4 Variable Volume Secondary/Equal-sized pumps* (page 42)
- *Tower Manager for 4 Cooling Towers/Equally-sized Parallel towers* (page 52)
- *Open or Closed Circuit Tower* (page 59)

You must add several different control programs to the controller to build a complete system. See *Connecting multiple control programs* (page 69).

Designing Chiller Manager Parallel/Equal-sized and Parallel/Dissimilar-sized applications

You can configure applications for the Chiller Manager for 2 - 8 equal-sized machines and up to 8 dissimilar-sized machines (4, if using Add/Drop programming). The following example is based on 4 equal-sized chillers, with notes highlighting the differences when designing for 4 dissimilar-sized chillers.

To design your application, build a control program in EquipmentBuilder and then configure the properties in the i-Vu® application.

Generate files in EquipmentBuilder

- 1 In EquipmentBuilder, you can select basic staging for up to 8 machines.

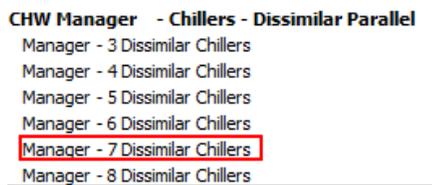
NOTE There are 4 chillers in the following example.



NOTE Dissimilar-sized chillers

You must use the following workaround for dissimilar-sized chiller applications.

The current program is limited to 4 chillers, 1 small and 3 large. To set up the workaround, you must select **7 Equal Chillers** (not 4) in step 1 in EquipmentBuilder. This results in 7 Chiller Rotation Levels to set up your Run Order and 7 possibilities for Add/Drop. See *Chiller Manager - Dissimilar-sized* (page 11) for further instructions on configuring Add/Drop for a 3-and-1 system.



- 2 For equal-sized or dissimilar-sized chillers, click **Next**.
- 3 On the **Summary** tab, select your options from the drop-down lists.

NOTE Some of the lists do not have selectable options for the equipment.

The screenshot shows the configuration interface for a chiller manager. At the top, there are three tabs: 'Summary', 'Points', and 'Sequence'. The 'Summary' tab is active. Below the tabs, the 'Equipment Name' is 'Manager - 4 Equal Chillers' and the 'Type' is 'Manager - 4 Equal Chillers'. There are radio buttons for 'English' (selected) and 'Metric'. The main configuration area contains several settings:

- Status: Status (dropdown)
- Run Conditions: Multiple Select (dropdown)
- Safeties: Safeties (dropdown)
- Staging Method: Thermal Load AND Chilled Water Supply Temperature (dropdown)
- Run Order Selection: Numbered Array (dropdown)
- Sequence Rotation: Fixed Period - Selectable (dropdown)
- Chiller Chilled Water Supply Temp. Setpoint & Reset: Setpoint (dropdown)
- Power Management: Soft Start, Demand Response & Limiting
- Enable Control: Enable (dropdown)
- Points: Inputs and Outputs - Carrier (dropdown)
- Program Reset: Manager & Lockout Resets (dropdown)
- Temperature Alarms: Chilled Water Alarms (dropdown)

- 4 Click **Next**.
- 5 Browse to the appropriate folder and save your control program, drivers, and sequence of operation, and click **Next**.

Configuring properties in the i-Vu® application

To adjust the following properties in the i-Vu® interface, select the controller in the navigation tree and click the **Properties > Control Program** tab. The properties are listed here in the same order that they appear in the i-Vu® interface.

All of the following apply to both similar and dissimilar-sized chillers, except for the run order.

Chiller Manager status

Manager Status

Displays the overall condition of the Chiller Manager program and the individual chillers.

Manager Status						
Chillers	Position	Enable	Status	Maintenance Lockout	Power Loss Lockout	Failure Status
Chiller 1	1	Off	Off	Off	Off	Normal
Chiller 2	2	Off	Off	Off	Off	Normal
Chiller 3	3	Off	Off	Off	Off	Normal
Chiller 4	4	Off	Off	Off	Off	Normal

Current stage number is: 0
Current rotation sequence number is: 1

Chiller Plant Load:
Current load is 0.00 ton.

Number of chillers called to be ON:
Stages ON (BAV) 0.00

Number of Chillers to be called ON (Stages ON) above can act as Link to:
-- Headered Pump manager or
-- Headered Cooling Tower Manager

Run Conditions

Select the Command method in the **Equipment Manager Enable Command - Select: — Run** drop-down list and enable other options.

NOTE Selectable Run Conditions have additional Properties.

▼ Run Conditions

Equipment Manager Enable Command - Select: — Run **via Remote S/S** ▼

Equipment Enable Status (BMSV) OFF

On - Off - Auto: **Auto** ▼

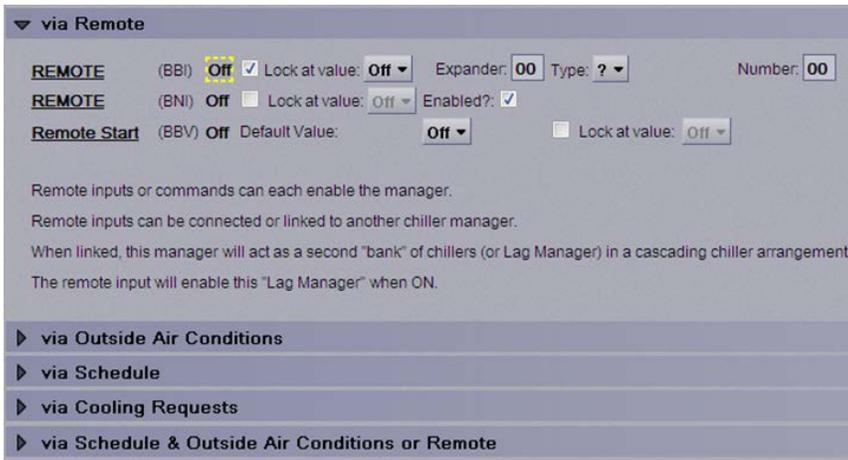
Equipment Manager Run Status: Off

CTs Available (ANI2) 4.00 Lock at value: 0 Enabled?:

Allow number of available Cooling Towers to limit number of Chilllers? **No** ▼

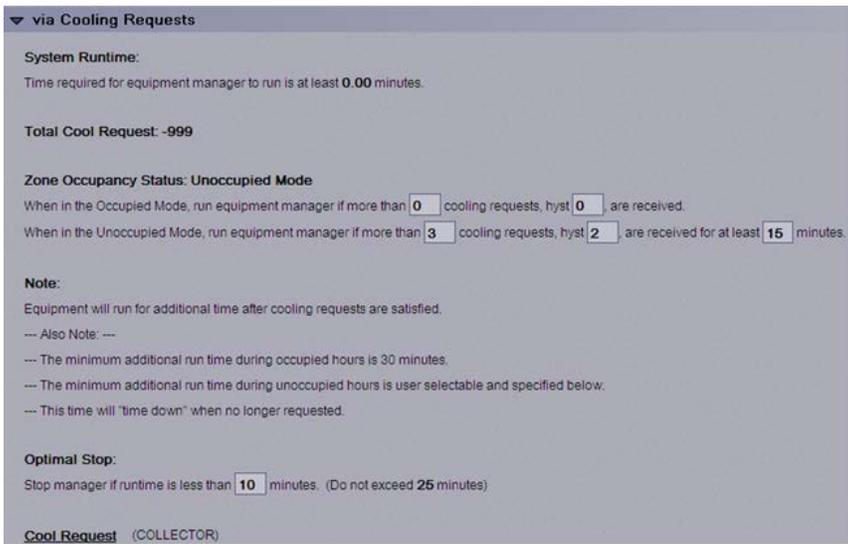
OFF
via Remote S/S
via OA Temp Only
via Schedule
via Clg.Requests &OA
via Sch&OA or RemS/S

via Remote example



via Cooling Requests – has 2 purposes:

- You can enable the **Manager** to receive a specific number of cooling requests (normally, calls for cooling are from chilled water consumers)
- Provides the number of cooling callers to the optional **Trim and Respond** supply water reset feature. See *Chiller Manager setpoints* (page 13).



Chiller Shutdowns

Set the 3 shutdown inputs:

- **Refrig** - a refrigerant leak detector
- **Emerg** - a hardwired shutdown switch

- **Remote Shutdown** - a remote network variable

Chiller Shutdowns

Refrig Shutdn (BBI) Off Lock at value: Off Expander: 00 Type: Binary Input Number: 00

Emerg Shutdn (BBI) Off Lock at value: Off Expander: 00 Type: Binary Input Number: 00

Remote Shutdown (BNI) Off Lock at value: Off Enabled?:

Alarm(s):

REF LEAK (BALM) Normal
Enable Alarm 0:02 mm:ss after input is On.

EMER OFF (BALM) Normal
Enable Alarm 0:02 mm:ss after input is On.

REM SHUTDOWN (BALM) Normal
Enable Alarm 0:02 mm:ss after input is On.

Chiller plant staging

The Chiller Plant Staging – 4 Stages

Provides access to the chilled water temperature and flow inputs. You can select either hardwired or network input points. The hardwired water temperature inputs shown below are typically installed in the common supply and return headers and are used for chiller staging.

Chiller Plant Staging - 4 Stages

CHWS Temp (BAI) 52.0 *F Lock at value: 52.0 Expander: 00 Type: Thermistor Number: 00

CHWR Temp (BAI) 58.0 *F Lock at value: 58.0 Expander: 00 Type: Thermistor Number: 00

CHWR Temp (ANI) 0.00 Lock at value: 0 Enabled?:
Use network chilled water return temperature point instead of hardware point? No

CHWS Temp (ANI) 0.00 Lock at value: 0 Enabled?:
Use network chilled water supply temperature point instead of hardware point? No

CHWR Temp (BAV) 58.00

CHWS Temp (BAV) 52.00

Gain used to smooth the chilled water supply temperature input reading is 1, where 1 = no smoothing and 10 = maximum.
Note: This gain will provide a smoother transition of noisy input readings to its final value by ramping the differential or change in input up or down. Higher gains will have smaller increments or decrements to the differential but slows the transition to the final value. A gain of 1 disables the smoothing so the output is equal to the input. Gains must be > 0.

Override Current Number of Chillers: Off

Under **Chilled Water Supply Temperature - Trip Point**, you can set a fixed number of chillers to be locked on. If they are not, **Override Current Number of Chillers** is hidden. You can also select the units for load determination in **Building Thermal Load: 0**.

Chilled Water Supply Temperature - Trip Point:
 Enable stage up of each chiller if chilled water supply temperature > **42.00** degrees + degrees
 Setpoint above is based on effective setpoint from "Setpoint Section" and includes any reset.
 Hysteresis is as set in "Chiller Plant Staging - Setup" section below.

Override Current Number of Chillers:

Building Thermal Load: **tons**

There are 9 possible staging options for the Chiller Manager, which you must select in EquipmentBuilder when you build the control program:

- Supply Temp & kW Demand (ACR - RCR Carrier Routine)
- Chilled Water Supply Temperature Only
- Thermal Load AND/OR Chilled Water Supply Temperature
- Percent Thermal Capacity AND/OR Chilled Water Supply Temperature
- Percent KW Capacity AND/OR Chilled Water Supply Temperature
- Chilled Water Return Temperature Only

NOTE The logic is identical for Thermal Load, Thermal Capacity, and kW Capacity, except for the variables of **AND** or **OR**.

Status:
 Run Conditions:
 Safeties:
 Staging Method:
 Run Order Selection:
 Sequence Rotation:
 Chiller Chilled Water Supply Temp, Setpoint & Reset:
 Power Management: Demand Response & Limiting
 Enable Control:
 Points:
 Program Reset:
 Temperature Alarms:

The following example uses **Thermal Load AND Chilled Water Supply Temperature**.

In the i-Vu® interface, you can configure the following plant-staging parameters. Stage 1 and the last Stage (4, in this example) are unique, but the stages between 1 and the last stage are identical. Because of this, the Stage 3 screen capture is omitted.

Chiller Plant Staging - Setup

Number of Stages Enabled is: **0.00**.

Stage 1

Enable Stage 1:
Anytime the chiller manager is enabled.

Stage 1 minimum ON and minimum OFF timers
Minimum ON timer: **30** : **00** (mm:ss) current state: **False**
Minimum OFF timer: **20** : **00** (mm:ss) waiting to change: **True**

Stage 2

Enable Stage 2 if:
Building thermal load > **90** tons (kW if metric) (hysteresis of **40**) AND
Chilled water supply temperature > **44.00** degrees (hysteresis of **1** degrees)

Stage 2 Delays
Enable Delay: Wait **10** : **00** (mm:ss) after Stage 1 is enabled before Stage 2 can be enabled. Delay currently **False** for 0:00 (mm:ss).
Disable Delay: Wait **10** : **00** (mm:ss) after Stage 3 is disabled before Stage 2 can be disabled. Delay currently **False** for 0:00 (mm:ss).

Stage 2 minimum ON and minimum OFF timers
Minimum ON timer: **30** : **00** (mm:ss) current state: **False**
Minimum OFF timer: **20** : **00** (mm:ss) waiting to change: **False**

Stage 4

Enable Stage 4 if:
Building thermal load > **270** tons (kW if metric) (hysteresis of **90**) AND
Chilled water supply temperature > **44.00** degrees (hysteresis of **1** degrees)

Stage 4 Delays
Enable Delay: Wait **10** : **00** (mm:ss) after Stage 3 is enabled before Stage 4 can be enabled. Delay currently **False** for 0:00 (mm:ss).

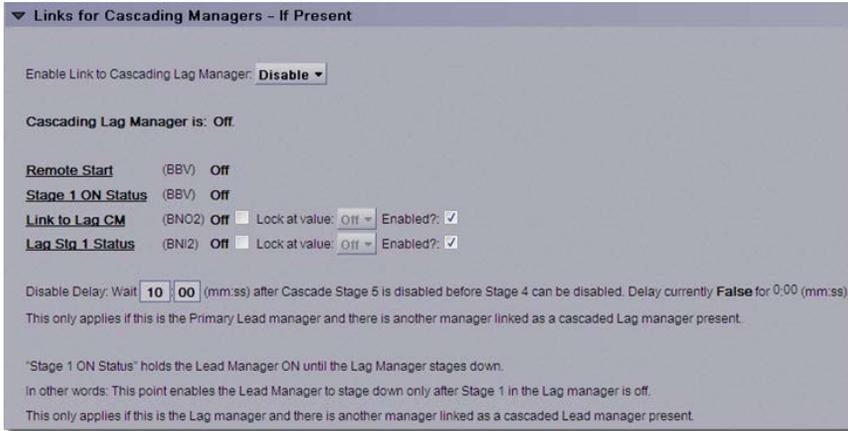
Stage 4 minimum ON and minimum OFF timers
Minimum ON timer: **30** : **00** (mm:ss) current state: **False**
Minimum OFF timer: **20** : **00** (mm:ss) waiting to change: **False**

You can set the individual parameters on a stage-by-stage basis, which can be used or overridden, based on careful adjustment of the defined settings. You can also set **Minimum ON** and **Minimum OFF** time delays.

NOTE The tonnage-based staging requires a common chilled water flow sensor.

Links for Cascading Managers - if Present

Links a Chiller Manager equipment file to another equipment file to increase the number of available control steps, which is useful for plants with more than 8 chillers. You can access status and delay values when cascading Managers.



Chiller run order for equal-sized chillers

Chiller Run Order (Equal-sized)

Defines the chiller run order for the Equal Sized Chiller Manager. You can specify 4 separate run orders and lock to a specific run order. You can also lock to a specific **Run Order** in **Chiller Run Order** options.



Chiller run order for dissimilar-sized chillers

Chiller Run Order (Dissimilar-Sized)

Defines the chiller run order when building the **Dissimilar-sized Chiller Manager**. You can specify multiple run orders with multiple steps for complex run order arrangements. This is used frequently to replicate the **Add/Drop** sequencing available in the CCN Chillervisor.

	Lock Chiller	Start Status
CH1	Off	On
CH2	Off	Off
CH3	Off	Off
CH4	Off	Off
CH5	Off	Off
CH6	Off	Off
CH7	Off	Off

▶ Chiller Rotation Level 1 - Selection Array
 ▶ Chiller Rotation Level 2 - Selection Array
 ▶ Chiller Rotation Level 3 - Selection Array
 ▶ Chiller Rotation Level 4 - Selection Array

NOTE Currently, the Dissimilar-Sized Chiller Manager is limited to Add/Drop applications with 1 small and 3 large chillers. This requires 7 steps of control, as shown below using 7 machines and 7 steps.

The following example shows how to configure **Add/Drop** for a 3 large and 1 smaller chiller plant system.

Assumptions:

- Chiller 1, 2, and 3 are large
- Chiller 4 is small
- Chiller 5, 6, and 7 are not used

The run order for this system is:

- Step 1 - CH4
- Step 2 - CH1
- Step 3 - CH1, CH4
- Step 4 - CH1, CH2
- Step 5 - CH 1, CH2, CH4

- Step 6 – CH1, CH2, CH3
- Step 7 – CH1, CH2, CH3, CH4

▼ Chiller Rotation Level 1 - Selection Array

This rotation level is: **On**
 Current Stage is: **0.00**

Chillers	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
CH1	Off ▼	On ▼	On ▼	On ▼	On ▼	On ▼	On ▼
CH2	Off ▼	Off ▼	Off ▼	On ▼	On ▼	On ▼	On ▼
CH3	Off ▼	On ▼	On ▼				
CH4	On ▼	Off ▼	On ▼	Off ▼	On ▼	Off ▼	Off ▼
CH5	Off ▼						
CH6	Off ▼						
CH7	Off ▼						

Chiller rotation

Chiller Rotation

Configure chiller rotation for the following:

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

NOTE To manually rotate the run order, select **Manual Rotation** for the **Sequence rotation method** and set **4** to **Rotate**.

▼ Rotation of Sequences - Method

Sequence rotation method: **Manual Rotation** ▼

Rotation Method Parameters:

1. If method is "Daily," rotate sequence daily at the defined time below.
2. If method is "Weekly," rotate sequence on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," rotate sequence on day **1** of each month at the defined time below.
4. If method is "Manual Rotation," **Rotate** ▼ sequence now.
5. If method is "Runtime," rotate sequence after **180** hours of runtime.

Defined Time for Rotation:
 All automatic rotation will occur at **13:00** (24hr format).

Reset Rotation of Sequences:
 Reset the rotation of sequences back to the first sequence: **Off** ▼ (Note: Set to Off once reset has taken place.)

Chiller Manager setpoints

Chilled Water Supply Setpoint Reset (OAT)

Select this option in EquipmentBuilder and then set the Properties associated with the optional **Outside Air Temperature Reset** for chilled water.

Chilled Water Supply Setpoint Reset - Based on Outside Air Temperature

Outside Air Temperature Reset:
 OA Temp (Low deg., High deg.) resets CHWS setpoint adjustment (degree range):
 Convert values in the range [55 , 85] to [10 , 0].

Setpoint Adjustment:
 Current setpoint adjusted by 5.0 °F.

Chilled Water Supply Setpoint Reset (Trim and Respond)

Select **Trim and Respond** for the **Setpoint Reset Type** in EquipmentBuilder and then set the parameters on the **Properties > Control Program** tab in the i-Vu® interface.

Summary	Points	Sequence
Equipment Name: Manager - 4 Equal Chillers		
Type: Manager - 4 Equal Chillers		
<input checked="" type="radio"/> English <input type="radio"/> Metric		
Status	Status ▾	
Run Conditions	Multiple Select ▾	
Safeties	Safeties ▾	
Staging Method	Supply Temp & kW Demand - (ACR - RCR Carrier Routine) ▾	
Run Order Selection	Numbered Array ▾	
Sequence Rotation	Fixed Period - Selectable ▾	
Setpoint Reset Type	None ▾ None Trim and Respond Outside Air Temperature <input type="checkbox"/> Demand Response & Limiting (ACR/RCR)	
Power Management		

Trim and Respond adjusts the chilled water supply setpoint, based on the number of system cooling requests. You can find information on the number of incoming cooling requests in the **Cooling Requests** section of **Run Conditions**.

Chilled Water Supply Setpoint Reset - Based on Cooling Requests

Optimized Reset:
System Cooling Request resets CHWS setpoint adjustment:
Initial Reset deg., Max Reset deg., Min Reset deg.
Every mins, Trim by deg. and Respond by deg. but no more than deg.

Setpoint Adjustment:
Current setpoint adjusted by **7.0 °F**.

Chilled Water Supply Temperature Effective Setpoint

Effective Chilled Water Setpoint :
Current effective setpoint (including any reset or demand adjustment) is: **49.0 °F**.

Soft Start and Demand Limiting

Soft Start

The Soft Start options limit chiller kW when bringing additional chillers online, which reduces demand charges and contributes to proper load balance.

▼ **Soft Start**

Soft Start - (This limits the running chiller(s) power (kW) through demand limiting when bringing on an additional chiller)
Soft Start is: **Enabled** ▼

Soft Start Settings

- Limit current running chiller(s) power to: % whenever a new chiller stages on.
- Prevent Soft Start if Chilled Supply Water Temperature is: -- Greater than a chilled water temperature setpoint of **42.2 °F** + °F.
- Restrict rate of change of the demand limit on soft start: Currently **100.00** Limit rise to % per : (mm:ss) Rate of change restricted? **False**

Demand Limiting

Demand Limiting operates the Carrier® ChillerVu™ in conjunction with a network demand meter to limit plant capacity to 3 defined levels.

Demand Limiting - (This limits the running chiller(s) power (kW) through demand limiting when the facility kW demand is above preset electric meter limits)

Demand Limiting is: **Disabled** ▼

Limit (hold) chiller staging to current stage (current number of chillers enabled) if the electric meter current demand level is: -- Greater than or equal to:

Current System Demand Level (ANI) Lock at value: Enabled?:

Demand Limiting is: **Inactive**

Current Demand Level: **0.00**

Maximum Demand Limit is: % (default to 100%)

If Electric Meter Demand Level is 1, limit chiller power (kW) to: %

If Electric Meter Demand Level is 2, limit chiller power (kW) to: %

If Electric Meter Demand Level is 3, limit chiller power (kW) to: %

Minimum Demand Limit is: % (default to 50% - demand limit cannot go below this value.)

Current demand limit is: **100.00 %**

Convert (ratio) the demand limit values (percentages) to the values required by the chiller "demand limit" inputs.
 Convert demand limit percentages of **(0 to 100)** % to chiller demand limit input requirements to .

Individual chiller control

Chiller # Control

Each chiller in the system has **Chiller # Control** properties.

You can:

- Set the delays for
 - chiller start
 - shutdown
 - power loss restore
- Select Maintenance Mode to remove the chiller from sequencing logic, if it is unavailable or needs repair
- Manually reset a chiller's operational status if the Chiller Manager has detected machine failure
- Set alarm delay values, alarm status, and runtime alarm values

NOTE To avoid unexpectedly long delay times, carefully consider the delay values you set in **Chiller Plant Staging** (page 7).

Individual Chiller Control - Configuration

Chiller 1 Control

Chiller Start Delay: Enable chiller : mm:ss after equipment is commanded **On**.

Shutdown Delay: Prior to disabling Chiller, hold output signal for : mm:ss.

CH1 Delay on power loss restore is : (mm:ss) with output of **False** for 0:00 (mm:ss).

Chiller 1 Enable:
Chiller 1 is currently **Enabled**.

Chiller 1 Maintenance Mode:

Re-enable Chiller 1 on Failure now:

Chiller 1 Failure Lockout is: **False**.

Alarm(s):
Chiller Status Alarms: Feedback Delay: Debounce Time:

CH1 FAIL (BALM) **Normal**

CH1 HAND (BALM) **Off**

CH1 RNTM (BALM) **Off**

Send runtime message if runtime exceeds hours.

Individual Chiller Command Points - Configuration

Provides the status of the available hardware and network points. You can specify if the Chiller Manager can write control values to the chiller and define specific I/O points.

NOTES

- Network Points provide statuses and do not normally need to be Locked.
- The URL's for the Network Points are accessible on the **Properties > Network Points** tab in the i-Vu® interface.

Individual Chiller Command Points - Configuration

Chiller 1

Enable CM Write to CH1? (BBV) **No** Default Value: Lock at value:

Hardware Points		Lock at value:	Expander:	Type:	Number:
CH1 Enable	(BBO) On	<input type="checkbox"/> Off	<input type="text" value="00"/>	Relay / Triac Output	<input type="text" value="00"/>
CH1 Status	(BBI) Off	<input type="checkbox"/> Off	<input type="text" value="00"/>	Binary Input	<input type="text" value="00"/>
CH1 Power Loss	(BBI) Off	<input type="checkbox"/> Off	<input type="text" value="00"/>	Binary Input	<input type="text" value="00"/>
CH1 Hold	(BBI) Off	<input type="checkbox"/> Off	<input type="text" value="00"/>	Binary Input	<input type="text" value="00"/>
CH1 Ext_Reset	(BBI) Off	<input type="checkbox"/> Off	<input type="text" value="00"/>	Binary Input	<input type="text" value="00"/>
CH1 Demand Limit	(BAC) 100.0 %	<input type="checkbox"/> 0.0	<input type="text" value="00"/>	Electrical 0-10 Volt	<input type="text" value="00"/>

Chiller Manager - Inputs and Outputs - Carrier

The following list of network points is for a Chiller Manager built using **Inputs and Outputs – Carrier**.

Network Points				
<u>CH1 Enable</u>	(BNO2) Yes	<input type="checkbox"/> Lock at value:	No ▾	Enabled?: <input checked="" type="checkbox"/>
<u>Enable CM Write to CH1</u>	(BNO) No	<input type="checkbox"/> Lock at value:	No ▾	Enabled?: <input checked="" type="checkbox"/>
<u>Chiller 1 Status</u>	(BNI) On	<input type="checkbox"/> Lock at value:	Off ▾	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Power Loss</u>	(BNI) Off	<input type="checkbox"/> Lock at value:	Off ▾	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Hold</u>	(BNI) Off	<input type="checkbox"/> Lock at value:	Off ▾	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Ext.Reset</u>	(BNI) Off	<input type="checkbox"/> Lock at value:	Off ▾	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CCN Comm</u>	(BNI) No Comm	<input type="checkbox"/> Lock at value:	No Comm ▾	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Mode</u>	(ANI) -999	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Run Capacity</u>	(ANI) -999.0	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Run Hours</u>	(ANI) -999	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CHWR</u>	(ANI) -999.0	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CHWS</u>	(ANI) -999.0	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 % KW</u>	(ANI) -999.0	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Ctrl Status</u>	(ANI) -999	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Alarm Status</u>	(ANI) -999	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Demand Limit</u>	(ANO2) 100.00	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CHWS Setpoint</u>	(ANO2) 48.66	<input type="checkbox"/> Lock at value:	0	Enabled?: <input checked="" type="checkbox"/>

Chiller Manager reset and alarms

Automatic Resets: Program Reset and Reset on all Chiller Failures

You can manually restart the Chiller Manager program and define the program-based chiller lockouts.

NOTE The term **Lockout**, in this instance, refers to machines that are locked out of staging by the Chiller Manager program. It does not clear any specific chiller-based lockouts that exist within the actual chiller control.

▼ **Automatic Resets: Program Reset and Reset on All Chiller Failures**

Manager Control Program Reset: Off ▾

Note: This command will perform a restart of the manager control program. Program must be OFF for reset to work.

All Chiller Reset:

Automatically resets all chillers should chillers fail. **Enable** ▾

Chilled Water Supply and Return Temperature Alarms

Displays the status and configuration values for the water temperature alarms.

Chilled Water Supply and Return Temperature Alarms

Alarm(s):
Enable Chilled Water Supply Temperature alarms after the equipment has been running for mm:ss.

CHST_HI (BALM) **Normal**
Send High Chilled Water Supply Temp Alarm if temperature > deg. for mm:ss.

CHST_LO (BALM) **Normal**
Send Low Chilled Water Supply Temp Alarm if temperature < deg. for mm:ss.

Enable Chilled Water Return Temperature alarms after the equipment has been running for mm:ss.

CHRT_HI (BALM) **Normal**
Send High Chilled Water Return Temp Alarm if temperature > deg. for mm:ss.

CHRT_LO (BALM) **Normal**
Send Low Chilled Water Supply Temp Alarm if temperature < deg. for mm:ss.

Designing Chiller Manager Parallel/Equal-sized applications using ACR/RCR staging

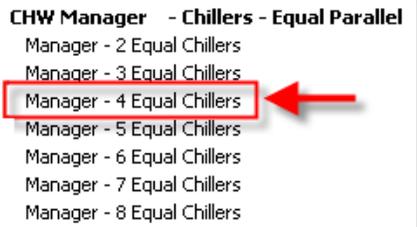
You can configure applications for a **Chiller Manager with Supply Temp and kW Demand – (ACR – RCR Carrier Routine)** staging method. The options include staging routines for Additional Cooling Required and Reduced Cooling Required, similar to the routines in the Carrier Chillervisor System Manager.

To design your application, build a control program in EquipmentBuilder and then configure the properties in the i-Vu® application.

Generate files in EquipmentBuilder

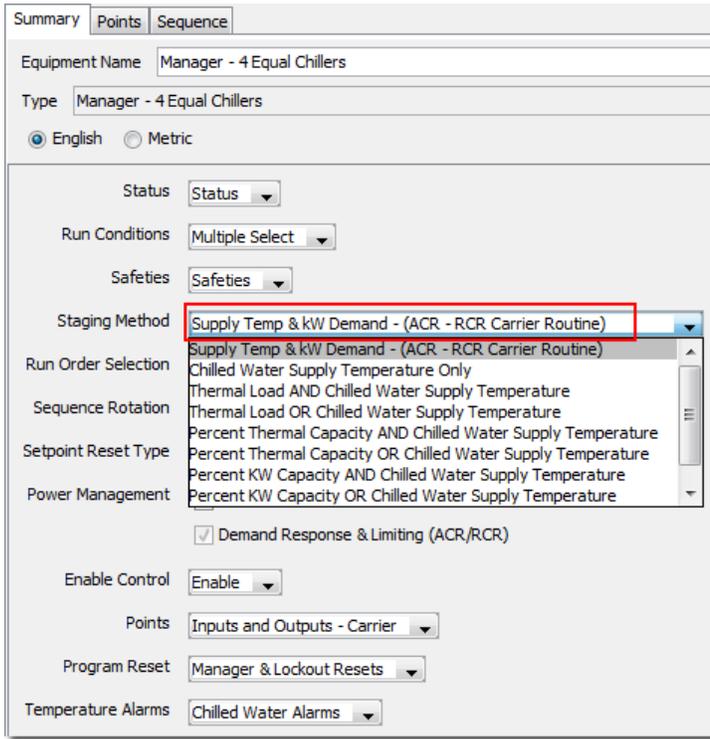
- 1 In EquipmentBuilder, you can select basic staging for up to 8 machines.

NOTE There are 4 chillers in the following example.



- 2 Click **Next**.
- 3 On the **Summary** tab, select your options from the drop-down lists.
- 4 For **Staging Method**, select **Supply Temp & kW Demand - (ACR - RCR Carrier Routine)**.

NOTE The option **Demand Response & Limiting (ACR/RCR)** is automatically enabled and you cannot deselect it.



- 5 Click **Next**.
- 6 Browse to the appropriate folder and save your control program, drivers, and sequence of operation, and click **Next**.

Configuring properties in the i-Vu® application

To adjust the following properties in the i-Vu® interface, select the controller in the navigation tree and click the **Properties > Control Program** tab. The properties are listed here in the same order that they appear in the i-Vu® interface.

Chiller Manager status

Manager Status

Displays the current operating condition of the Chiller Manager, including current plant load and number of requested chillers.

Chillers	Position	Enable	Status	Unavailable	Power Loss Lockout	Failure Status
Chiller 1	1	On	On	Off	Off	Normal
Chiller 2	2	Off	Off	Off	Off	Normal
Chiller 3	3	Off	Off	Off	Off	Normal

Current stage number is: **1**
 Current rotation sequence number is: **1**

Chiller Plant Load: (if available)
 Current load is **0.00 ton**.

Number of chillers called to be ON:
Stages ON (BAV) **1.00**

Number of Chillers to be called ON (Stages ON) above can act as Link to:
 -- Headered Pump manager or
 -- Headered Cooling Tower Manager

Run Conditions

Select the Command method in the **Equipment Manager Enable Command - Select: — Run** drop-down list and enable other options.

NOTE Selectable Run Conditions have additional Properties.

▼ **Run Conditions**

Equipment Manager Enable Command - Select: — Run **via Remote S/S** ▼

Equipment Enable Status (BMSV) OFF

On - Off - Auto: **Auto** ▼

Equipment Manager Run Status: Off

CTs Available (ANI2) **4.00** Lock at value: Enabled?:

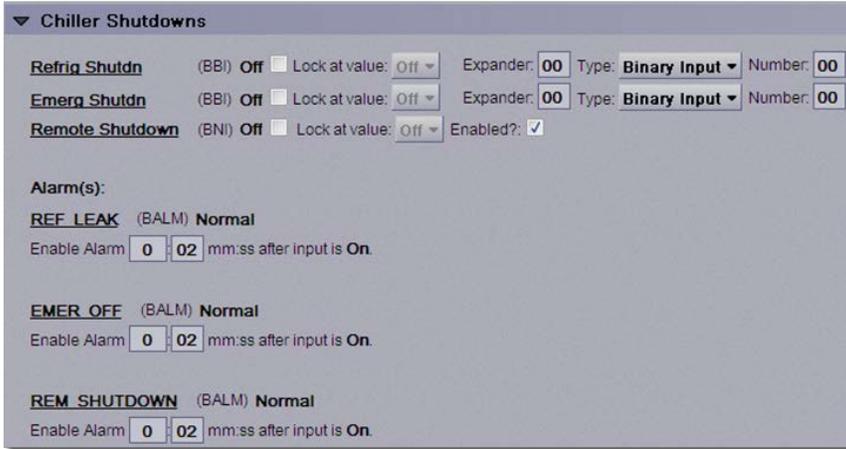
Allow number of available Cooling Towers to limit number of Chilllers? **No** ▼

Chiller Shutdowns

Set the 3 shutdown inputs:

- **Refrig** - a refrigerant leak detector

- **Emerg** - a hardwired shutdown switch
- **Remote Shutdown** - a remote network variable



Chiller plant staging

Chiller Plant Staging – # Stage(s) – Temperature & Demand – ACR/RCR Algorithm

You can adjust chiller staging and view current maintenance conditions of the ACR and RCR routines. You can limit the maximum number of running stages or override the number of running chillers to a fixed number.

Before an additional stage is enabled, the following ACR parameters must be true:

- The current chilled water supply temperature is above the effective setpoint plus ACR **Delta T**
- The current pull-down rate is less than the defined ACR pull-down rate
- The current demand limit status is off
- The adjustable delay timer is activated when the 3 previous conditions are true



ACR - Additional Cooling Requirements - Stage Up Logic

----- **Stage Up - ACR - Criteria** -----

Stage Up if the following 4 conditions are met:

1. ----- (Current chilled water temperature is greater than (current chilled water temperature effective setpoint + delta temperature))
 (Effective Setpoint is the chilled water temperature setpoint offset by any setpoint reset or demand limit reset)
 Condition 1 is: **On**

CHW Temp (BAV) **55.00 °F**
Eff Spt + Delta T (BAV) **45.00 °F**

Eff Spt (BAV) **42.00 °F**
Delta T (BAV) **3 °F** Default Value: Lock at value:

2. ----- AND the chilled water temperature pulldown rate is less than the Pulldown Rate Limit (in degrees per minute - default 0.5 - user definable)
 Condition 2 is: **On**

ACR Pull Rate Actual (BAV) **0.00**
ACR Pull Rate Spt. (BAV) **0.5** Default Value: Lock at value:

3. ----- AND the plant is not in Demand Limit
 Condition 3 is: **On**

Demand Limit (BBV) **Off**

4. ----- ALL must be true for a certain time delay
 Condition 4 is: **Off**

ACR Stage Up Time Delay is: : (mm:ss) with output of **False** for 9,21 (mm:ss).

Chiller Load exceeds Chiller Capacity
 Alarm if chilling is still required but no more chillers available - for a period of: : (mm:ss)

Cap Exc (BALM) **Off**

Before a stage can be disabled, the following RCR parameters must be true:

- The current chilled water supply temperature is less than the effective setpoint plus 60% of the ACR **Delta T**
- The current load is less than the anticipated combined load, if a stage is dropped
- The current demand limit status is off

- The adjustable delay timer is activated when the 3 previous conditions are true

—— Stage Down - RCR - Criteria ——

Stage Down if the following 4 conditions are met:

1. ----- Current chilled water temperature is less than current chilled water temperature effective setpoint + (delta temperature x 0.6)
 (Effective Setpoint is the chilled water temperature setpoint offset by any setpoint reset or demand limit reset)
 Condition 1 is: **Off**.

CHW Temp (BAV) **55.00 °F**
Eff Stpt + Delta T x 0.6 (BAV) **43.80 °F**
ACR Stpt Delta T (BAV) **3.00 °F**

2. ----- AND the current average plant load is less than the anticipated combined chiller capacity of the next stage down.
 Condition 2 is: **On**.

Avg Plant Load % (BAV) **0.00 %**
Anticipated Thermal Capacity % (BAV) **5.00 %**

3. ----- AND the plant is not in Demand Limit
 Condition 3 is: **On**.

Demand Limit (BBV) **Off**

4. ----- ALL must be true for a certain time delay
 Condition 4 is: **Off**.

RCR Stage Down Time Delay is: (mm:ss) with output of **False** for 0:00 (mm:ss).

Chiller run order for equal-sized chillers

Chiller Run Order (Equal-sized)

Defines the chiller run order for the Equal Sized Chiller Manager. You can specify 4 separate run orders and lock to a specific run order. You can also lock to a specific **Run Order** in **Chiller Run Order** options.

▼ Chiller Run Order

Lock rotation to order: **NO** ▼

Current Rotation Level: **1**

Note: Do not zero out order.

Chillers	Lock Chiller	Order 1	Order 2	Order 3	Order 4	Start Status	Current Order
CH1	Off ▼	<input type="text" value="1"/>	<input type="text" value="4"/>	<input type="text" value="3"/>	<input type="text" value="2"/>	Off	1.
CH2	Off ▼	<input type="text" value="2"/>	<input type="text" value="1"/>	<input type="text" value="4"/>	<input type="text" value="3"/>	Off	2.
CH3	Off ▼	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="1"/>	<input type="text" value="4"/>	Off	3.
CH4	Off ▼	<input type="text" value="4"/>	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="1"/>	Off	4.

Chiller rotation

Chiller Rotation

Configure chiller rotation for the following:

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

NOTE To manually rotate the run order, select **Manual Rotation** for the **Sequence rotation method** and set **4** to **Rotate**.

▼ Rotation of Sequences - Method

Sequence rotation method: **Manual Rotation** ▼

Rotation Method Parameters:

1. If method is "Daily," rotate sequence daily at the defined time below.
2. If method is "Weekly," rotate sequence on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," rotate sequence on day **1** of each month at the defined time below.
4. If method is "Manual Rotation," **Rotate** ▼ sequence now.
5. If method is "Runtime," rotate sequence after **180** hours of runtime.

Defined Time for Rotation:
All automatic rotation will occur at **13 : 00** (24hr format).

Reset Rotation of Sequences:
Reset the rotation of sequences back to the first sequence: **Off** ▼ (Note: Set to Off once reset has taken place.)

Chiller power

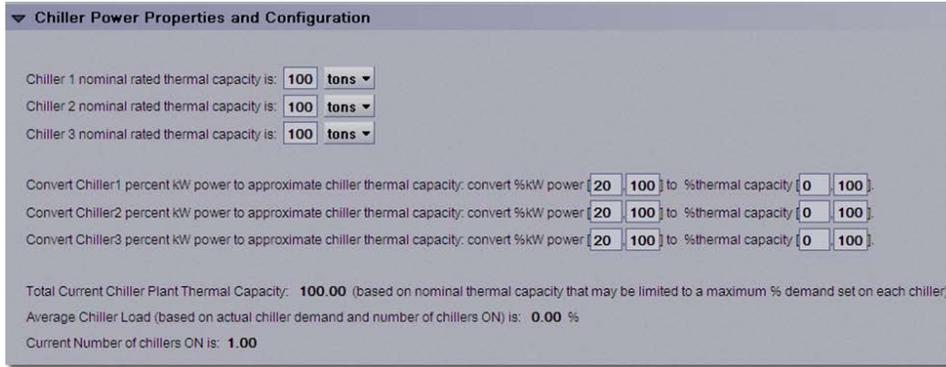
Chiller Power Properties and Configuration

Specify the following 2 Properties used by the RCR calculations:

- The nominal tonnage of each chiller, typically supplied by the machine technical data

Designing Chiller Manager Parallel/Equal-sized applications using ACR/RCR staging

- The converted %kW value from each machine to approximate its thermal capacity



Water Temperature Inputs

You can configure several of the following input water temperature values:

- Hardware-based water sensors
- Network-based water sensors
- Water temp sources and values, to display the controlling sensor value and its source

- A manual override, allowing the user to set a fixed value for either sensor

Water Temperature Inputs

Hardware Points

Local - CHWS Temperature

CHWS Temp (BAI) **44.0 °F** Lock at value: **44.0** Expander: **00** Type: **Thermistor** Number: **00**

Local CHWS Temp (BAV) **44.0 °F**

Local - CHWR Temperature

CHWR Temp (BAI) **62.0 °F** Lock at value: **62.0** Expander: **00** Type: **Thermistor** Number: **00**

Local CHWR Temp (BAV) **62.0 °F**

Network Points

Networked - CHWS Temperature

CHWS Temp (ANI2) **-999.00** Lock at value: **0** Enabled?:

Networked - CHWR Temperature

CHWR Temp (ANI2) **-999.00** Lock at value: **0** Enabled?:

Water Temp Sources & Values

CHWS Temp Source & Value

CHWS Temp Source (BMSV) **Local**

CHWS Temp (BAV) **44.0 °F**

CHWR Temp Source & Value

CHWR Temp Source (BMSV) **Local**

CHWR Temp (BAV) **62.0 °F**

Manual Overrides

Manual Override - CHWS Temperature

CHWS Temp Override: **Off** ▼

CHWS Temp Manual Override Value to: **32** °F

Manual Override - CHWR Temperature

CHWR Temp Override: **Off** ▼

CHWR Temp Manual Override Value to: **0** °F

Chilled Water Supply Temperature Setpoint

This property displays system setpoint values.

The following setpoint example is based on Outside Air Reset, which you select when building the equipment file. It includes:

- Baseline Chilled Water Supply Temperature Setpoint
- Reset parameters for outside air setpoints
- The effective setpoint resulting from the reset schedule or demand limiting

The screenshot shows a configuration window for the Chilled Water Supply Temperature Setpoint. It includes a section for 'Chilled Water Supply Temperature Setpoint' with a value of 42 °F. Below that is a section for 'Chilled Water Supply Setpoint Reset - Based on Outside Air Temperature'. This section includes an 'Enable setpoint adjustment' field set to 10:00 mm:ss, an 'Outside Air Temperature Reset' section with a range of 55 to 85 degrees and a reset range of 10 to 0, and a 'Current Outside Air Temperature' of 65.00 °F. The 'Setpoint Adjustment' is shown as 6.6 °F. A separate box at the bottom shows the 'Effective Chilled Water Setpoint' as 48.6 °F.

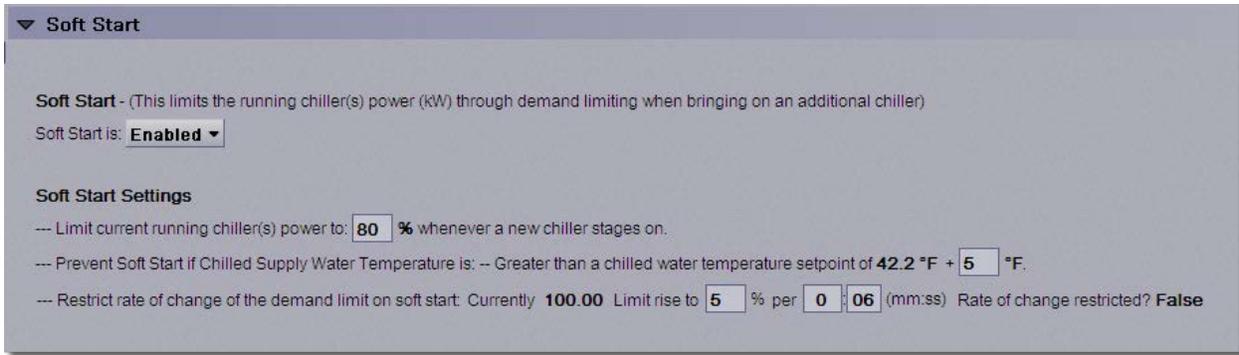
Soft Start and Demand Limiting

Soft Start

Soft Start is a demand control feature which produces even distribution of plant load and reduces demand peaks when stages are added. You can specify a demand limit for all running chillers whenever an additional chiller is brought online.

You can set the following:

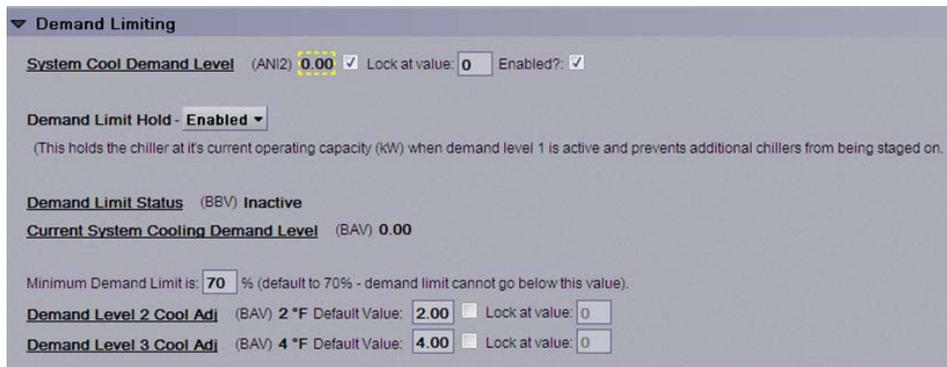
- The demand limit on start-up
- The maximum setpoint delta
- The rate of change as the demand limit relaxes



Demand Limiting

Demand Limiting properties define the Chiller Manager's response, when used with a network demand meter. The plant capacity is adjusted when receiving System Cooling Demand Levels 1, 2, or 3.

- **System Cool Demand Level**, if enabled, keeps the chillers running at their current demand level and prevents additional chillers from being brought online
- **Demand level 2 and 3 Cool Adj** specifies base setpoint adjustments sent to the running chillers
- Adjust **Minimum Demand Limit** as necessary



Chiller # Demand Limit Configuration

You can set the chiller's maximum efficiency level with the **Chiller # Maximum Demand Limit Configuration**. During ACR operation, a chiller set to any value other than 100%, cannot exceed the specified demand level. The chiller remains at this level even if ACR determines that additional cooling capacity is required. The value is overridden only when all available chillers are online and additional capacity is still required.

You can set additional demand level reductions when Demand Level 2 or 3 are in use.



Individual chiller control

Chiller # Control

Each chiller in the system has **Chiller # Control** properties.

You can:

- Set the delays for
 - chiller start
 - shutdown
 - power loss restore
- Select Maintenance Mode to remove the chiller from sequencing logic, if it is unavailable or needs repair
- Manually reset a chiller's operational status if the Chiller Manager has detected machine failure
- Set alarm delay values, alarm status, and runtime alarm values

NOTE To avoid unexpectedly long delay times, carefully consider the delay values you set in **Chiller Plant Staging** (page 7).

The screenshot shows the configuration interface for Chiller 1. It includes sections for Chiller Start Delay (0:15 mm:ss), Shutdown Delay (1:00 mm:ss), CH1 Delay on power loss restore (0:30 mm:ss), Chiller 1 Enable status (Enabled), Chiller 1 Maintenance Mode (Normal), Re-enable Chiller 1 on Failure now (Off), Chiller 1 Failure Lockout (False), Alarm(s) with Feedback Delay (90) and Debounce Time (5), and CH1 status indicators (CH1 FAIL Normal, CH1 HAND Off, CH1 RNTM Off). A runtime message is set to 10000 hours.

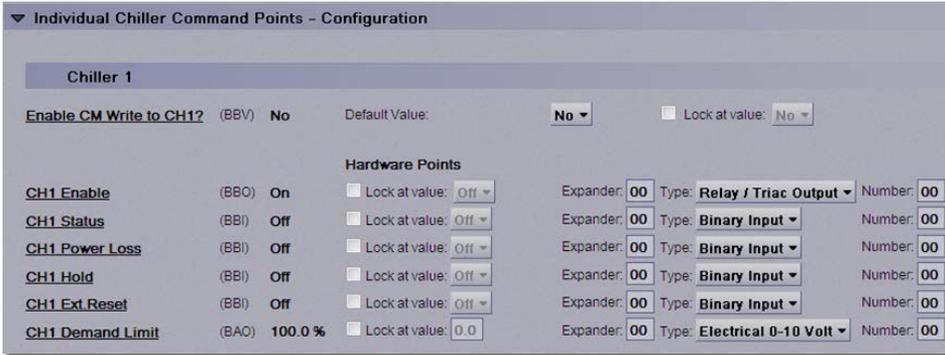
Individual Chiller Command Points - Configuration

Provides the status of the available hardware and network points. You can specify if the Chiller Manager can write control values to the chiller and define specific I/O points.

NOTES

- Network Points provide statuses and do not normally need to be Locked.

- The URL's for the Network Points are accessible on the **Properties > Network Points** tab in the i-Vu® interface.



Chiller Manager - Inputs and Outputs - Carrier

The following list of network points is for a Chiller Manager built using **Inputs and Outputs – Carrier**.

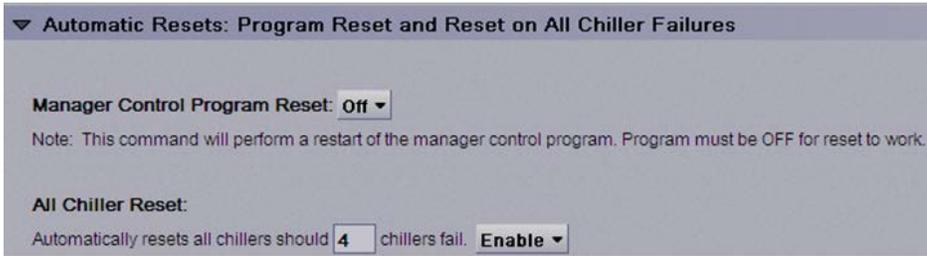
Network Points			
<u>CH1 Enable</u>	(BNO2)	Yes	Enabled?: <input checked="" type="checkbox"/>
<u>Enable CM Write to CH1</u>	(BNO)	No	Enabled?: <input checked="" type="checkbox"/>
<u>Chiller 1 Status</u>	(BNI)	On	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Power Loss</u>	(BNI)	Off	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Hold</u>	(BNI)	Off	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Ext Reset</u>	(BNI)	Off	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CCN Comm</u>	(BNI)	No Comm	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Mode</u>	(ANI)	-999	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Run Capacity</u>	(ANI)	-999.0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Run Hours</u>	(ANI)	-999	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CHWR</u>	(ANI)	-999.0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CHWS</u>	(ANI)	-999.0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 % KW</u>	(ANI)	-999.0	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Ctrl Status</u>	(ANI)	-999	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Alarm Status</u>	(ANI)	-999	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 Demand Limit</u>	(ANO2)	100.00	Enabled?: <input checked="" type="checkbox"/>
<u>CH1 CHWS Setpoint</u>	(ANO2)	48.66	Enabled?: <input checked="" type="checkbox"/>

Chiller Manager reset and alarms

Automatic Resets: Program Reset and Reset on all Chiller Failures

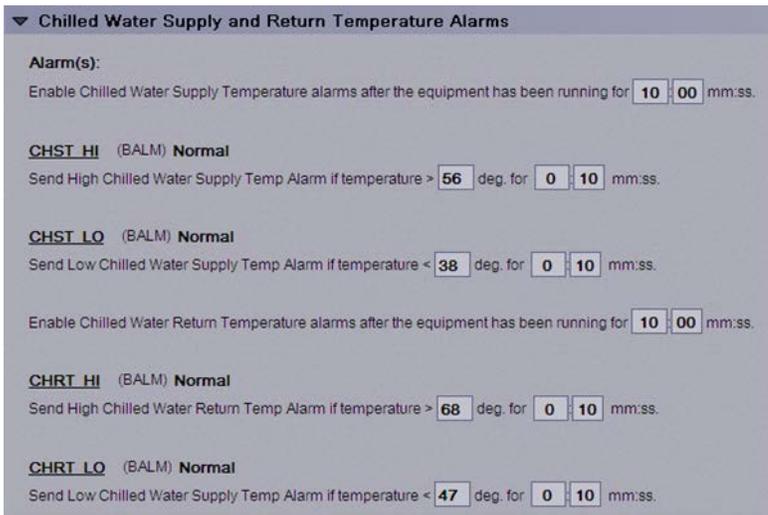
You can manually restart the Chiller Manager program and define the program-based chiller lockouts.

NOTE The term **Lockout**, in this instance, refers to machines that are locked out of staging by the Chiller Manager program. It does not clear any specific chiller-based lockouts that exist within the actual chiller control.



Chilled Water Supply and Return Temperature Alarms

Displays the status and configuration values for the water temperature alarms.



Designing Pump Manager/Constant Volume Primary/Equal-sized applications

Pump manager can be configured for constant-speed, equally-sized pumps for systems with 3 - 8 pumps. Variable Primary Flow applications (not shown here) are also supported.

The following example is based on the 4-pump Pump Manager for Constant Volume Primary/Equal-sized pumps. These properties differ from other versions only in the number of pumps shown.

NOTE You can control systems with 1 or 2 pumps using either the **Chilled Water Pumps – Basic Arrangements**, or the **Single Chiller Systems** equipment. However, they are not covered in this document.

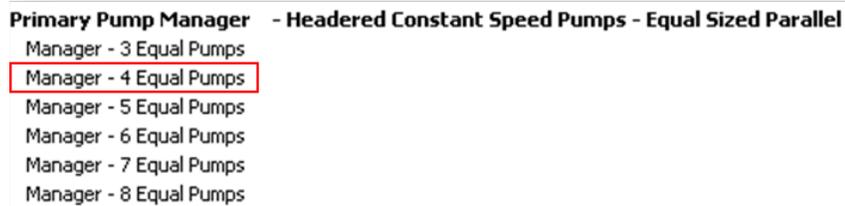
To design your application, build a control program in EquipmentBuilder and then configure the properties in the i-Vu® application.

NOTE This document contains screen captures and specific application hints. Some features are the same for each application.

Generate files in EquipmentBuilder

- 1 In EquipmentBuilder, select the number of pumps.

NOTE The number of pumps that the Pump Manager operates is determined by the number of stages called for by the associated Chiller Manager program or the actual number of enabled chillers. Additional information can be found in *Inputs and Staging* (page 35).



- 2 Click **Next**.
- 3 In **Engineering Options**, select your **Run Order Selection** and **Sequence Rotation** from the drop-down lists.

NOTE For **Numbered Array**, specify a fixed run order. For **Lowest Runtime**, the pumps with the lowest runtime are started first. *Run Order* (page 37) describes both versions.

The screenshot shows the 'Engineering Options' dialog box for 'Manager - 4 Equal Pumps'. The 'Run Order Selection' dropdown is set to 'Numbered Array' and is highlighted with a red box. Other options include 'Sequence Rotation' set to 'Fixed Period - Selectable', 'Status' set to 'Status', 'Run Conditions and Staging' set to 'Run Command Inputs & Staging', 'Enable Control' set to 'Enable', 'Points' set to 'Inputs and Outputs', and 'Program Reset' set to 'Manager & Lockout Resets'. The language is set to 'English'.

The screenshot shows the 'Engineering Options' dialog box for 'Manager - 4 Equal Pumps'. The 'Run Order Selection' dropdown is set to 'Lowest Runtime' and is highlighted with a red box. Other options include 'Sequence Rotation' set to 'Lowest Runtime - Selectable', 'Status' set to 'Status', 'Run Conditions and Staging' set to 'Run Command Inputs & Staging', 'Enable Control' set to 'Enable', 'Points' set to 'Inputs and Outputs', and 'Program Reset' set to 'Manager & Lockout Resets'. The language is set to 'English'.

- 4 Click **Next**.
- 5 Browse to the appropriate folder and save your control program, drivers, and sequence of operation, and click **Next**.

Configuring properties in the i-Vu® application

To adjust the following properties in the i-Vu® interface, select the controller in the navigation tree and click the **Properties > Control Program** tab. The properties are listed here in the same order that they appear in the i-Vu® interface.

Pump Manager status

Manager Status

Displays the overall condition of the Pump Manager program and the individual pumps.

Manager Status						
Pumps	Position	Enable	Status	Maintenance Lockout	Power Loss Lockout	Failure Status
Pump 1	1	Off	Off	Off	Off	Normal
Pump 2	2	Off	Off	Off	Off	Normal
Pump 3	3	Off	Off	Off	Off	Normal
Pump 4	4	Off	Off	Off	Off	Normal

Pump Manager inputs and staging

Inputs and Staging

This property displays the inputs that tell the Pump Manager when to run the pumps and how many to enable. The number of enabled pumps always equals the number of chiller stages called for, or the actual number of enabled chillers.

- For **Equal-sized – Parallel Chiller Manager** applications, connect the Pump Manager to the Chiller Manager by using the Analog Network Input **CM Stages ON** linked to **Stages On** variable in the associated Chiller Manager.

- For **Dissimilar-sized - Parallel Chiller Manager** applications, connect the Pump Manager to the Chiller Manager using the Binary Network Input(s) **Enable Pump #** linked to the Binary Network Output **Chiller # Enable** point, for each chiller in the associated Chiller Manager.

Configure Input Points Below - Input Points link up with Chiller Manager output enables. These inputs enable the pumps.
-- Choose Either the Analog Link from Chiller Manager OR
-- The individual Binary Link(s) from the Chiller Manager or other.

Analog Links

CM Stages ON (ANI2) 1.00 Lock at value: 0 Enabled?:

Binary Links

Enable Pump 1 (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Enable Pump 1 (BNI) Off Lock at value: Off Enabled?:

Enable Pump 2 (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Enable Pump 2 (BNI) Off Lock at value: Off Enabled?:

Enable Pump 3 (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Enable Pump 3 (BNI) Off Lock at value: Off Enabled?:

Enable Pump 4 (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Enable Pump 4 (BNI) Off Lock at value: Off Enabled?:

Delay ON and **Delay OFF** settings for each stage are also in **Inputs and Staging** properties.

Stage 1:
 Delay ON : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).

Stage 2:
 Delay ON : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).

Stage 3:
 Delay ON : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).

Stage 4:
 Delay ON : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is : (mm:ss) with output of **False** for 0:00 (mm:ss).

Start pumps after stage for cascading or chained pumps.

Number of Stages ON is: **1.00**.

Pump Manager run order

In EquipmentBuilder, there are 2 options for pump run order and sequencing. You can select Numbered Array to specify a fixed run order, or Lowest Runtime, which starts the pumps with the lowest runtime first. See *Generate files in EquipmentBuilder* (page 33).

Pump Run Order — for Numbered Array

Specify the pump start sequence and lock the program to one of the available run orders.

NOTE Only one run order is active at a time.

▼ Pump Run Order

Lock rotation to order **NO** ▾

Current Rotation Level: **1**

Note: Do not zero out order.

Pumps	Lock Pump	Order 1	Order 2	Order 3	Order 4	Start Status	Current Order
Pump1	Off ▾	1	4	3	2	Off	1.
Pump2	Off ▾	2	1	4	3	Off	2
Pump3	Off ▾	3	2	1	4	Off	3.
Pump4	Off ▾	4	3	2	1	Off	4.

Pump Run Order — for Lowest Runtime

Rotate the pump run order based on runtime.

The following screens show the:

- Current status of the run order, based on the runtime calculations
- Status of each pump
- Option to manually set the runtime to an initial value
- Option to reset the current accumulated runtime

▼ Pump Run Order

Lock "ROTATION ORDER" to: **Lowest Runtime** ▾

Note: Do not zero out order in "Manual Order".

ROTATION ORDER

Pumps	Lock Pump	Lowest Runtime	Manual Order	Start Status	Current Order
P1	Off ▾	1	1	Off	1
P2	Off ▾	2	2	Off	2
P3	Off ▾	3	3	Off	3
P4	Off ▾	4	4	Off	4

Pump 1: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P1: Run order based on runtime is: 1.00.

Pump 2: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P2: Run order based on runtime is: 2.00.

Pump 3: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P3: Run order based on runtime is: 3.00.

Pump 4: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P4: Run order based on runtime is: 4.00.

▼ Runtime Reset

Runtime Clear Method:

Select runtime clear method: Clear Runtimers - **Manual Reset** ▾

Runtimers Clear Method Parameters:

1. If method is "Daily," clear runtimers daily at the defined time below.
2. If method is "Weekly," clear runtimers on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," clear runtimers on day **1** of each month at the defined time below.

— **Defined Time for Runtimers Clear:** All automatic clear methods (1,2 & 3 above) will occur at **13:00** (24hr format).

4. If method is "Manual Clear," **Do Not Clear** ▾ runtimers now.
5. If method is "When Manager Off," Then runtimers clear each time manager turns off.

Pump Manager rotation

Rotation of Sequences - Method

Configures pump rotation functions. If you select rotation, the program sequences through the following run orders:

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

NOTE When you select **Manual Rotation** as the **Sequence rotation method:** and **Rotate** in **4. If method is "Manual Rotation"**, the sequence rotates through the fixed run order options you chose on **Pump Run Order**. You can also lock to a specific **Run Order** on the **Pump Run Order** property.

▼ Rotation of Sequences - Method

Rotation Method:
 Select rotation method: Rotate Equipment Order - **When Manager Off** ▼
 -- Operates only for "Lowest Runtime" rotation order (as selected above)

Rotation Method Parameters:

1. If method is "Daily," rotate sequence daily at the defined time below.
2. If method is "Weekly," rotate sequence on day of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," rotate sequence on day of each month at the defined time below.

— **Defined Time for Rotation:** All automatic rotation methods (1,2 & 3 above) will occur at : (24hr format).

4. If method is "Manual Rotation," **Do Not Rotate** ▼ sequence now.
5. If method is "When Manager Off," Then new staging order resets only after manager is off.

Pump-specific variables

Pump # Control

Each pump in the system has a Pump # Control page where you set variables specific to each pump. If a pump needs to be taken out of service, you can set it to **Pump # Maintenance Mode** so the Pump Manager no longer controls the pump. To avoid unexpectedly long delay times, consider the delay values already set in **Inputs and Staging**, when you are adjusting these values.

▼ Pump 1 Control

Pump Start Delay: Enable pump : mm:ss after equipment is commanded On.

Shutdown Delay: Prior to disabling CW Pump, hold output signal for : mm:ss.

Pump 1 Delay on power loss restore is : (mm:ss) with output of **False** for 0:00 (mm:ss).

Pump 1 Enable:
Pump 1 is currently **Disabled**.

Pump 1 Maintenance Mode: **Normal** ▼

Re-enable Pump 1 on Failure now: **Off** ▼

Re-enable Pump 1 on return of status? **No** ▼

Pump 1 Failure Lockout is: **False**.

Alarm(s):
Pump Status Alarms: Feedback Delay: Debounce Time:

P1_FAIL (BALM) **Normal**

P1_HAND (BALM) **Off**

P1_RNTM (BALM) **Off**

Send runtime message if runtime exceeds hours.

Individual Pump Command Points - Configuration

You can define specific I/O points associated with each pump. There are hardware and network points available. Enter the URL for the network points on **Properties > Network Points** tab (not shown).

▼ Individual Pump Command Points - Configuration

There is one hardware point and one network point for each pump point shown below. Select and configure your points from any of these available hardware or network points as best fits your project.

Pump 1

Hardware Points

Pump 1 Enable	(BBO) Off <input type="checkbox"/>	Lock at value: Off ▼	Expander: <input type="text" value="00"/>	Type: Relay / Triac Output ▼	Number: <input type="text" value="00"/>
Pump 1 Status	(BBI) Off <input type="checkbox"/>	Lock at value: Off ▼	Expander: <input type="text" value="00"/>	Type: Binary Input ▼	Number: <input type="text" value="00"/>
Pump 1 Power Loss	(BBI) Off <input type="checkbox"/>	Lock at value: Off ▼	Expander: <input type="text" value="00"/>	Type: Binary Input ▼	Number: <input type="text" value="00"/>

Network Points

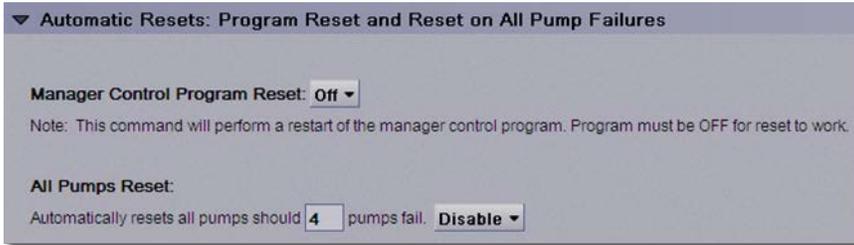
Pump 1 Enable	(BNO) Off <input type="checkbox"/>	Lock at value: Off ▼	Enabled?: <input checked="" type="checkbox"/>
Pump 1 Status	(BNI) Off <input type="checkbox"/>	Lock at value: Off ▼	Enabled?: <input checked="" type="checkbox"/>
Pump 1 Power Loss	(BNI) Off <input type="checkbox"/>	Lock at value: Off ▼	Enabled?: <input checked="" type="checkbox"/>

Pump Manager reset

Automatic Resets: Program Reset and Reset on All Pump Failures

You can manually restart the Pump Manager program and define how the program-based pump Lockouts are handled.

NOTE The term **Lockout**, in this instance, refers to machines that are locked out of staging by the Pump Manager program.



▼ Automatic Resets: Program Reset and Reset on All Pump Failures

Manager Control Program Reset:

Note: This command will perform a restart of the manager control program. Program must be OFF for reset to work.

All Pumps Reset:

Automatically resets all pumps should pumps fail.

Designing Pump Manager/Variable Volume Secondary/Equal-sized applications

You can configure applications for a secondary Pump Manager for variable speed, equally-sized pump systems using 3 - 8 pumps.

NOTE Although not covered in this document, you can control systems with 1 or 2 secondary, variable speed pumps by using **Chilled Water Pumps – Basic Arrangements**.

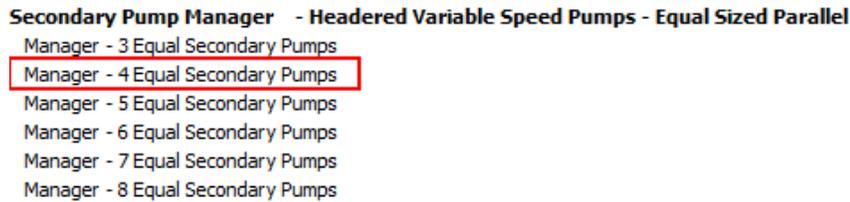
The following example is based on the 4-pump Pump Manager for variable volume, secondary, equal-sized systems. These properties differ from other versions only in the number of pumps shown. The number of pumps that the Pump Manager operates at any given time is determined by a PID control that is based on Differential Pressure. You can find additional details on general PID settings in *Tower mechanical systems* (page 62).

To design your application, build a control program in EquipmentBuilder and then configure the properties in the i-Vu® application.

Generate files in EquipmentBuilder

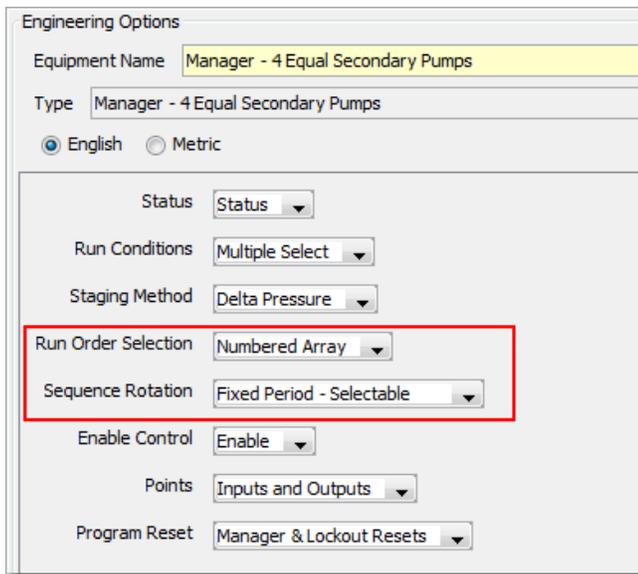
- 1 In EquipmentBuilder, select the number of pumps.

NOTE There are 4 pumps in the following example.



- 2 Click **Next**.
- 3 In **Engineering Options**, select your **Run Order Selection** and **Sequence Rotation** from the drop-down lists.

NOTE For **Numbered Array**, you specify a fixed run order. For **Lowest Runtime**, the pumps with the lowest runtime are started first. *Run Order* (page 37) describes both versions.



- 4 Click **Next**.
- 5 Browse to the appropriate folder and save your control program, drivers, and sequence of operation, and click **Next**.

Configuring properties in the i-Vu® application

To adjust the following properties in the i-Vu® interface, select the controller in the navigation tree and click the **Properties > Control Program** tab. The properties are listed here in the same order that they appear in the i-Vu® interface.

Pump Manager status

Manager Status

Displays the overall condition of the Pump Manager program and the individual pumps

Manager Status							
Pumps	Position	Enable	Status	VFD Status	Maintenance Lockout	Power Loss Lockout	Failure Status
Pump 1	1	Off	Off	0.00	Off	Off	Normal
Pump 2	2	Off	Off	0.00	Off	Off	Normal
Pump 3	3	Off	Off	0.00	Off	Off	Normal
Pump 4	4	Off	Off	0.00	Off	Off	Normal

Current stage number is: 0
 Current rotation sequence number is: 1

VSD Pump Speed Output:
 Current speed output is 0.00 %

Pump Manager run conditions

Run Conditions

You can select an option in the drop-down list for **Equipment Manager Enable Command — Run** and set **On - Off - Auto**.

▼ Run Conditions

Equipment Manager Enable Command - Select: — Run OFF ▼

Equipment Enable Status (BMSV) ?

On - Off - Auto: Auto ▼

Equipment Manager Run Status: ?

OFF

via Remote S/S

via OA Temp Only

via Schedule

via Clg.Requests &OA

via Sch&OA or RemS/S

Every option for Run Conditions that you enable has additional Properties with more specific options.

The following examples show **via Remote** and **via Cooling Requests**.

▼ **via Remote**

REMOTE (BBI) Off Lock at value: Expander: Type: Number:

REMOTE (BNI) Off Lock at value: Enabled?:

Remote Start (BBV) Off Default Value: Lock at value:

Remote inputs or commands can each enable this manager.

Remote inputs can be connected or linked to another manager, hardware point, or remote network point.

via Cooling Requests — You can enable the Manager, based on receiving a specific number of cooling requests.

NOTE The Manager normally calls for cooling from chilled water consumers.

▼ **via Cooling Requests**

System Runtime:
Time required for equipment manager to run is at least minutes.

Total Cool Request: -999

Zone Occupancy Status: Unoccupied Mode
When in the Occupied Mode, run equipment manager if more than cooling requests, hyst are received.
When in the Unoccupied Mode, run equipment manager if more than cooling requests, hyst are received for at least minutes.

Note:
Equipment will run for additional time after cooling requests are satisfied.
--- Also Note: ---
--- The minimum additional run time during occupied hours is 30 minutes.
--- The minimum additional run time during unoccupied hours is user selectable and specified below.
--- This time will "time down" when no longer requested.

Optimal Stop:
Stop manager if runtime is less than minutes. (Do not exceed 25 minutes)

Cool Request (COLLECTOR)

Pump Manager staging

In **Staging of Pumps – Differential Pressure Control Loop** and **Control Output Override**: you can:

- adjust the differential pressure setpoint
- adjust the VFD Minimum Output value
- override the VFD output

- establish parameters related to the differential pressure high limit

▼ Staging of Pumps – Differential Pressure Control Loop

Diff Pressure (BA) 0.00 psi Lock at value: 0.00 Expander: 00 Type: ? Number: 00

Differential Pressure:
Differential Pressure is 0.00 psi.

Setpoint:
Current Setpoint is 12 psi.

Differential Pressure PID (reverse acting): (BPID) Setpoint: 12.00 Go: Off Input: 0.00
PID output: 0.

VFD Minimum Output:
VFD minimum speed output is 20 %.

Control Output Override:
Enable Output Override Off Lock: False
Enable Output Override value to 0 % Lock: False

High Differential Pressure Protection:
If differential pressure increases from 15 (normal psi - kPa if metric) to 20 (max. psi - kPa)
decrease pump speed from 100 (normal %) to 0 (min. %).

Pump Staging Override:
Lock number of pumps to run to 1. Off

Alarms – establish high and low pressure alarm values

Alarms

Alarm(s):
Enable Differential Pressure alarms after the equipment has been running for 2 : 00 mm:ss.

PRESS HI (BALM) Normal
Send High Differential Pressure Alarm if pressure > setpoint by 25 %, hyst 2 , for 1 : 00 mm:ss.

PRESS LO (BALM) Normal
Send Low Differential Pressure Alarm if pressure < setpoint by 25 %, hyst 2 , for 1 : 00 mm:ss.

Staging Trip Points and Delays – establishes the turn on and turn off points for each pump.

The following are examples of **Stage 1** and **Stage 2**.

Stage 1

Stage 1 is **Off**.
 Enable Stage 1 if PID output > % (negative value runs first stage always) (hysteresis of %) for : (mm:ss). Delay currently **False** for 0:00 (mm:ss).

Stage 1 Delays:
 Disable Delay: Wait : (mm:ss) after Stage 2 is disabled before Stage 1 can be disabled. Delay currently **False** for 0:00 (mm:ss).

Stage 1 Minimum Timers
 Min on for stage 1: : (mm:ss) current state **False**
 Min off for stage 1: : (mm:ss) waiting to change **False**

Stage 2

Stage 2 is **Off**.
 Enable Stage 2 if PID output > % (hysteresis of %) for : (mm:ss). Delay currently **False** for 0:00 (mm:ss).

Stage 2 Delays:
 Enable Delay: Wait : (mm:ss) after Stage 1 is enabled before Stage 2 can be enabled. Delay currently **False** for 0:00 (mm:ss).
 Disable Delay: Wait : (mm:ss) after Stage 3 is disabled before Stage 2 can be disabled. Delay currently **False** for 0:00 (mm:ss).

Stage 2 Minimum Timers
 Min on for stage 2: : (mm:ss) current state **False**
 Min off for stage 2: : (mm:ss) waiting to change **False**

Pump Manager run order

In EquipmentBuilder, there are 2 options for pump run order and sequencing. You can select Numbered Array to specify a fixed run order or Lowest Runtime, which starts the pumps with the lowest runtime first. See *Generate files in EquipmentBuilder* (page 33) for details.

The following shows the details of both versions in the Properties > Control Program tab in the i-Vu® interface.

Pump Run Order – for Numbered Array

Specify the pump start sequence and lock the program to one of the available run orders.

NOTE Only one run order is active at a time.

▼ Pump Run Order

Lock rotation to order: ▾
 Current Rotation Level:
 Note: Do not zero out order.

Pumps	Lock Pump	Order 1	Order 2	Order 3	Order 4	Start Status	Current Order
Pump1	<input type="text" value="Off"/> ▾	<input type="text" value="1"/>	<input type="text" value="4"/>	<input type="text" value="3"/>	<input type="text" value="2"/>	Off	1.
Pump2	<input type="text" value="Off"/> ▾	<input type="text" value="2"/>	<input type="text" value="1"/>	<input type="text" value="4"/>	<input type="text" value="3"/>	Off	2.
Pump3	<input type="text" value="Off"/> ▾	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="1"/>	<input type="text" value="4"/>	Off	3.
Pump4	<input type="text" value="Off"/> ▾	<input type="text" value="4"/>	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="1"/>	Off	4.

Pump Run Order — for **Lowest Runtime** - rotates the pump run order based on runtime

The following screens have the:

- Current status of the run order, based on the runtime calculations
- Status of each pump
- Option to manually set the runtime to an initial value
- Option to reset the current accumulated runtime

Pump Run Order

Lock 'ROTATION ORDER' to: **Lowest Runtime**

Note: Do not zero out order in "Manual Order".

ROTATION ORDER					
Pumps	Lock Pump	Lowest Runtime	Manual Order	Start Status	Current Order
P1	Off	1	1	Off	1
P2	Off	2	2	Off	2
P3	Off	3	3	Off	3
P4	Off	4	4	Off	4

Pump 1: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P1: Run order based on runtime is: **1.00**.

Pump 2: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P2: Run order based on runtime is: **2.00**.

Pump 3: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P3: Run order based on runtime is: **3.00**.

Pump 4: Total accumulated runtime = 0. Latch to preset value of 0 Reset? -- P4: Run order based on runtime is: **4.00**.

Runtime Reset

Runtime Clear Method:
 Select runtime clear method: Clear Runtimers - **Manual Reset**

Runtimers Clear Method Parameters:

1. If method is "Daily," clear runtimers daily at the defined time below.
2. If method is "Weekly," clear runtimers on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," clear runtimers on day **1** of each month at the defined time below.

— **Defined Time for Runtimers Clear:** All automatic clear methods (1, 2 & 3 above) will occur at **13:00** (24hr format).

4. If method is "Manual Clear," **Do Not Clear** runtimers now.
5. If method is "When Manager Off," Then runtimers clear each time manager turns off.

Pump Manager rotation

Rotation of Sequences - Method

Configures pump rotation functions. If you select rotation, the program sequences through the following run orders:

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

NOTE When you select **Manual Rotation** as the **Sequence rotation method:** and **Rotate** in **4. If method is "Manual Rotation"**, the sequence rotates through the fixed run order options you chose on **Pump Run Order**. You can also lock to a specific **Run Order** on the **Pump Run Order** property.

▼ **Rotation of Sequences - Method**

Sequence rotation method: **Manual Rotation** ▼

Rotation Method Parameters:

1. If method is "Daily," rotate sequence daily at the defined time below.
2. If method is "Weekly," rotate sequence on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," rotate sequence on day **1** of each month at the defined time below.
4. If method is "Manual Rotation," **Do Not Rotate** ▼ sequence now.
5. If method is "Runtime," rotate sequence after **180** hours of runtime.

Defined Time for Rotation:

All automatic rotation will occur at **13** : **00** (24hr format).

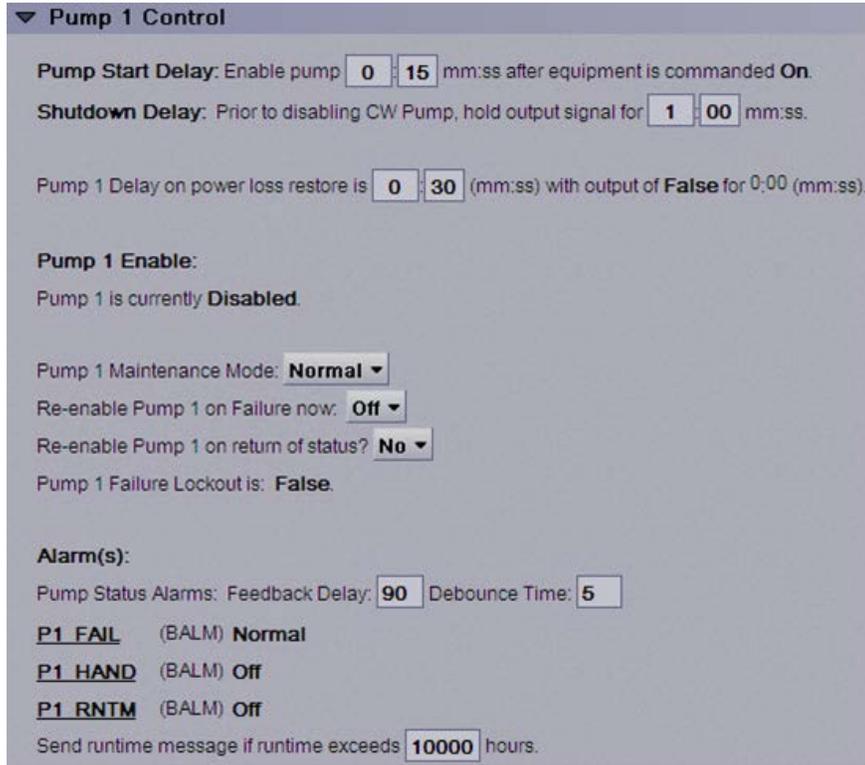
Reset Rotation of Sequences:

Reset the rotation of sequences back to the first sequence: **Off** ▼ (Note: Set to Off once reset has taken place.)

Pump-specific variables

Pump # Control

Each pump in the system has a Pump # Control page where you set variables specific to each pump. If a pump needs to be taken out of service, you can set it to **Pump # Maintenance Mode** so the Pump Manager no longer controls the pump. To avoid unexpectedly long delay times, consider the delay values already set in **Inputs and Staging**, when you are adjusting these values.



▼ Pump 1 Control

Pump Start Delay: Enable pump mm:ss after equipment is commanded **On**.

Shutdown Delay: Prior to disabling CW Pump, hold output signal for mm:ss.

Pump 1 Delay on power loss restore is (mm:ss) with output of **False** for 0:00 (mm:ss).

Pump 1 Enable:
Pump 1 is currently **Disabled**.

Pump 1 Maintenance Mode: **Normal** ▼

Re-enable Pump 1 on Failure now: **Off** ▼

Re-enable Pump 1 on return of status? **No** ▼

Pump 1 Failure Lockout is: **False**.

Alarm(s):
Pump Status Alarms: Feedback Delay: Debounce Time:

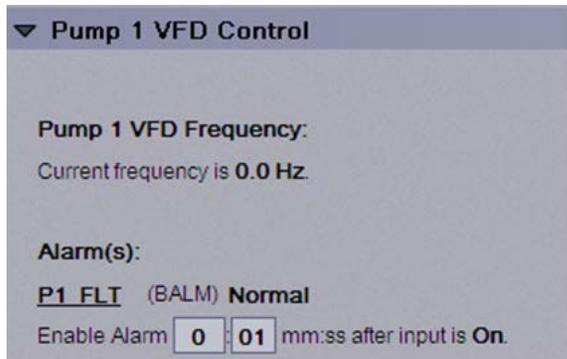
P1_FAIL (BALM) **Normal**

P1_HAND (BALM) **Off**

P1_RNTM (BALM) **Off**

Send runtime message if runtime exceeds hours.

Pump # VFD Control — the current VFD output signal in Hertz, and the alarm delay



▼ Pump 1 VFD Control

Pump 1 VFD Frequency:
Current frequency is **0.0** Hz.

Alarm(s):
P1_FLT (BALM) **Normal**

Enable Alarm mm:ss after input is **On**.

Individual Pump Command Points - Configuration

You can define specific I/O points associated with each pump. There are hardware and network points available. Enter the URL for the network points on **Properties > Network Points** tab (not shown).

Individual Pump Command Points - Configuration

There is one hardware point and one network point for each pump point shown below. Select and configure your points from any of these available hardware or network points as best fits your project.

Pump 1

Hardware Points						
Pump 1 Enable	(BBO) Off	<input type="checkbox"/> Lock at value: Off	Expander: 00	Type: Relay / Triac Output	Number: 00	
Pump 1 Status	(BBI) Off	<input type="checkbox"/> Lock at value: Off	Expander: 00	Type: Binary Input	Number: 00	
Pump 1 Power Loss	(BBI) Off	<input type="checkbox"/> Lock at value: Off	Expander: 00	Type: Binary Input	Number: 00	
P1 VFD Output	(BAO) 0.0 %	<input type="checkbox"/> Lock at value: 0.0	Expander: 00	Type: Electrical 0-10 Volt	Number: 00	
P1 VFD Fault	(BBI) Off	<input type="checkbox"/> Lock at value: Off	Expander: 00	Type: Dry Contact	Number: 00	

Network Points						
Pump 1 Enable	(BNO) Off	<input type="checkbox"/> Lock at value: Off	Enabled?: <input checked="" type="checkbox"/>			
Pump 1 Status	(BNI) Off	<input type="checkbox"/> Lock at value: Off	Enabled?: <input checked="" type="checkbox"/>			
Pump 1 Power Loss	(BNI) Off	<input type="checkbox"/> Lock at value: Off	Enabled?: <input checked="" type="checkbox"/>			
P1 VFD Output	(ANO) 0.00	<input type="checkbox"/> Lock at value: 0	Enabled?: <input checked="" type="checkbox"/>			
P1 VFD Fault	(BNI) Off	<input type="checkbox"/> Lock at value: Off	Enabled?: <input checked="" type="checkbox"/>			

Pump Manager reset

Automatic Resets: Program Reset and Reset on All Pump Failures

You can manually restart the Pump Manager program and define how the program-based pump Lockouts are handled.

NOTE The term **Lockout**, in this instance, refers to machines that are locked out of staging by the Pump Manager program.

Automatic Resets: Program Reset and Reset on All Pump Failures

Manager Control Program Reset: Off

Note: This command will perform a restart of the manager control program. Program must be OFF for reset to work.

All Pumps Reset:
Automatically resets all pumps should 4 pumps fail. Disable

Designing Tower Manager/Cooling Towers/Equal-sized Parallel applications

You can configure applications for a Tower Manager for equally-sized tower configurations with 2 - 8 towers. Tower Manager interfaces with either an Open or Closed Single Tower application. Actual I/O points associated with cooling towers are controlled by the single tower equipment. The Tower Manager provides staging and run order and coordinates with the associated Chiller Manager program.

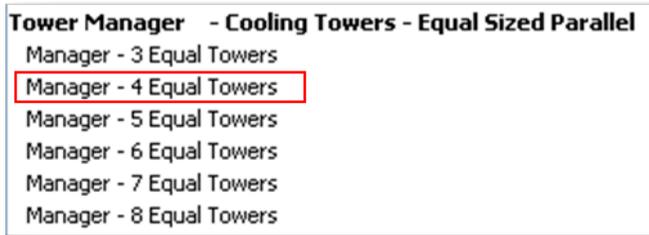
The following example is based on the Tower Manager for 4-tower equally-sized configurations.

To design your application, build a control program in EquipmentBuilder and then configure the properties in the i-Vu® application.

NOTE This document contains screen captures and specific application hints. Some features are the same for each application.

Generate files in EquipmentBuilder

- 1 In EquipmentBuilder, select the number of cooling towers. The following example uses **4 Equal Towers**.



- 2 Click **Next**.
- 3 In **Engineering Options**, select your **Run Order Selection** and Sequence Rotation. No other options apply to the Tower Manager.

NOTE For **Numbered Array**, specify a fixed run order. For **Lowest Runtime**, the towers with the lowest runtime are started first.

The screenshot shows the 'Engineering Options' dialog box for 'Manager - 4 Equal Towers'. The 'Run Order Selection' dropdown is highlighted with a red box and set to 'Numbered Array'. The 'Sequence Rotation' dropdown is set to 'Fixed Period - Selectable'. Other options include 'Status', 'Run Conditions and Staging', 'Enable Control', 'Points', 'Program Reset', and 'Temperature Alarms'.

The screenshot shows the 'Engineering Options' dialog box for 'Manager - 4 Equal Towers'. The 'Run Order Selection' dropdown is highlighted with a red box and set to 'Lowest Runtime'. The 'Sequence Rotation' dropdown is set to 'Lowest Runtime - Selectable'. Other options include 'Status', 'Run Conditions and Staging', 'Enable Control', 'Points', 'Program Reset', and 'Temperature Alarms'.

- 4 Click **Next**.
- 5 Browse to the appropriate folder and save your control program, drivers, and sequence of operation, and click **Next**.

Configuring properties in the i-Vu® application

To adjust the following properties in the i-Vu® interface, select the controller in the navigation tree and click the **Properties > Control Program** tab. The properties are listed here in the same order that they appear in the i-Vu® interface.

Tower Manager status

Manager Status

Displays the overall condition of the Tower Manager program and the individual pumps.

Manager Status						
Towers	Position	Enable	Status	VFD Status	Maintenance Lockout	Power Loss Lockout
Tower 1	1	Off	Off	Off	Off	Normal
Tower 2	2	Off	Off	Off	Off	Normal
Tower 3	3	Off	Off	Off	Off	Normal
Tower 4	4	Off	Off	Off	Off	Normal

Current stage number is: 0
 Current rotation sequence number is: 1
 CTs Available (BAV) 4.00

Tower Manager inputs and output delays

Headered Equal Sized Cooling Tower Inputs & Staging - 4 Cell Stages – shows the inputs that the Tower Manager needs in order to determine when to run. Shows the number of towers that should be enabled. The number of enabled towers always equals the number of chiller stages called for or the actual number of enabled chillers.

NOTE Linkage to the associated Chiller Manager differs between Equal Sized and Dissimilar Sized Chiller Plant Systems. Select the Linkage method from the following 2 options:

- For **Equal Sized – Parallel Chiller Manager** applications – Connect the Tower Manager to the Chiller Manager using the Analog Network Input **CM Stages On** linked to the **Stages On** variable in the associated Chiller Manager program.

▼ **Headered Equal Sized Cooling Tower Inputs & Staging - 4 Cell Stages**

Configure Input Points Below - Input Points link up with Chiller Manager output enables. These inputs enable the cells.
 -- Choose Either the Analog Link from Chiller Manager OR
 -- The individual Binary Link(s) from the Chiller Manager or other.

Analog Links

CM Stages ON (ANI2) 0.00 Lock at value: Enabled?:

- For **Dissimilar Sized – Parallel Chiller Manager** applications – Connect the Tower Manager to the Chiller Manager using the Binary Network Input(s) **Enable Cell #** linked to the Binary Network Output **Chiller # Enable** point, for each chiller in the associated Chiller Manager program.

Binary Links

Cell	(BBI)	Lock at value	Expander	Type	Number
Enable Cell 1	Off	Off	00	Dry Contact	00
Enable Cell 1	(BNI) Off	Off			Enabled?: <input checked="" type="checkbox"/>
Enable Cell 2	Off	Off	00	Dry Contact	00
Enable Cell 2	(BNI) Off	Off			Enabled?: <input checked="" type="checkbox"/>
Enable Cell 3	Off	Off	00	Dry Contact	00
Enable Cell 3	(BNI) Off	Off			Enabled?: <input checked="" type="checkbox"/>
Enable Cell 4	Off	Off	00	Dry Contact	00
Enable Cell 4	(BNI) Off	Off			Enabled?: <input checked="" type="checkbox"/>

Delay ON and **Delay OFF** settings for each stage are also available in the **Inputs and Staging** properties.

Stage 1:
 Delay ON : Delay time is **0 : 02** (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is **1 : 00** (mm:ss) with output of **False** for 0:00 (mm:ss).

Stage 2:
 Delay ON : Delay time is **0 : 02** (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is **1 : 00** (mm:ss) with output of **False** for 0:00 (mm:ss).

Stage 3:
 Delay ON : Delay time is **0 : 02** (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is **1 : 00** (mm:ss) with output of **False** for 0:00 (mm:ss).

Stage 4:
 Delay ON : Delay time is **0 : 02** (mm:ss) with output of **False** for 0:00 (mm:ss).
 Delay OFF : Delay time is **1 : 00** (mm:ss) with output of **False** for 0:00 (mm:ss).

Tower run order and rotation

Cooling Tower Cell Run Order

Defines the tower cell run order. You can select 4 different run orders and lock to a specific run order.

▼ Cooling Tower Cell Run Order

Lock rotation to order: **NO** ▼

Current Rotation Level: **1**

Note: Do not zero out order.

Towers	Lock Tower	Order 1	Order 2	Order 3	Order 4	Start Status	Current Order
Tower1	Off ▼	1	4	3	2	Off	1.
Tower2	Off ▼	2	1	4	3	Off	2.
Tower3	Off ▼	3	2	1	4	Off	3.
Tower4	Off ▼	4	3	2	1	Off	4.

Rotation of Sequences - Method

Use the following **Sequence Rotation Method** to configure chiller rotation:

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

NOTE When you select **Manual Rotation** as the **Sequence rotation method:** and **Rotate** in **4. If method is "Manual Rotation"**, the sequence rotates through the fixed run order options you chose in the **Tower Run Order Properties**. You can also lock to a specific **Run Order** on the **Tower Run Order** page.

▼ Rotation of Sequences - Method

Sequence rotation method: **Daily** ▼

Rotation Method Parameters:

1. If method is "Daily," rotate sequence daily at the defined time below.
2. If method is "Weekly," rotate sequence on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," rotate sequence on day **1** of each month at the defined time below.
4. If method is "Manual Rotation," **Do Not Rotate** ▼ sequence now.
5. If method is "Runtime," rotate sequence after **180** hours of runtime.

Defined Time for Rotation:

All automatic rotation will occur at **13 : 00** (24hr format).

Reset Rotation of Sequences:

Reset the rotation of sequences back to the first sequence: **Off** ▼ (Note: Set to Off once reset has taken place.)

Tower-specific inputs and outputs

Cooling Tower # Control

Each tower in the system has a Tower Control page where you can set variables specific to each machine. Also, if a tower needs to be taken out of service, you can set it to **Maintenance Mode** so the Tower Manager no longer controls the Tower.

NOTE To avoid unexpectedly long delay times, take the delays here into account when setting the delays in the **Inputs and Staging** section.

▼ Cooling Tower 1 Control

Start Delay: Enable tower: : mm:ss after equipment is commanded On.

Shutdown Delay: Prior to disabling tower, hold output signal for: : mm:ss.

Cooling Tower 1 Delay on power loss restore is: : (mm:ss) with output of **False** for 0:00 (mm:ss).

Cooling Tower 1 Enable:
CT 1 is currently **Disabled**.

Cooling Tower 1 Maintenance Mode: **Normal** ▼

Re-enable Cooling Tower 1 on Failure now: **Off** ▼

Cooling Tower 1 Failure Lockout is: **False**.

Alarm(s):

Cooling Tower Status Alarms: Feedback Delay: Debounce Time:

CT1_FAIL (BALM) **Normal**

CT1_HAND (BALM) **Off**

CT1_RNTM (BALM) **Off**

Send runtime message if runtime exceeds hours.

Individual Cooling Tower Command Points - Configuration

You can define each tower's specific I/O points. There are hardware and network points available for each point. The URL for the network points are entered on **Properties > Network Points** tab (not shown).

▼ Individual Cooling Tower Command Points - Configuration

There is one hardware point and one network point for each cooling tower point shown below. Select and configure your points from any of these available hardware or network points as best fits your project.

Pump 1

CT 1 Enable	(BBO) Off <input type="checkbox"/>	Lock at value: Off ▼	Expander: <input type="text" value="00"/>	Type: Relay / Triac Output ▼	Number: <input type="text" value="00"/>
CT 1 Status	(BBI) Off <input type="checkbox"/>	Lock at value: Off ▼	Expander: <input type="text" value="00"/>	Type: Binary Input ▼	Number: <input type="text" value="00"/>
CT 1 Power Loss	(BBI) Off <input type="checkbox"/>	Lock at value: Off ▼	Expander: <input type="text" value="00"/>	Type: Binary Input ▼	Number: <input type="text" value="00"/>

Network Points

CT 1 Enable	(BNO) Off <input type="checkbox"/>	Lock at value: Off ▼	Enabled?: <input checked="" type="checkbox"/>
CT 1 Status	(BNI) Off <input type="checkbox"/>	Lock at value: Off ▼	Enabled?: <input checked="" type="checkbox"/>
CT 1 Power Loss	(BNI) Off <input type="checkbox"/>	Lock at value: Off ▼	Enabled?: <input checked="" type="checkbox"/>

Tower Manager resets and alarms

Automatic Resets: Program Reset and Reset on All Tower Failures

Manually restarts the Tower Manager program and defines how the program-based tower lockouts are handled.

▼ Automatic Resets: Program Reset and Reset on All Tower Failures

Manager Control Program Reset: **Off** ▼

Note: This command will perform a restart of the manager control program. Program must be OFF for reset to work.

All Towers Reset:

Automatically resets all towers should **4** towers fail. **Disable** ▼

Condenser Water Supply and Return Temperature - (Alarms)

Displays status and specific values for the water temperature alarms.

▼ Condenser Water Supply and Return Temperature

CWS Temp (BA) 0.0 °F Lock at value: 0.0 Expander: 00 Type: **Thermistor** Number: 00

CWR Temp (BA) 0.0 °F Lock at value: 0.0 Expander: 00 Type: **Thermistor** Number: 00

Alarm(s):

Enable Condenser Water Supply Temperature alarms after the equipment has been running for 10 00 mm:ss.

CWST_HI (BALM) **Normal**

Send High Condenser Water Supply Temp Alarm if temperature > 86 deg. for 0 10 mm:ss.

CWST_LO (BALM) **Normal**

Send Low Condenser Water Supply Temp Alarm if temperature < 65 deg. for 0 10 mm:ss.

Enable Condenser Water Return Temperature alarms after the equipment has been running for 10 00 mm:ss.

CWRT_HI (BALM) **Normal**

Send High Condenser Water Return Temp Alarm if temperature > 100 deg. for 0 10 mm:ss.

CWRT_LO (BALM) **Normal**

Send Low Condenser Water Supply Temp Alarm if temperature < 75 deg. for 0 10 mm:ss.

Designing Open and Closed Tower applications

The following example is based on an Open Circuit Tower with commonly used settings. Closed Tower options are indicated in the text.

To design your application, build a control program in EquipmentBuilder and then configure the properties in the i-Vu® application.

Generate files in EquipmentBuilder

The Cooling Tower equipment directly controls cooling tower systems in either a standalone or Tower Manager environment. You can select options in EquipmentBuilder to control condenser water pumps, bypass valves, tower fans, and a tower sump pump. Optional sensors include networks of hardwired Outside Air Temperature and Outside Relative Humidity, Basin Water Temperature, and Condenser Water Return Temperature. The Loop Supply Water sensor input is included by default.

- 1 In EquipmentBuilder, select **Open Circuit Tower** or **Closed Circuit Tower** under **Cooling Towers - Single**.

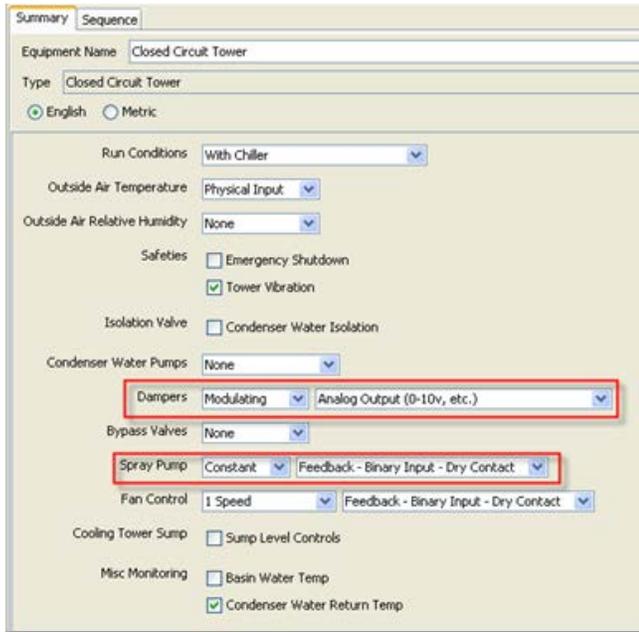


- 2 Click **Next**.
- 3 Select your specific options from the drop-down lists on the **Summary** tab.

A screenshot of the "Summary" tab in the EquipmentBuilder configuration window. The "Equipment Name" is "Open Circuit Tower" and the "Type" is "Open Circuit Tower". The language is set to "English". The configuration includes several sections with drop-down menus and checkboxes:

- Run Conditions:** With Chiller
- Outside Air Temperature:** Physical Input
- Outside Air Relative Humidity:** Physical Input
- Safeties:** Emergency Shutdown (checked), Tower Vibration (checked)
- Isolation Valve:** Condenser Water Isolation (checked)
- Condenser Water Pumps:** Lead Standby, Feedback - Binary Input - Dry Contact
- Bypass Valves:** Modulating, Analog Output (0-10v, etc.)
- Fan Control:** VFD, Feedback - Binary Input - Dry Contact
- Cooling Tower Sump:** Sump Level Controls (checked)
- Misc Monitoring:** Basin Water Temp (checked), Condenser Water Return Temp (checked)

NOTE The only difference between the Open and Closed Circuit Tower is that the Closed Tower equipment has **Dampers** and **Spray Pump** control.



- 4 Click **Next**.
- 5 Browse to the appropriate folder and save your control program, drivers, and sequence of operation, and click **Next**.

Configuring properties in the i-Vu® application

To adjust the following properties in the i-Vu® interface, select the Carrier® ChillerVu™ in the navigation tree and click the **Properties > Control Program** tab.

The screens shown are based on an Open Circuit Tower with commonly used selections. **Damper** and **Spray Pump** properties are shown in the order that they appear for Closed Circuit Tower equipment.

NOTE Many of the properties for this equipment are self-explanatory and have minimal descriptions.

Circuit Tower run conditions

Run Conditions

Displays the status of the **Ctg Tower Enable** point with options to set minimum on and off time values, the shutdown delay parameter, and the software HOA switch.

To link the Cooling Tower programs with an associated Tower Manager program, connect the Binary Network Input **Cooling Tower Enable** point in the Tower program to the corresponding **CT # Enable** point in the Tower Manager program.

Run Conditions

Ctg Tower Enable (BNI) Off Lock at value: **Off** Enabled?:

Minimum **On** time: **0** : **05** mm:ss Minimum **Off** time: **0** : **05** mm:ss

Shutdown Delay: Prior to disabling Run Command, hold output signal for **0** : **04** mm:ss.

Equipment Run Status: Off

On - Off - Auto: **Auto** ▾

Run Status Link (BBV) Off

Power On Delay: Wait **30** sec after controller powers up before enabling control of equipment.

Circuit Tower optional sensors

Outside Air Temperature and Outside Air Relative Humidity

Access the OAT and OARH sensor inputs and their sensor failure parameters.

NOTE This example shows a hardwired sensor. You can specify network sensors instead.

Outside Air Temperature

OAT Sensor (BA) **0.0 °F** Lock at value: **0.0** Expander: **00** Type: **Thermistor** Number: **00**

OA Temperature (BAV) **0.0 °F**

Alarm:

SENSEFAIL (BALM) **Normal**

Send OA Temp Sensor Failure Alarm if input reading > **225** °F (sensor max.) or < **-25** °F (sensor min.) for **0** : **10** mm:ss.

Outside Air Relative Humidity

OARH Sensor (BA) **0.0 %rh** Lock at value: **0.0** Expander: **00** Type: **0-5 Volt** Number: **00**

OA Relative Humidity (BAV) **0.0 %rh**

Alarm:

OAHFAIL (BALM) **Normal**

Send OARH Sensor Failure Alarm if input reading > **101** %rh (sensor max.) or < **-1** %rh (sensor min.) for **0** : **10** mm:ss.

Circuit Tower shutdowns

Emergency Shutdown — ESD input status and its alarm functions

Emergency Shutdown

Emerg Shutdn (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Alarm(s):

EMER OFF (BALM) Normal

Enable alarm 0 : 02 mm:ss after input is On.

Vibration Shutdown — Vibration shutdown input status and its alarm functions

Vibration Shutdown

Vib Shutdown (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Cooling Tower Vibration Shutdown:

Shutdown is currently Off. Reset?

Alarm(s):

CT VIBR (BALM) Normal

Enable alarm 0 : 02 mm:ss after input is On.

Tower mechanical systems

Condenser Water Isolation Valve Control

Set status of the optional isolation valve output channel, parameters, and alarm functions. You can adjust the open and close delays for the valve.

Condenser Water Isolation Valve Control

CW Iso Vlv Sts (BBI) Closed Lock at value: Closed Expander: 00 Type: Binary Input Number: 00

CW Iso Valve (BBO) Closed Lock at value: Closed Expander: 00 Type: Relay / Triac Output Number: 00

CW Isolation Valve Control:

Open valve 0 : 00 mm:ss after equipment is commanded ON.

Delay valve from closing for 1 : 00 mm:ss after equipment is commanded OFF.

Alarm(s):

CW Isolation Valve Status Alarm(s): Feedback delay: 1 : 00 mm:ss Debounce time: 0 : 10 mm:ss

CWV FAIL (BALM) Normal

CWV HAND (BALM) Off

CWV RNTM (BALM) Off

Send runtime message if runtime exceeds 10000 hours.

Condenser Water Pump Lead/Standby Control

Set the optional condenser pump's configuration and maintenance parameters:

- Lead/Standby Control
- Lead/Standby status and configuration
- Start/Stop and status values

Designing Open and Closed Tower applications

- Pump lockout parameters

Condenser Water Pump Lead/Standby Control

CW Pump1 Status (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00
 Status Delay: On enabling Pump 1, delay status signal for 0 05 mm:ss.

CW Pump2 Status (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00
 Status Delay: On enabling Pump 2, delay status signal for 0 05 mm:ss.

CW Pump1 S/S (BBO) Off Lock at value: Off Expander: 00 Type: Relay / Triac Output Number: 00
 Shutdown Delay: Prior to disabling Pump 1, hold output signal for 0 10 mm:ss.

CW Pump2 S/S (BBO) Off Lock at value: Off Expander: 00 Type: Relay / Triac Output Number: 00
 Shutdown Delay: Prior to disabling Pump 2, hold output signal for 0 10 mm:ss.

Lead Pump Status: OK
Pump 1 Operation Status (BMSV) OFF - OK to Run
Pump 2 Operation Status (BMSV) OFF - OK to Run

Lead Pump Status: OK
Pump 1 Operation Status (BMSV) OFF - OK to Run
Pump 2 Operation Status (BMSV) OFF - OK to Run

Pump 1 Status Alarm(s): Feedback Delay: 0 30 mm:ss Debounce Time: 0 10 mm:ss

CWP1 FAIL (BALM) Normal
CWP1 HAND (BALM) Off
CWP1 RNTM (BALM) Off
 Send runtime message if runtime exceeds 10000 hr. Accumulated runtime: 0.0 hr Clear?

Pump 2 Status Alarm(s): Feedback Delay: 0 30 mm:ss Debounce Time: 0 10 mm:ss

CWP2 FAIL (BALM) Normal
CWP2 HAND (BALM) Off
CWP2 RNTM (BALM) Off
 Send runtime message if runtime exceeds 10000 hr. Accumulated runtime: 0.0 hr Clear?

Pumps Lockout:
 Lock out both pumps if both have failed 3 consecutive times.
 Restart if either pump status is made.

Lockout Alarm:
 Manually release lockout? Off
 Disable above Lockout: Enabled
 If disabled, the pumps continue to cycle until either pumps status is made.

CWP TTL FAIL (BALM) Normal

Condenser Water Pump Lead/Standby Conditions

Set parameters for Lead/Standby rotation logic and the current runtime since the last rotation for each pump. Although the pumps are configured for Lead/Standby, you can use this function to change the run order.

Condenser Water Pump - Lead/Standby Conditions

Rotation Method: **Daily** ▾

Rotation Method Parameters:

1. If method is "Daily," rotate lead pump daily at the defined time below.
2. If method is "Weekly," rotate lead pump on day **3** of each week at the defined time below. (Monday = 1 through Sunday = 7)
3. If method is "Monthly," rotate lead pump on day **1** of each month at the defined time below.
4. If method is "Manual Rotation," **Do Not Rotate** ▾ lead pump now.
5. If method is "Runtime," rotate lead pump after **360** hr of runtime.

Runtime since last rotation:

- Pump 1 **0.0** hr
- Pump 2 **0.0** hr

Defined Time for Rotation:

All automatic rotation will occur at **13** : **00** (24hr format).

Damper Control – (Closed Circuit Tower Only)

Set parameters for optional PID-based tower damper control. You can access PID values by clicking on the **BACnet PID** value.

Damper Control

Damper (BAO) **0.0** % Lock at value: **0.0** Expander: **00** Type: **Electrical 0-10 Volt** ▾ Number: **00**

Damper CWS Temperature Setpoint:

Current setpoint is **78** °F

BACnet PID (BPID) Setpoint **78.00** Go: **Off** Input **0.00**

Spray Pump Control – (Closed Circuit Tower Only)

Set parameters for optional Spray Pump Control, OAT lockout, enable conditions, and alarm settings.

▼ Spray Pump Control

CWS Temp (BAI) 0.0 °F Lock at value: 0.0 Expander: 00 Type: **Thermistor** Number: 00

Spr Pmp Status (BBI) Off Lock at value: Off Expander: 00 Type: **Dry Contact** Number: 00

Spray Pump (BBO) Off Lock at value: Off Expander: 00 Type: **Relay / Triac Output** Number: 00

OA Conditions:
 Spray Pump **is not** enabled based on current outside air conditions.
 Spray Pump allowed if OA Temperature > 36 deg.

Cooling Tower Spray Pump:
 Enable pump if CWS Temperature > 81 deg., hyst 5 for 1:00 mm:ss.

Alarm(s):

Enable Condenser Water Supply Temperature alarms after the equipment has been running for 10:00 mm:ss.

CWST HI (BALM) **Normal**
 Send High Condenser Water Supply Temp Alarm if temperature > 86 deg. for 0:10 mm:ss.

CWST LO (BALM) **Normal**
 Send Low Condenser Water Supply Temp Alarm if temperature < 65 deg. for 0:10 mm:ss.

Spray Pump Status Alarms: Feedback Delay: 30 Debounce Time: 10

SPR FAIL (BALM) **Normal**

SPR HAND (BALM) **Off**

SPR RNTM (BALM) **Off**
 Send runtime message if runtime exceeds 10000 hours.

Bypass Valve Control

Set parameters for optional PID-based condenser water bypass valve control. You can access PID values by clicking on the **BACnet PID** value.

▼ Bypass Valve Control

Byp Vlv Output (BAO) 0.0 % Lock at value: 0.0 Expander: 00 Type: **Electrical 0-10 Volt** Number: 00

Bypass Valve CWS Temperature Setpoint:
 Current setpoint is 80 °F.

BACnet PID (BPID) Setpoint: 80.00 Go: Off Input: 0.00

Fan Control

Set parameters for variable speed tower fan control, Loop setpoint, sensor values, min/max outputs, PID parameters, and alarm settings. You can access PID values by clicking on the **BACnet PID** value.

▼ Fan Control

Loop Supply Temp Sensor (BA) 0.0 °F Lock at value: 0.0 Expander: 00 Type: **Thermistor** Number: 00

Loop Supply Temp (BAV) 0.0 °F

CT Fan Status (BBI) Off Lock at value: Off Expander: 00 Type: **Dry Contact** Number: 00
 Status Delay: On enabling CT Fan, delay status signal for 0 05 mm:ss.

CT VFD Fault (BBI) Off Lock at value: Off Expander: 00 Type: **Dry Contact** Number: 00

CT Fan VFD Output (BAC) 0.0 % Lock at value: 0.0 Expander: 00 Type: **Electrical 0-10 Volt** Number: 00

CT Fan VFD Percent (BAV) 0.0 %

CT Fan VFD S/S (BBO) Off Lock at value: Off Expander: 00 Type: **Relay / Triac Output** Number: 00
 Minimum On time: 3 00 mm:ss Minimum Off time: 1 00 mm:ss

Fan Loop Supply Temperature Setpoint: 82 °F (Note: Setpoint must be more than Bypass Valve Setpoint, if applicable.)

BACnet PID (BPID) Setpoint: 82.00 Go: Off Input: 0.00

VFD Minimum Output: 10 %

VFD Inactive Output: 0 %

VFD Output Override: Lock at value: 0 %

Fan Control:
 Enable fan if control output > 1 % hyst 0

Alarm(s):

Fan Status Alarm(s): Feedback delay: 0 30 mm:ss Debounce time: 0 10 mm:ss

FAN FAIL (BALM) Normal

FAN HAND (BALM) Off

FAN RNTM (BALM) Off

Send runtime message if runtime exceeds 10000 hr. Accumulated runtime: 0.0 hr Clear?

VFD FLT (BALM) Normal

Enable alarm 0 01 mm:ss after input is On.

Sump Makeup and Shutdown Alarms

Set parameters for optional Makeup Water controls. You can also adjust the "valve on" time.

- The **Low Wtr Makeup** input is used to open the **Makeup Valve**
- The **Low Wtr Level** input is for alarm purposes

Designing Open and Closed Tower applications

- The **High Wtr Level** input is for alarm purposes, but when On, it disables the **Makeup Valve** output.

Sump Makeup and Shutdown Alarms

Low Wtr Makeup (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

High Wtr Level (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Low Wtr Level (BBI) Off Lock at value: Off Expander: 00 Type: Dry Contact Number: 00

Makeup Valve (BBO) Closed Lock at value: Closed Expander: 00 Type: Relay / Triac Output Number: 00

Low Sump Water Level:
Open makeup valve if switch is On for 0 05 mm:ss.

Alarm(s):

SUMP_HI (BALM) Normal
Enable alarm 0 10 mm:ss after input is On.

SUMP_LO (BALM) Normal
Enable alarm 0 03 mm:ss after input is On.

Basin Return Temperature and Condenser Water Return Temperature

Set input and alarm values for the basin water and condenser water return temperatures

Basin Water Temperature

CT Basin Temp (BA) 0.0 °F Lock at value: 0.0 Expander: 00 Type: Thermistor Number: 00

Alarm(s):
Enable Cooling Tower Basin Water Temperature Alarms after the cooling tower has been running for 1 00 mm:ss.

CTBT_HI (BALM) Normal
Send High CT Basin Temp Alarm if temperature > 86 deg. for 1 00 mm:ss.

CTBT_LO (BALM) Alarm
Send Low CT Basin Temp Alarm if temperature < 38 deg. for 1 00 mm:ss.

Condenser Water Return Temperature

CWR Temp Sensor (BA) 0.0 °F Lock at value: 0.0 Expander: 00 Type: Thermistor Number: 00

CW Return Temp (BAV) 0.0 °F

Alarm(s):
Enable Condenser Water Return Temperature alarms after the equipment has been running for 10 00 mm:ss.

CWRT_HI (BALM) Normal
Send High Condenser Water Return Temp Alarm if temperature > 100 °F for 0 10 mm:ss.

CWRT_LO (BALM) Normal
Send Low Condenser Water Supply Temp Alarm if temperature < 75 °F for 0 10 mm:ss.

Connecting multiple control programs

You must add several different control programs to the controller to build a complete system. You link programs by using Network Points so they operate as a unified system.

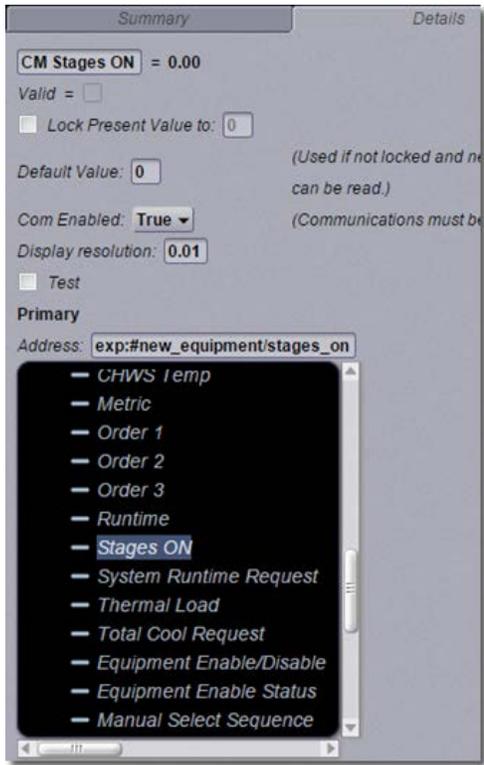
The following example:

- Links the Tower Manager and the Pump Manager to the Chiller Manager
- Links the Cooling Tower programs to the Tower Manager
- Based on the following assumptions:
 - 3 chillers controlled by a Chiller Manager – 3 chillers/Equal Sized
 - 3 chilled water pumps controlled by a Pump Manager – Variable Primary Flow
 - 3 cooling towers, controlled by a Tower Manager
 - 3 Cooling Towers, each with dedicated Condenser Water Pumps, controlled by an instance of the Single Tower program

Connect Pump Manager to the Chiller Manager

- 1 Select the **Pump Manager** on the navigation tree and click **Properties > Network Points** tab.
- 2 Click **CM Stages ON** and then select the **Details** tab.
- 3 In the **Address** tree, navigate to the **Chiller Manager** program and click **Stages ON**.

NOTE The address window path updates automatically.

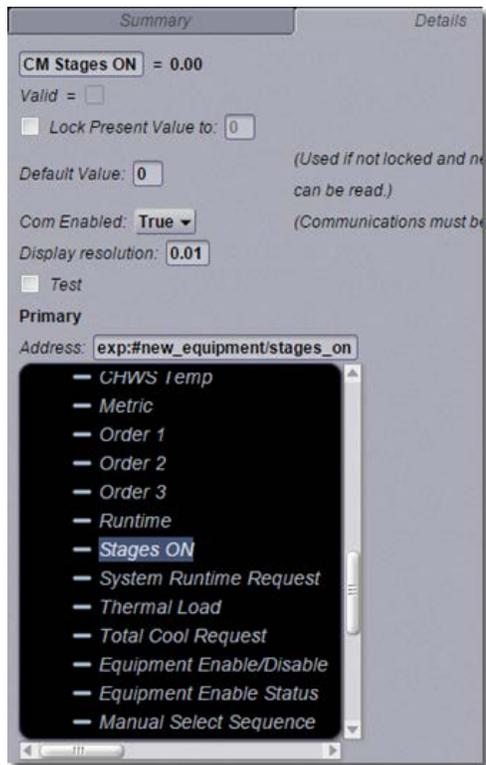


- 4 Click **Accept**.

Connect Tower Manager to the Chiller Manager

- 1 Select the **Tower Manager** on the navigation tree and click **Properties** > **Network Points** tab.
- 2 Click **CM Stages ON** and then select the **Details** tab.
- 3 In the **Address** tree, navigate to the **Chiller Manager** program and click **Stages ON**.

NOTE The address window path updates automatically.

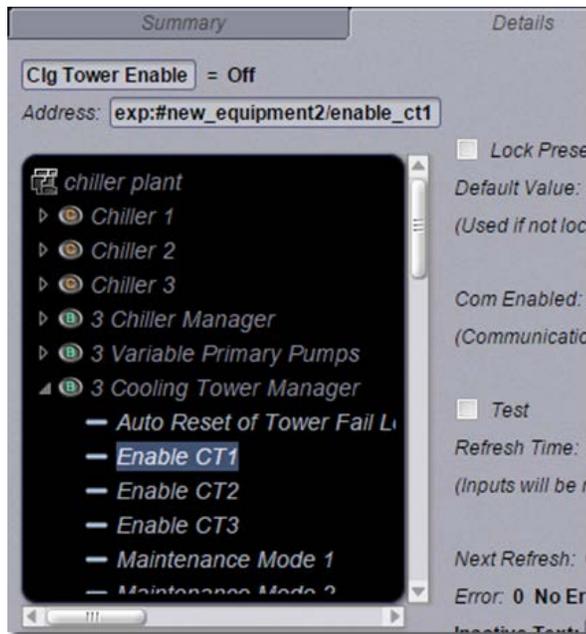


- 4 Click **Accept**.

Connect Tower Manager to the Chiller Manager

- 1 Select **Tower 1** on the navigation tree and click **Properties > Network Points** tab.
- 2 Click **Clg Tower Enable** and then select the **Details** tab.
- 3 In the **Address** tree, navigate to the **Tower Manager** program and click **Enable CT#**.

NOTE The address window path updates automatically.



- 4 Click **Accept**.
- 5 Repeat steps for each Tower program, selecting the appropriate **CT#** point.

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 - no revision history	

* For internal use only



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