HydroLink2 Supervisory Control Panel
Application and Troubleshooting Guide

For use in all equipment utilizing the HydroLink2 Aurora Control
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Introduction

The HydroLink 2 Supervisory Control Panel is a Niagara AX based control, designed to automate the chiller assembly with an application specific supervisory control. By using an application specific control, optimal plant room management can be obtained to insure proper operation and easier servicing with a turnkey solution. It features a Niagara AX based control with its own I/O and a color touchscreen tablet as a user interface. Turn-key custom programming of the Supervisory Control will be provided based upon your specific requirements for the whole chiller plant to manage the chillers and as an option, the pumps and other hydronic specialties.

Benefits of the HydroLink2 Supervisory control:

• It is a powerful and flexible Niagara AX software platform based controller.
• Optimal supervisory control programming to meet your specific site specifications.
• Customized integration of mechanical room components such as variable speed pumps and other hydronic specialties of the plant room into the site BAS.
• Guaranteed compatibility of the Supervisory Controller with the Unit Controllers.
• The sophistication of the Niagara based control allows better equipment support and servicing. Customer benefits from our experience in providing custom Supervisory Controllers.
• Improved system visibility from the BAS.

The HSC Panel is the ideal match to manage your complete chiller mechanical room.

HydroLink2 Supervisory Control
HydroLink2 Supervisory Control Features

- HydroLink 2 Control uses the powerful NIAGARA software platform.
- Internal power supply and a 120Vac convenience outlet are built into the cabinet.
- Over 2 sq. ft. [0.19 m²] of control mounting area for custom controls such as relays or transducers.
- Provides for a customized programmed chiller plant controller.
- Internal mounted and wired 10" Touch Screen tablet for interfacing with Supervisory Controller.
HydroLink2 Supervisory Control Features cont.

- Niagara AX Based.
- Supports BACnet MS/TP, BACnet IP, and LonWorks® as standard BAS options
- Can stage up to five screw compressors or ten scroll compressors
- Run time equalization supported
- Compressor fault compensation staging logic
- Unit override detection and compensation staging logic
- Manual compressor lockout recognition logic to allow unit servicing without disrupting the staging continuity
- Supports heating-only, cooling-only, and simultaneous heating and cooling
- Customizeable I/O local to the supervisory controller to support peripheral mechanical room devices such as pumps, valves, cooling towers, and flow monitoring equipment
- Local Display with touch screen control to navigate through screens showing operational data
- Network variables to allow direct BAS control and monitoring of unused IO on the IO34
- Historical trending of key temperatures and statuses
HydroLink2 Supervisory Control Features cont.

The HydroLink Supervisory Control (HSC) is scalable from two to five dual scroll Reversible Chillers or two to five single screw compressor chillers. Heating and cooling mode are both supported. The control algorithm is a PID based algorithm that operates a sequencing logic which determines which chiller is next in the sequence based on unit run time, local overrides, BAS overrides, as well as unit fault status.

The PID compares the controlled water temperature to the desired temperature (Set Point) and the controlled water temperature of the previous few minutes in order to generate a demand percentage for capacity. The sequencing logic will respond to capacity demand changes by starting or stopping a compressor to a chiller. If the demand is increasing and crosses a threshold for starting another compressor, the sequencing logic will do one of two things: If a chiller is running only one compressor, the second compressor will be started. Otherwise, the logic will select a non-running and non-faulted chiller with the least amount of run time and issue a compressor command to that chiller. If the demand is decreasing and crosses a threshold for stopping a compressor, the sequencing logic will do one of two things: If a chiller is running only one compressor, that compressor will be stopped. Otherwise, the logic will select from the running chillers the chiller with the highest run time and remove one of the compressor calls.

The supervisory controller can be programmed for communications to virtually any type of BAS. BACnet is the standard option for the supervisor’s BAS connection. Peripheral devices such as pumps and other chiller plant equipment can—on a custom basis—be added to the control of the supervisor. Contact the manufacturer for more info.
Staging Description

Overview
The HydroLink 2 Supervisory Control (HSC), has staging software that can be enabled or disabled by a single binary (two-state) variable named “SystemEnable.” The mode of operation is selected by a multi-state variable called “SystemMode” which indicates to the program which setpoints (heating or cooling) and mode of operation will be used. The HSC selected mode is communicated to each individual unit controller. If the system configuration includes a six-pipe header rack, then the capabilities of simultaneous heating and cooling will be functional. If a simultaneous mode is selected, the unit controllers will modulate the three-way water valves on the header rack to blend the source fluid with the “secondary load” fluid to maintain a temperature setpoint while the HSC will stage on and off the individual compressors to maintain the “primary load” fluid temperature. If the piping configuration is not a six-pipe, then simultaneous heating and cooling modes will not function. In the heating-only or cooling-only modes, the HSC will stage compressors on or off to maintain the desired header rack leaving water temperature.

Fixed Speed Scroll Compressors
The HSC will stage units based on:
- Leaving water temperature
- Compressor fault status
- Unit run time

The staging logic uses a specialized PID control algorithm that is designed to control stepped capacity systems. The control algorithm not only has the standard proportional and integral features, but also a derivative feature that is used to recognize short and long term load responses to capacity changes and to ambient temperature influences. This feature improves the capacity-to-load matching accuracy and is predictive. The output range of the PID control is 0% to 100%. This range is divided into equal segments to provide turn-on and turn-off thresholds for the compressors. If the option selected were a 4 compressor stager, then the first compressor would be turned on when the PID output reaches 25%. The second at 50%, the third at 75% and the fourth at 100%. For staging down, the first ‘stop’ command would be issued at 75%, the second at 50%, the third at 25%, and the fourth at 0% output of the PID. When a start or a stop command is issued, a delay timer is initiated. While the delay timer is active, the PID is ‘frozen’ at the current value so that the system capacity change can begin to take effect. When the timer has expired, the derivative portion of the PID will be able to freeze the PID output if the water temperature is moving toward the setpoint at a satisfactory rate—staging up or down. This will reduce the likelihood of engaging or dropping too many stages and causing severe overshoot of setpoint. When staging up, the staging logic will select the next unit based on unit cumulative run time. If there’s a unit with only one compressor commanded on, then the second compressor in that unit will be the next one to be turned on. Otherwise, the staging logic will issue a compressor call to the non-running unit that has the least amount of runtime and shows no compressor faults or lock-outs. Likewise, when staging down, if there’s a unit with only one compressor running, that compressor will be the next one off. Otherwise, the staging logic will remove a compressor call from the running unit with the most run time. The staging logic recognizes a manually locked-out compressor and will remove it from the staging sequence to avoid ‘dead spots’ in the staging response. An adjustable deadband is used to reduce the on/off cycling of compressors when the controlled water temperature is reasonably close to the set point.
HSC Installation Requirements

Mounted HSC Panel Indoors

- Location must be free of moisture and excessive heat and dust.
- Ambient conditions should not exceed 35°F to 110°F (0 to 90% RH, non-condensing).
- Location must allow HSC Panel door to swing open free of obstruction.
- Mounting and wiring must meet or exceed all local building codes.
- Dedicated 115/120V power supply

Mounting Details

Mount HSC Panel indoors and within close proximity to the mechanical room that houses the chillers and devices it controls. The HSC Panel must be free and clear of any obstructions that prevent access to and within the enclosure. The HSC Panel can attach to a wall or to an optional stand capable of supporting the HSC Panel. Installation shall meet or exceed all local building codes.

The back of the HSC Panel has keyways at the top and bottom of the panel at 16 inches on center to provide easy mounting points.

**HYDROLINK SUPERVISORY CONTROL BOX**

**DOOR LATCHES**

**LOCK**

**TOUCHPAD DISPLAY**

**COLOR SCREEN**

**WALL MOUNT BACK SIDE**

**ALL DIMENSIONED HOLES ARE KNOCK outs 7/8" AND 1 3/8" IN SIZE**
Supervisory Control Box Electrical Requirements

**Breaker Size:** 20A

**Wire Size:** 14AWG
NOTE: Dedicated 115V/120V Power Supply Required

**Min Supply Voltage:** 105V

**Max Supply Voltage:** 127V
**HSC Wiring Requirements**

All EIA-485 communication wiring connections shall be made with communication wire that meets or exceeds the specifications shown in ANSI/ASHRAE Standard 135.

- Installing contractor will complete the wiring of the HSC.
- BACnet I/P – A communication protocol that should only be used to connect the HydroLink 2 Supervisory Controller to the Building Automation System if so desired.
- BACnet MS/TP – A communication protocol that is used to connect the HSC Panel to the unit mounted HydroLink 2 controllers, and can be used by the Building Automation System on the “RS-485 option card.
- Daisy Chain – A wiring method used when connecting RS-485 MS/TP communication protocol. This method should be used to connect the HSC Panel to the unit mounted HydroLink 2 controllers.

**Field Wiring**

The HSC Panel requires a dedicated 120VAC be field wired for power. The HydroLink2 controller will be factory wired in the panel to a dedicated 24VDC circuit. The BAS communications, the local chiller communications trunk, the header rack isolation valves, header rack pressure transducer and header rack temperature sensors are to be wired in the field by the installing contractor. If the BAS connection is BACnet MS/TP, the recommended cable is a 22 AWG stranded shielded twisted pair. The local chiller communications trunk is also recommended to be a 22 AWG stranded shielded twisted pair.

The HMI (Human Machine Interface) is also factory pre-wired for power and communication to the supervisory controller. The HMI will connect to the HydroLink 2 Supervisory Controller via Lan 2, this will allow the tablet to display the screens used for setup and configuration. Refer to the “HMI reloading/rebooting Procedure” section or contact the WFI tech support team for questions or assistance with the HMI application.

- 24VDC power supply is dedicated to power the HydroLink2, Onyxx XM 34IO and Onyxx XM 34IO-B devices. DO NOT connect other equipment to this dedicated power supply.
- Do not apply 24VAC power by reinserting the connector plug into the HydroLink2, Onyxx XM 34IO or Onyxx 34IO-B) until all other wiring is completed, including the Onyxx XM 34IO, or Onyxx XM 34IO-B inputs and outputs. Screw down all connector screws prior to testing & installation.
HMI Screens

Log-In Screen
Once the configuration setup is complete, there will be a “HydroLink Aurora logo” in the center of the screen. The “System” button on the navigation bar will become enabled, and display the module count for the system. For example, “System 2U” stands for “System with (2) Units.” (See picture below).

NOTE: All other links on the navigation bar are disabled on the “Login” screen. Click on the “System” button, (example shows “System 2U”) then the entire navigation bar will be enabled, and the HMI will display the “System” screen. Once end-user leaves the “login” screen, navigate each screen in the HSC, and verify that the data on the Units HMI is matching the data on the Supervisory HMI.
HMI Screens

System Screen

**System Setpoints:** Displays the Heating and Cooling setpoints, which the program uses to control capacity to operate the system and is adjustable from the Temperature Control screen on Settings screen.

**System Mode:** Displays the current operating mode selected of the system, and is adjustable from the Temperature Control screen on Settings screen.

**Hot / Cold / Net Energy Fluid:**
- Leaving (°F) – This is the Header Rack leaving fluid temperature, that can be shown in °F or °C.
- Entering (°F) – This is the Header Rack entering fluid temperature, that can be shown in °F or °C.

**Chiller Status:** Displays the current command of the unit such as “Enabled” or “Disabled.”

Navigation Tool Bar
All HSC screens on the HMI will display a navigation tool bar at the top of the screen, which includes the following links: “Header Rack,” “System,” “Overview,” and a “Settings” link that will allow the end user to view more details about the system.

**NOTE:** The number of modules in the system will appear on the System and Overview buttons in the navigation bar. (See screenshot below)
HMI Screens cont.

Header Rack Screen
Displays header rack entering/leaving fluid temperatures, differential pressures (if available), bypass valve, three-way valve, and isolation valve position. Also shown on this screen, “heating and cooling” set points, control temperature, mode selected, and “Active Alert Status.

**Header:** Displays the current selected header rack type of the system, and is adjustable from the Temperature Control screen on Settings screen.

**Header Mode:** Displays the current operating mode selected of the system, and is adjustable from the Temperature Control screen on Settings screen.

**Header Rack Valves:** Displays the current command of each valve on the header rack.
- **Bypass (0-100%)**
  - Hot/Cold/Net Energy bypass valves will modulate to provide the constant flow thru the header rack as chillers start to enable/disable to control capacity.
- **3Way (0-100%)**
  - Load/Source 3way valves will modulate to blend fluid to control the hot and cold loops in the simultaneous heat/cool modes (NOTE: These modes only work with a 6-pipe header rack configuration).
- **Isolation (Off/On)**
  - Load/Source Isolation valves are to open (On) and close (Off) as the staging software enables and disables the chiller.

**Active Alert Status:**
- **System Maintenance (Normal / Alarm)** - Provides an alarm that will trigger every 90-calendar days, to remind owner to check and clean strainers. This requires a hard reset from the HMI.
- **Temp Sensor Failure (Normal / Alarm)** - Provides an alarm if any header rack temperature sensor becomes out of range or offline. (True(Alarm) if sensor out of range and False(Normal) if sensors are within range)
- **High Header Temp (Normal / Alarm)** - Will monitor the entering header fluid temperature. True (Alarm) if sensor out of range and temp is too HIGH, and a False (Normal) if sensors are within range).
- **Low Header Temp (Normal / Alarm)** -Will monitor the entering header fluid temperature. True (Alarm) if sensor out of range and temp is too LOW, and a False (Normal)
HMI Screens cont.

Header Rack Screens cont.
If the “No Header Rack” option is selected for the Header Rack Type, when the Header Rack screen is activated a display indicating the system is not configured for a header rack will be displayed.
HMI Screens cont.

Overview Screen
Displays chiller status, operation, compressor lockout status, heating and cooling set points, and compressor contactor status. This screen gives an overview of each chiller.

<table>
<thead>
<tr>
<th>Chiller 1</th>
<th>Chiller 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Normal</td>
</tr>
<tr>
<td>Operation</td>
<td>Standby</td>
</tr>
<tr>
<td>Mode</td>
<td>Heating Only</td>
</tr>
<tr>
<td>Circuit A</td>
<td>Off</td>
</tr>
<tr>
<td>Circuit B</td>
<td>Off</td>
</tr>
</tbody>
</table>

**Setpoint** - (Heating / Cooling) the selected setpoint the unit is trying to maintain.

**Control Temp** - The current temperature of the control sensor.

**Status**: Displays the current overall fault status of chiller. “Normal” for normal operation or “Lockout” indicating the unit has locked out due to a fault.

**Operation**: Displays the current operating condition of unit such as “Standby” or “Single Compressor Cooling.”

**Mode**: Displays the current operating mode selected of the chiller, and is adjustable from the Manual Operation screen on Settings screen.

**Circuit A & B**: Displays the On/Off status, and the current lockout status of each compressor detected by Aurora Boards.
HMI Screens cont.

Settings Screen
All temperature, network, or capacity settings for the system or HydroLink controller can be accessed or changed thru the “Settings” screen. The method of temperature control, mode of operation, and manual operation all take place in this screen.
HMI Screens cont.

Header Rack Settings Screen
Allows the end-user to configure the header rack functionality.

<table>
<thead>
<tr>
<th>Header Rack Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Header Graphic Type</strong></td>
</tr>
<tr>
<td><strong>Header Logic Type</strong></td>
</tr>
<tr>
<td><strong>Header System Control</strong></td>
</tr>
<tr>
<td><strong>Differential Pressure Enable</strong></td>
</tr>
<tr>
<td><strong>System Control Temp Option</strong></td>
</tr>
<tr>
<td><strong>Full Building (Auto) Control Temp</strong></td>
</tr>
</tbody>
</table>

**Header Graphic Type** – Displays the existing header rack type and provides the appropriate header information for that header rack type.

**Header Logic Type** – Displays the existing header rack type and provides the appropriate header logic for that header rack type.

**Header System Control** - Selection between Setpoint (False) and Aqua Stat (True) control for some header rack.

**Differential Pressure Enable** – Displays the current header rack DP across the header Rack’s entering/leaving fluid.

**System Control Temp Option** – Displays the controlled variable that the system uses to control capacity. (Header Rack LWT/Storage Tank Temp) -

**Full Building (Auto) Control Temp** – Used in FBA mode ONLY, displays the controlled variable that controls the secondary loop leaving water temperature. (Header Rack LWT/Heat Exchanger LWT) -
HMI Screens cont.

Temperature Control Settings Screen
Allows user to adjust the heating and cooling setpoints, and the setpoint reset (from the BAS). The effective setpoint of the system are also displayed.

![Temperature Control Settings Screen](image)

**Temperature Control Method** – Displays the control method current selection to operate the system. The three options include:

- **Setpoint Control** – Manual Control; will use selectable onboard sensors at the unit level and control via a PID loop.
- **Aqua Stat Control** – Using external (field supplied) temperature sensor and 24VAC commands directly to the unit.
- **Network Control** – Supervisor Control; Operation commands will come directly thru Supervisory Controller (BACnet MS/TP) communication or from the BAS.

**Heating Settings**
- **Hot Setpoint**: Heating set point used for system capacity control in heating modes.
- **Hot Setpoint Reset**: Allows a reset value command ranging from (+/- 5 degrees) to reset the system hot-water set point.
- **Hot Effective Setpoint**: A combination of the Hot Set point, and the Hot Setpoint Reset, used for system capacity control in heating modes.

**Cooling Settings**
- **Cold Setpoint**: Cooling set point used for system capacity control in cooling modes.
- **Cold Setpoint Reset**: Allows a reset value command ranging from (+/- 5 degrees) to reset the system cold-water set point.
- **Cold Effective Setpoint**: A combination of the Cold Setpoint, and the Cold Setpoint Reset, used for system capacity control in cooling modes.
HMI Screens cont.

Unit Manual Operation Screen
Displays the system-level manual commands and some statuses. It also displays the current unit operating status with links to the unit-level manual commands.

System Enable: Allows units to run using the “Auto Staging Program” this should be enabled at all the times for units to operate using the staging program. If disabled, the units are commanded off from the Supervisory controller.

System Mode: Allows the user to change modes on the system.
Integrated Hydrolink Aurora Controls have 8 operating modes (shown below) to select from:
1 - Compressors Off, Isolation Valves Open
2 - Cooling Only
3 - Heating Only
4 - Auto Full Building - (6-pipe header)
5 - Full Building
6 - Primary Cooling - (6-pipe header)
7 - Primary Heating - (6-pipe header)
8 - System Off - (Compressors off, Isolation Valves Closed)

Emergency Shutdown: Enable (On) or Disable (Off) Emergency Shutdown. This command will immediately (5 sec) shutdown all compressor and any other outputs. This screen shows whether it is active or not.

Capacity Limit Enable: This variable should be set to “On” (True) to enable the limiting functionality, and set to “Off” (False) to disable this feature. The default set to Off.

Capacity Limit Setting: The system will be limited to the capacity limit setting. This parameter displays the number of units that is available to operate in the system, and is used to limit energy consumption during peak hours. The default setting is setup to operate at 100%.

NOTE: See the example of systems and the ability to limit the capacity in the table below.

<table>
<thead>
<tr>
<th>System Capacity Limit Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Limited</td>
</tr>
<tr>
<td>1-Unit</td>
</tr>
<tr>
<td>2-Units</td>
</tr>
<tr>
<td>3-Units</td>
</tr>
<tr>
<td>4-Units</td>
</tr>
<tr>
<td>5-Units</td>
</tr>
</tbody>
</table>

Unit Manual Ops: Allows access to a unit-level manual operations screen, which allows some override commands to an individual unit.
HMI Screens cont.

Unit Manual Operation Screen cont.
Displays the unit-level manual commands and some active statuses. Allows the user to override some commands for individual unit control.

Unit Manual Control Option

Emergency Shutdown: Will immediately (5 sec) shutdown all compressors and any other outputs. This screen shows whether it is in shutdown or a normal state.

Reset Alarms:
- Reset - Allows program to reset the alarms.
- Normal - Allows program to operate as normal with no alarms.

Enable Override: If set to overridden, user will take unit out of the “Auto Staging Program” rotation and enable/disable unit manually.

Mode Override: Must be set to “Auto” for HSC to stage. If “Not set to AUTO” user will take unit out of the “Auto Staging Program” rotation and can pick a different mode for that unit.

Unit Control Program Option

Network Control:
- Network - Indicates that the system is under Supervisory (HSC) control.
- Normal - Indicates the unit will operate as a stand-alone unit.

Temperature Control Method – Displays the control method current selection to operate the system. The three options include,
- Setpoint Control - Manual Control; will use selectable onboard sensors at the unit level and control via a PID loop.
- Aqua stat Control - Using external (field supplied) temperature sensor and 24VAC commands directly to the unit.
- Network Control – Supervisor Control; Operation commands will come directly thru Supervisory Controller (BACnet Mstp) communication.

Unit Active Status
These values are indicating the unit’s current operating status.

NOTE: When the “Mode Override and/or Enable Override” feature is activated, the unit is taken out of the “Auto Staging Program” sequence and will only operate manually via the Local- HMI at the chiller.
**HMI Screens cont.**

**Capacity Settings**
Displays the staging values and parameters for increasing/decreasing capacity control for the system.

<table>
<thead>
<tr>
<th>Capacity Settings 2U</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setpoints</strong></td>
<td><strong>Control Temp</strong></td>
</tr>
<tr>
<td>Heating</td>
<td>125.0°F</td>
</tr>
<tr>
<td>Cooling</td>
<td>45.0°F</td>
</tr>
<tr>
<td><strong>Unit Stage On Settings</strong></td>
<td><strong>Unit Stage Off Settings</strong></td>
</tr>
<tr>
<td>Capacity Setpoint</td>
<td>90.0 %</td>
</tr>
<tr>
<td>Hot Delta</td>
<td>2.0 °F</td>
</tr>
<tr>
<td>Cold Delta</td>
<td>2.0 °F</td>
</tr>
<tr>
<td>Timer Setpoint</td>
<td>3.0 min</td>
</tr>
<tr>
<td>Time Remaining (Status)</td>
<td>3.00 min</td>
</tr>
</tbody>
</table>

**Unit Stage On Settings**

- **Capacity Setpoint:** (Adjustable) Refers to unit capacity setpoint.
  - This value is 1/3 part of the “stage on” criteria.
  - When the average capacity setpoint (Enabled Units) is greater than this value, the “stage on timer” will start.

- **Hot Delta:** (Adjustable) Hot water stage on differential.
  - This value is 2/3 part of the “stage on” criteria (Applies when in Heating modes).
  - When the hot header leaving water temperature is less than the hot water set point, by the difference of this value, then the “stage on timer” will start.

- **Cold Delta:** (Adjustable) Chilled water stage on differential.
  - This value is 2/3 part of the “stage on” criteria (Applies when in Cooling modes).
  - When the cold header leaving water temperature is greater than the cold-water set point, by the difference of this value, then the “stage on timer” will start.

- **Timer Setpoint:** (Adjustable) This value is 3/3 part of the “stage on” criteria.
  - This timer will start when the enabled units, meet the criteria to stage on is met. When timer expires, and the stage on criteria is satisfied, the next unit will be enabled with the least amount of runtime by the HSC.

- **Time Remaining:** (Non-Adjustable) This value is 3/3 part of the “stage on” criteria.
  - The remaining time left of the “stage on timer” to enable the unit with the least amount of runtime.
HMI Screens cont.

Capacity Settings cont..

Unit Stage Off Settings

Capacity Setpoint: (Non-Adjustable) Refers to unit capacity setpoint. This value is (1/3) part of the “stage off” criteria. When the average capacity setpoint (Enabled Units) is less than this value the “stage off timer” will start.

Cold Delta: (Adjustable) Chilled water stage off differential. This value is (2/3) part of the “stage off” criteria (Applies when in Cooling modes). When the cold header leaving water temperature is less than the cold-water set point, by the difference of this value, then the “stage off timer” will start.

Hot Delta: (Adjustable) Hot water stage off differential. This value is (2/3) part of the “stage off” criteria (Applies when in Heating modes). When the hot header leaving water temperature is greater than the hot water set point, by the difference of this value, then the “stage off timer” will start.

Timer Setpoint: (Adjustable) This value is (3/3) part of the stage OFF criteria. This timer will start when the enabled units, meet the criteria to “stage off” is met. When the timer expires, the unit with the most amount of runtime will be disabled by the HSC.

Time Remaining: (Non-Adjustable) This value is (3/3) part of the “stage off” criteria. The remaining time left of the “stage off timer” to disable the unit with the most amount of runtime.

Runtime: A calculated value that indicates the amount of time the compressors are operating.

Capacity SP: This value changes (from 0-100%) depending on the demand of the unit.

Circuit A/B: Compressor Off/On status Alarms Settings Displays alarm status and provides the ability to reset and change thresholds to adjust system alarms.
HMI Screens cont.

PID Controller Screen
The HSC logic control method utilizes internal PID (proportional integral derivative) algorithms. The PID controls a feedback loop to maintain a temperature setpoint. NOTE: Please consult with our technical support team if further PID fine-tuning is desired.
HMI Screens cont.

Alert Settings Screen
Displays alert status and provides the ability to reset and change thresholds to adjust system alerts.

![Alert Settings Screen](image)

**Status**

**System Maintenance**: Provides an alarm, to remind building operator to check and clean strainers. This requires a hard reset from this screen.

**Header Temp Sensor**: Provides a status if any header rack temperature sensors are out of range or offline. (True (Alarm) if sensor out of range and False (Normal) if sensors are within range) Sensor would need to be repaired/replaced immediately if sensor is not properly working.

**Header High Temp**: This point will monitor the entering hot water header temperature and will send a True/False alarm if temp is too high.

**Header Low Temp**: This point will monitor the entering cold-water header temperature and will send a True/False alarm if temp is too low.

**Setpoints/Resets**

**Maintenance Reset**: Provides a way to reset the alarm, after the building operator checks and cleans strainers to the unit. This is a hard reset from this screen.

**Scheduled Maintenance Setpoint**: An adjustable timeframe, to remind building operator to check and clean strainers.

**Header Hot EWT Threshold**: This point will monitor the entering hot water header temperature and will send a True/False alarm if temperature is too high.

**Header Cold EWT Threshold**: This point will monitor the entering cold-water header temperature and will send a True/False alarm if temperature is too high.
HMI Screens cont.

Configuration Screen

<table>
<thead>
<tr>
<th>System Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Count</strong></td>
</tr>
<tr>
<td><strong>VFD Logic Enabled</strong></td>
</tr>
<tr>
<td><strong>Lead Lag Enabled</strong></td>
</tr>
<tr>
<td><strong>Network Control</strong></td>
</tr>
</tbody>
</table>

**System Unit Count:** The number of modular units banked together and installed in the system.

**VFD Logic Enabled:** Selection between local (Disabled or False) and network (Enabled or True) determination of variable speed compressor target operating capacity. When this point is Enabled the variable speed compressor target capacity is set by the “capacity set point” in the staging software logic, and the fixed compressor control set by a Y2 call from the staging software logic, which takes priority over the internal control values based on total system target operating capacity.

**Lead Lag Enabled:** Selection of Enabling (True) or Disabling (False) of compressor lead lag operation by internal compressor control logic. This variable does not work with a variable speed applications.

**Network Control:** Indication that system is under network control. This value should be set by BAS because when system is under network control many local commands and settings will not work.
HMI Screens cont.

BACnet/MSTP Configuration Screen
Building Automation – RS485-2 (Com 2)

This section is for the BAS to configure the HSC to tie into the Automation System via Mstp.

To Local Units – RS485-1 (Com 1)
This section is for the Startup Tech to configure the HSC to communicate to the Module Units.

Building Automation – IP-en0 (Primary)
This section is for the BAS to configure the HSC to tie into the Automation System via IP.

Local Units Enabled – RS485-1 (Com 1)
This section is for the Startup Tech to configure the HSC to communicate to the Module Units.

Network Number: The network number should be defaulted at 8100 for the local units. It can be configured to integrate per building automation system contractor.

Object ID: The object ID is a read only status on the HMI. However, can be adjusted by a factory technician.

Baud Rate: Selectable from several speeds.

Address: Unique MAC Address

Max Master: Highest network number available.
**HMI Screens cont.**

**Reboot Screen**

**Reboot The Controller** – The reboot process can take up to 10 minutes and should not be interrupted.
HydroLink2 Supervisory Control Panels “System Configuration” should be completed by a factory trained start-up tech to ensure proper operation.
Change HSC Network IP Address

1. To change the IP address on the HSC via the HMI, swipe upward from the bottom of the tablet on any screen.
2. Press the (black colored, white trimmed, circle shaped) “Home” button to return to the home screen.
3. Press the (6-black dots inside a white circle shape) “App” button
4. Open up Google Chrome web browser and enter the HSC IP address in the web address bar.
5. Enter the proper credentials listed below:
   UN: user
   PW: Networkip
6. Press the “Login” button to login to the HSC Tcp Ip Platform Service Plugin.
7. Proceed to change the “en0” port, which is the primary port.
Change HSC Network IP Address cont.

8. Once the new IP address has been entered, scroll to the bottom of the screen and click “SAVE.”
9. Then, the system will need to reboot to make the changes. It will prompt you to continue, Click “OK”
10. The system will take up to 10 minutes to reboot and start up. Be patient. Then return to the “Home” screen on the HMI and launch the HydroLink app.
Powering on HMI

Power up the Android Tablet Interface by pressing and holding the “Power” button. While the tablet is booting up, the screen will go blank for a minute, wait for the HMI to display the “Initializing Screen.” During this time, the tablet is connecting to the HSC via Wi-Fi router located in the Supervisor Control Panel.

The HMI will display the picture above during the initializing process. While initializing, it will perform the following functions:

1) Enable Wi-Fi adapter
2) Connect to wireless access point
3) Connect to Supervisory HydroLink 2 Controller. When the tablet has completed initializing, it will automatically login the HSC’s Home screen.

NOTE: If the tablet is not successful in connecting to the HSC, the page displayed above will indicate which step failed. Then document the “failed step” and begin to troubleshoot the issue. If the tablet will not connect to the HSC, refer to the “HMI Rebooting” section of this manual for help reconfiguring the HMI.
Login Screen (Pre Factory Tech Startup) First Time Connecting

NOTE: When powering up the HMI for the first time, the “System Login” screen will look like the picture above. The entire navigation bar (at the top of screen) are disabled. At this point, contact the manufacture to schedule a required Factory Tech Startup for your system. During startup, the Technician will need to complete the “Configuration Setup” and safely start the chillers. After the configuration setup is complete, the “System Login” screen will display an Enabled “System” button that will allow the user to view the system operating status.
Application Example:
*Four Pipe Standard Header Rack with Fixed Capacity Scroll Dedicated Chiller*
The application of this system allows it to be applied in a wide range of two pipe hydronic systems where either chilled or hot water production is controlled through the Building Automation System (BAS). Because this system is dedicated to exclusively deliver either chilled water only or hot water only, water is not mixed within the header rack.

**Cooling Only** operation is based on a chilled water temperature set point with the source connected to a Net Energy Water Loop to reject the heat of compression. Upon sensing that the leaving chilled water temperature has risen above the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving chilled water temperature in the header rack.

An optional field provided and installed chilled water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed chilled water temperature sensor is installed in the storage tank to control the unit modular chiller’s compressor staging operation. The temperature sensor located in the chilled water temperature header rack will be ignored for control, but will be monitored.

In the application of **Heating Only**, production of hot water is the primary mode while chilled water is the uncontrolled byproduct of the process. Upon sensing that the leaving hot water temperature has dropped below the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving hot water temperature in the header rack.

An optional field provided and installed hot water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed hot water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging operation. The temperature sensor located in the hot water temperature header rack will be ignored for control, but will be monitored.

The supervisory controller comes standard configured for Cooling Only operation. The operating mode can only be changed from Cooling Only to Heating Only by a factory technician at the time of system commissioning.
Controller Configuration
The communications links (RS-485 and Ethernet) may be field configured for setting an address, device instance and baud rate where applicable. The staging can be scaled in the field to support 2 to 10 stages of compressor capacity. The run time equalization feature may be enabled or disabled in the field.

Operator Functions
The local display will support multiple access level users to allow read-only, Building User/Owner, and factory admin-level access. The Building User/Owner will be able to adjust the operating temperature set point, enable/disable the system, reset lockout alarms, and view detailed unit summaries.

Water Control
One of the primary functions of the supervisory controller is to manage the water flow through the modular chiller plant to maintain efficient system water circulation. When the system is enabled, the 2-way water isolation valve on a single specified unit module will be commanded open so that the water can circulate. When the staging algorithm starts the first unit module in the sequence, then the isolation valve that was opened for circulation will be allowed to close again and will remain closed until the associated unit is commanded on or until all other isolation valves have closed—provided that the System Enable command is still ON.

Optional Bypass Control: The optional bypass control is available to prevent dead heading of the system water circulating pumps in a variable volume system when all of the unit modules water control valves are closed and is recommended for use with all piping header racks. When the system is enabled, the 2-way water bypass valve will be commanded open so that the water can circulate through the bypass. When the staging algorithm starts the first unit module in the sequence, then the bypass valve that was opened for circulation will be allowed to close again and will remain closed until all other unit module isolation valves have closed.
Temperature Control

Another primary function of the supervisory controller is to provide control of the water temperature by staging on or off the compressors in the array of chillers based upon the commanded temperature set point communicated over the BAS. The compressor staging PID algorithm compares the chiller plant leaving water temperature*, trending over an adjustable time period, to the commanded water temperature set point in order to determine system demand. The sequencing logic will respond to changes in the system demand by initiating or terminating compressor “enable” or “disable” commands to the unit module(s). If the demand is increasing and crosses the threshold for starting another compressor, the sequencing logic will select and enable the unit module with the least amount of accumulated compressor run time and then issue an “enable” command to the compressor with the lowest run time. In the event that a unit module is already operating a lead compressor, the controller will issue an “enable” command to the lag compressor of that unit module. As the system demand decreases and crosses the threshold for halting compressor operation, the sequencing logic will issue a “disable” command to the compressor with the highest run time.

* Optional entering water temperature control available as an engineering special; contact factory.

Chilled Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the chilled water temperature set point higher from 0 - 10°F to maximize plant efficiency.

Hot Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the hot water temperature set point lower from 0 - 10°F to maximize plant efficiency.

Load Limit Function: a customer supplied external signal commanded over the BAS (0-100%) that limits the number of compressors that are available to be staged in order to limit electrical consumption of the central chiller plant.

Run Time Equalization

A run time equalization feature can be enabled or disabled. Run time is per unit module, and is the combined run time of both compressors in the unit. If the run time equalization feature is enabled, when an additional unit module is needed for increased capacity, the next compressor call will be issued to the unit with the lowest run time of the inactive unit modules. In the event of a lock-out fault on a compressor, the staging algorithm will bypass that unit module and use the one with the next lowest run time. Units with faulted compressors will be placed at the back of the line in the sequencing order. This will still allow single compressor operation if one of the two compressors is disabled.

System Notifications and Failure Alarms

The supervisory controller monitors the operation of each unit module within the chiller plant, but also monitors a number of system functions in order to provide notification and or alarms over the BAS.

Scheduled Maintenance Notification: General system notification based upon accumulated run hours.

Sensor Failure Alarm: Controlling water temperature sensor failure shuts down system and initiates alarm. All other sensors will only initiate an alarm.

High Condenser Temperature Alarm: Adjustable alarm point based upon entering condenser/net energy water loop temperature at chiller.

Low Evaporator Temperature Alarm: Adjustable alarm point based upon leaving chilled water temperature at chiller.

Remote Stop Alarm: Alarm that the chiller plant operation has been halted by a BAS command.

Emergency Stop Alarm: Provides notification that the operation of a single unit module has been halted as a result of an operator depressing the unit’s emergency shut down push button. Can be configured, by a factory technician at the time of system commissioning, to halt entire system operation and initiate alarm in the event that a single unit module’s emergency shut down push button has been depressed.

Refrigerant Monitor Alarm (Field Provided and Wired): Upon receiving an input from a refrigerant monitor, the entire system operation is halted and initiates an additional system alarm.
Control Inputs and Outputs:
*Four Pipe Standard Header Rack with Fixed Capacity Scroll Dedicated Chiller*

**System Network Inputs**

*Cooling Only Mode*
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Cooling”)
- Chilled Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Chilled Water Temperature Reset (optional)
- Load Limiting Status (optional)
- Remote Plant Shutdown (optional)

*Heating Only Mode*
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Heating”)
- Hot Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Hot Water Temperature Reset (optional)
- Load Limiting Status (optional)
- Remote Plant Shutdown (optional)

**System Control Outputs**
The Niagara Direct Input Output Module features digital and analog outputs to provide control of relays and speed reference outputs on VFDs or positioning outputs on modulating actuators.

*Cooling Only Mode*
- Alarm Relay/Annunciator (optional)
- Remote Chilled Water Pump Speed Reference
- Chilled Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*
  *Field installed in bypass header assembly if system configured for water bypass

*Heating Only Mode*
- Alarm Relay/Annunciator (optional)
- Remote Hot Water Pump Speed Reference
- Hot Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*
  *Field installed in bypass header assembly if system configured for water bypass
Control Inputs and Outputs:
Four Pipe Standard Header Rack
with Fixed Capacity Scroll Dedicated Chiller

System Network Outputs

Cooling Only Mode

• Entering Chilled Water Temperature
• Leaving Chilled Water Temperature
• Estimated Chilled Water Flow Rate
• Chilled Water Bypass Valve Position*
• Estimated Chilled Water Plant Load
• Entering Source/Net Energy Water Loop Temperature
• Leaving Source/Net Energy Water Loop Temperature
• Estimated Source/Net Energy Water Flow Rate
• Source/Net Energy Water Bypass Valve Position*
• Estimated Source/Net Energy Water Plant Load
• Active Module(s)
• Active Compressor(s)
• Active System and Unit Module Alarm(s)
  *Field installed in bypass header assembly if system configured for water bypass

Heating Only Mode

• Entering Hot Water Temperature
• Leaving Hot Water Temperature
• Estimated Hot Water Flow Rate
• Hot Water Bypass Valve Position*
• Estimated Hot Water Plant Load
• Entering Source/Net Energy Water Loop Temperature
• Leaving Source/Net Energy Water Loop Temperature
• Estimated Source/Net Energy Water Flow Rate
• Source/Net Energy Water Bypass Valve Position*
• Estimated Source/Net Energy Water Plant Load
• Active Module(s)
• Active Compressor(s)
• Active System and Unit Module Alarm(s)
  *Field installed in bypass header assembly if system configured for water bypass
Application Example:
*Four Pipe Reversing Header Rack with Fixed Capacity Scroll*
*Dedicated Chiller*
The application of this system allows it to be applied in a wide range of two pipe hydronic systems where chilled or hot water production is controlled through the Building Automation System (BAS). This system utilizes the three way water control valves within the header rack to reverse the water flow through the evaporator and condenser which allows water to be mixed within the system.

**Cooling** operation is based on a chilled water temperature set point with the source connected to a Net Energy Water Loop to reject the heat of compression. Upon sensing that the leaving chilled water temperature has risen above the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving chilled water temperature in the header rack.

An optional field provided and installed chilled water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed chilled water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging operation. The temperature sensor located in the chilled water temperature header rack will be ignored for control, but will be monitored.

During **Heating** operation, the three-way water valves in the header rack are energized to reverse the flow of water through the unit module in order to produce hot water. Upon sensing that the leaving hot water temperature has dropped below the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving hot water temperature in the header rack.

An optional field provided and installed hot water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed hot water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging operation. The temperature sensor located in the hot water temperature header rack will be ignored for control, but will be monitored.
Controller Configuration

The communications links (RS-485 and Ethernet) may be field configured for setting an address, device instance and baud rate where applicable. The staging can be scaled in the field to support 2 to 10 stages of compressor capacity. The run time equalization feature may be enabled or disabled in the field.

Operator Functions

The local display will support multiple access level users to allow read-only, Building User/Owner, and factory admin-level access. The Building User/Owner will be able to adjust the operating temperature set point, “enable/disable the system, reset lockout alarms, and view detailed unit summaries.

Water Control

One of the primary functions of the supervisory controller is to manage the water flow through the modular chiller plant to maintain efficient system water circulation. When the system is enabled, the 2-way water isolation valve on a single specified unit module will be commanded open so that the water can circulate. When the staging algorithm starts the first unit module in the sequence, then the isolation valve that was opened for circulation will be allowed to close again and will remain closed until the associated unit is commanded on or until all other isolation valves have closed—provided that the System Enable command is still ON.

Optional Bypass Control: The optional bypass control is available to prevent dead heading of the system water circulating pumps in a variable volume system when all of the unit modules water control valves are closed and is recommended for use with all piping header racks. When the system is enabled, the 2-way water bypass valve will be commanded open so that the water can circulate through the bypass. When the staging algorithm starts the first unit module in the sequence, then the bypass valve that was opened for circulation will be allowed to close again and will remain closed until all other unit module isolation valves have closed.
Temperature Control

Another primary function of the supervisory controller is to provide control of the water temperature by staging on or off the compressors in the array of chillers based upon the commanded temperature set point communicated over the BAS. The compressor staging PID algorithm compares the chiller plant leaving water temperature*, trending over an adjustable time period, to the commanded water temperature set point in order to determine system demand. The sequencing logic will respond to changes in the system demand by initiating or terminating compressor “enable” or “disable” commands to the unit module(s). If the demand is increasing and crosses the threshold for starting another compressor, the sequencing logic will select and enable the unit module with the least amount of accumulated compressor run time and then issue an “enable” command to the compressor with the lowest run time. In the event that a unit module is already operating a lead compressor, the controller will issue an “enable” command to the lag compressor of that unit module. As the system demand decreases and crosses the threshold for halting compressor operation, the sequencing logic will issue a “disable” command to the compressor with the highest run time.

*Optional entering water temperature control available as an engineering special; contact factory.

Chilled Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the chilled water temperature set point higher from 0 - 10°F to maximize plant efficiency.

Hot Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the hot water temperature set point lower from 0 - 10°F to maximize plant efficiency.

Load Limit Function: a customer supplied external signal commanded over the BAS (0-100%) that limits the number of compressors that are available to be staged in order to limit electrical consumption of the central chiller plant.

Run Time Equalization

A run time equalization feature can be enabled or disabled. Run time is per unit module, and is the combined run time of both compressors in the unit. If the run time equalization feature is enabled, when an additional unit module is needed for increased capacity, the next compressor call will be issued to the unit with the lowest run time of the inactive unit modules. In the event of a lock-out fault on a compressor, the staging algorithm will bypass that unit module and use the one with the next lowest run time. Units with faulted compressors will be placed at the back of the line in the sequencing order. This will still allow single compressor operation if one of the two compressors is disabled.

System Notifications and Failure Alarms

The supervisory controller monitors the operation of each unit module within the chiller plant, but also monitors a number of system functions in order to provide notification and or alarms over the BAS.

Scheduled Maintenance Notification: General system notification based upon accumulated run hours.

Sensor Failure Alarm: Controlling water temperature sensor failure shuts down system and initiates alarm. All other sensors will only initiate an alarm.

High Condenser Temperature Alarm: Adjustable alarm point based upon entering condenser/net energy water loop temperature at chiller.

Low Evaporator Temperature Alarm: Adjustable alarm point based upon leaving chilled water temperature at chiller.

Remote Stop Alarm: Alarm that the chiller plant operation has been halted by a BAS command.

Emergency Stop Alarm: Provides notification that the operation of a single unit module has been halted as a result of an operator depressing the unit’s emergency shut down push button. Can be configured, by a factory technician at the time of system commissioning, to halt entire system operation and initiate alarm in the event that a single unit module’s emergency shut down push button has been depressed.

Refrigerant Monitor Alarm (Field Provided and Wired): Upon receiving an input from a refrigerant monitor, the entire system operation is halted and initiates an additional system alarm.
System Network Inputs

**Cooling Mode**
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Cooling”)
- Chilled Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Chilled Water Temperature Reset (optional)
- Load Limiting Status (optional)
- Remote Plant Shutdown (optional)

**Heating Mode**
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Heating”)
- Hot Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Hot Water Temperature Reset (optional)
- Load Limiting Status (optional)
- Remote Plant Shutdown (optional)

System Control Outputs

The Niagara Direct Input Output Module features digital and analog outputs to provide control of relays and speed reference outputs on VFDs or positioning outputs on modulating actuators.

**Cooling Mode**
- Alarm Relay/Annunciator (optional)
- Remote Chilled Water Pump Speed Reference
- Chilled Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*
  *Field installed in bypass header assembly if system configured for water bypass

**Heating Mode**
- Alarm Relay/Annunciator (optional)
- Remote Hot Water Pump Speed Reference
- Hot Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*
  *Field installed in bypass header assembly if system configured for water bypass
System Network Outputs

Cooling Mode
- Entering Chilled Water Temperature
- Leaving Chilled Water Temperature
- Estimated Chilled Water Flow Rate
- Chilled Water Bypass Valve Position*
- Estimated Chilled Water Plant Load
- Entering Source/Net Energy Water Loop Temperature
- Leaving Source/Net Energy Water Loop Temperature
- Estimated Source/Net Energy Water Flow Rate
- Source/Net Energy Water Bypass Valve Position*
- Estimated Source/Net Energy Water Plant Load
- Active Module(s)
- Active Compressor(s)
- Active System and Unit Module Alarm(s)
  *Field installed in bypass header assembly if system configured for water bypass

Heating Mode
- Entering Hot Water Temperature
- Leaving Hot Water Temperature
- Estimated Hot Water Flow Rate
- Hot Water Bypass Valve Position*
- Estimated Hot Water Plant Load
- Entering Source/Net Energy Water Loop Temperature
- Leaving Source/Net Energy Water Loop Temperature
- Estimated Source/Net Energy Water Flow Rate
- Source/Net Energy Water Bypass Valve Position*
- Estimated Source/Net Energy Water Plant Load
- Active Module(s)
- Active Compressor(s)
- Active System and Unit Module Alarm(s)
  *Field installed in bypass header assembly if system configured for water bypass
Application Example:

*Four Pipe Standard Header Rack with Fixed Capacity Scroll*

*Reversible Chiller*
The operation of this system allows it to be applied in a wide range of two pipe hydronic systems where the system changeover between cooling and heating is controlled through the Building Automation System (BAS). Because this system utilizes refrigerant reversing valves within the reversible chiller, water is not mixed within the header rack.

**Cooling** operation based on a chilled water temperature set point with the source connected to a Net Energy Water Loop to reject the heat of compression. Upon sensing that the leaving chilled water temperature has risen above the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving chilled water temperature in the header rack.

An optional field provided and installed chilled water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed chilled water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging. The temperature sensor located in the chilled water temperature header rack will be ignored for control, but will be monitored.

During **Heating** operation, the refrigerant reversing valve is energized so that the flow of refrigerant changes within the unit module in order to produce hot water. Upon sensing that the leaving hot water temperature has dropped below the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving hot water temperature in the header rack.

An optional field provided and installed hot water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed hot water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging. The temperature sensor located in the hot water temperature header rack will be ignored for control, but will be monitored.
Controller Configuration

The communications links (RS-485 and Ethernet) may be field configured for setting an address, device instance and baud rate where applicable. The staging can be scaled in the field to support 2 to 10 stages of compressor capacity. The run time equalization feature may be enabled or disabled in the field.

Operator Functions

The local display will support multiple access level users to allow read-only, Building User/Owner, and factory admin-level access. The Building User/Owner will be able to adjust the operating temperature set point, “enable/disable the system, reset lockout alarms, and view detailed unit summaries.

Water Control

One of the primary functions of the supervisory controller is to manage the water flow through the modular chiller plant to maintain efficient system water circulation. When the system is enabled, the 2-way water isolation valve on a single specified unit module will be commanded open so that the water can circulate. When the staging algorithm starts the first unit module in the sequence, then the isolation valve that was opened for circulation will be allowed to close again and will remain closed until the associated unit is commanded on or until all other isolation valves have closed—provided that the System Enable command is still ON.

Optional Bypass Control: The optional bypass control is available to prevent dead heading of the system water circulating pumps in a variable volume system when all of the unit modules water control valves are closed and is recommended for use with all piping header racks. When the system is enabled, the 2-way water bypass valve will be commanded open so that the water can circulate through the bypass. When the staging algorithm starts the first unit module in the sequence, then the bypass valve that was opened for circulation will be allowed to close again and will remain closed until all other unit module isolation valves have closed.
Temperature Control

Another primary function of the supervisory controller is to provide control of the water temperature by staging on or off the compressors in the array of chillers based upon the commanded temperature set point communicated over the BAS. The compressor staging PID algorithm compares the chiller plant leaving water temperature*, trending over an adjustable time period, to the commanded water temperature set point in order to determine system demand. The sequencing logic will respond to changes in the system demand by initiating or terminating compressor “enable” or “disable” commands to the unit module(s). If the demand is increasing and crosses the threshold for starting another compressor, the sequencing logic will select and enable the unit module with the least amount of accumulated compressor run time and then issue an “enable” command to the compressor with the lowest run time. In the event that a unit module is already operating a lead compressor, the controller will issue an “enable” command to the lag compressor of that unit module. As the system demand decreases and crosses the threshold for halting compressor operation, the sequencing logic will issue a “disable” command to the compressor with the highest run time.

* Optional entering water temperature control available as an engineering special; contact factory.

Chilled Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the chilled water temperature set point higher from 0 - 10°F to maximize plant efficiency.

Hot Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the hot water temperature set point lower from 0 - 10°F to maximize plant efficiency.

Load Limit Function: a customer supplied external signal commanded over the BAS (0-100%) that limits the number of compressors that are available to be staged in order to limit electrical consumption of the central chiller plant.

Run Time Equalization

A run time equalization feature can be enabled or disabled. Run time is per unit module, and is the combined run time of both compressors in the unit. If the run time equalization feature is enabled, when an additional unit module is needed for increased capacity, the next compressor call will be issued to the unit with the lowest run time of the inactive unit modules. In the event of a lock-out fault on a compressor, the staging algorithm will bypass that unit module and use the one with the next lowest run time. Units with faulted compressors will be placed at the back of the line in the sequencing order. This will still allow single compressor operation if one of the two compressors is disabled.

System Notifications and Failure Alarms

The supervisory controller monitors the operation of each unit module within the chiller plant, but also monitors a number of system functions in order to provide notification and or alarms over the BAS.

Scheduled Maintenance Notification: General system notification based upon accumulated run hours.

Sensor Failure Alarm: Controlling water temperature sensor failure shuts down system and initiates alarm. All other sensors will only initiate an alarm.

High Condenser Temperature Alarm: Adjustable alarm point based upon entering condenser/net energy water loop temperature at chiller.

Low Evaporator Temperature Alarm: Adjustable alarm point based upon leaving chilled water temperature at chiller.

Remote Stop Alarm: Alarm that the chiller plant operation has been halted by a BAS command.

Emergency Stop Alarm: Provides notification that the operation of a single unit module has been halted as a result of an operator depressing the unit’s emergency shut down push button. Can be configured, by a factory technician at the time of system commissioning, to halt entire system operation and initiate alarm in the event that a single unit module’s emergency shut down push button has been depressed.

Refrigerant Monitor Alarm (Field Provided and Wired): Upon receiving an input from a refrigerant monitor, the entire system operation is halted and initiates an additional system alarm.
Control Inputs and Outputs:
*Four Pipe Standard Header Rack with Fixed Capacity Scroll Reversible Chiller*

**System Network Inputs**

**Cooling Mode**
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Cooling”)
- Chilled Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Chilled Water Temperature Reset (optional)
- Load Limiting Status (optional)
- Remote Plant Shutdown (optional)

**Heating Mode**
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Heating”)
- Hot Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Hot Water Temperature Reset (optional)
- Load Limiting Status (optional)
- Remote Plant Shutdown (optional)

**System Control Outputs**

The Niagara Direct Input Output Module features digital and analog outputs to provide control of relays and speed reference outputs on VFDs or positioning outputs on modulating actuators.

**Cooling Mode**
- Alarm Relay/Annunciator (optional)
- Remote Chilled Water Pump Speed Reference
- Chilled Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*
  *Field installed in bypass header assembly if system configured for water bypass

**Heating Mode**
- Alarm Relay/Annunciator (optional)
- Remote Hot Water Pump Speed Reference
- Hot Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*
  *Field installed in bypass header assembly if system configured for water bypass
Control Inputs and Outputs:
*Four Pipe Standard Header Rack with Fixed Capacity Scroll Reversible Chiller*

System Network Outputs

**Cooling Mode**
- Entering Chilled Water Temperature
- Leaving Chilled Water Temperature
- Estimated Chilled Water Flow Rate
- Chilled Water Bypass Valve Position*
- Estimated Chilled Water Plant Load
- Entering Source/Net Energy Water Loop Temperature
- Leaving Source/Net Energy Water Loop Temperature
- Estimated Source/Net Energy Water Flow Rate
- Source/Net Energy Water Bypass Valve Position*
- Estimated Source/Net Energy Water Plant Load
- Active Module(s)
- Active Compressor(s)
- Active System and Unit Module Alarm(s)
  *Field installed in bypass header assembly if system configured for water bypass*

**Heating Mode**
- Entering Hot Water Temperature
- Leaving Hot Water Temperature
- Estimated Hot Water Flow Rate
- Hot Water Bypass Valve Position*
- Estimated Hot Water Plant Load
- Entering Source/Net Energy Water Loop Temperature
- Leaving Source/Net Energy Water Loop Temperature
- Estimated Source/Net Energy Water Flow Rate
- Source/Net Energy Water Bypass Valve Position*
- Estimated Source/Net Energy Water Plant Load
- Active Module(s)
- Active Compressor(s)
- Active System and Unit Module Alarm(s)
  *Field installed in bypass header assembly if system configured for water bypass*
Application Example:
Six Pipe Dedicated Header Rack with Reversible Chiller
The operation of this system allows it to be applied in a wide range of two pipe hydronic systems where the system change over between cooling and heating is controlled through the Building Automation System (BAS). Because this system utilizes refrigerant reversing valves within the reversible chiller, water is not mixed within the header rack.

**Cooling** operation is based upon a chilled water temperature set point with the chillers load heat exchanger fully opened to the chilled water piping and its source (condenser) heat exchanger fully open to the Net Energy Water Loop piping to reject the heat of compression. Upon sensing that the leaving chilled water temperature has risen above the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving chilled water temperature in the header rack.

An optional field provided and installed chilled water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed chilled water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging. The temperature sensor located in the chilled water temperature header rack will be ignored for control, but will be monitored.

**Heating** operation is based upon a hot water temperature set point with the chillers load heat exchanger fully opened to the hot water piping and its source (evaporator) heat exchanger fully open to the Net Energy Water Loop piping to extract heat. Upon sensing that the leaving hot water temperature has dropped below the set point plus dead band value, the refrigerant reversing valves of the first unit module are energized to place the unit into the heating operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving hot water temperature in the header rack.

An optional field provided and installed hot water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed hot water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging. The temperature sensor located in the hot water temperature header rack will be ignored for control, but will be monitored.
Controller Configuration

The communications links (RS-485 and Ethernet) may be field configured for setting an address, device instance and baud rate where applicable. The staging can be scaled in the field to support 2 to 10 stages of compressor capacity. The run time equalization feature may be enabled or disabled in the field.

Operator Functions

The local display will support multiple access level users to allow read-only, Building User/Owner, and factory admin-level access. The Building User/Owner will be able to adjust the operating temperature set point, enable/disable the system, reset lockout alarms, and view detailed unit summaries.

Water Control

One of the primary functions of the supervisory controller is to manage the water flow through the modular chiller plant to maintain efficient system water circulation. When the system is enabled, the 2-way water isolation valve on a single specified unit module will be commanded open so that the water can circulate. When the staging algorithm starts the first unit module in the sequence, then the isolation valve that was opened for circulation will be allowed to close again and will remain closed until the associated unit is commanded on or until all other isolation valves have closed—provided that the System Enable command is still ON.

Optional Bypass Control: The optional bypass control is available to prevent dead heading of the system water circulating pumps in a variable volume system when all of the unit modules water control valves are closed and is recommended for use with all piping header racks. When the system is enabled, the 2-way water bypass valve will be commanded open so that the water can circulate through the bypass. When the staging algorithm starts the first unit module in the sequence, then the bypass valve that was opened for circulation will be allowed to close again and will remain closed until all other unit module isolation valves have closed.
Temperature Control

Another primary function of the supervisory controller is to provide control of the water temperature by staging on or off the compressors in the array of chillers based upon the commanded temperature set point communicated over the BAS. The compressor staging PID algorithm compares the chiller plant leaving water temperature*, trending over an adjustable time period, to the commanded water temperature set point in order to determine system demand. The sequencing logic will respond to changes in the system demand by initiating or terminating compressor “enable” or “disable” commands to the unit module(s). If the demand is increasing and crosses the threshold for starting another compressor, the sequencing logic will select and enable the unit module with the least amount of accumulated compressor run time and then issue an “enable” command to the compressor with the lowest run time. In the event that a unit module is already operating a lead compressor, the controller will issue an “enable” command to the lag compressor of that unit module. As the system demand decreases and crosses the threshold for halting compressor operation, the sequencing logic will issue a “disable” command to the compressor with the highest run time.

* Optional entering water temperature control available as an engineering special; contact factory.

Chilled Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the chilled water temperature set point higher from 0 - 10°F to maximize plant efficiency.

Hot Water Reset Function: a customer supplied external signal commanded over the BAS that shifts the hot water temperature set point lower from 0 - 10°F to maximize plant efficiency.

Load Limit Function: a customer supplied external signal commanded over the BAS (0-100%) that limits the number of compressors that are available to be staged in order to limit electrical consumption of the central chiller plant.

Run Time Equalization

A run time equalization feature can be enabled or disabled. Run time is per unit module, and is the combined run time of both compressors in the unit. If the run time equalization feature is enabled, when an additional unit module is needed for increased capacity, the next compressor call will be issued to the unit with the lowest run time of the inactive unit modules. In the event of a lock-out fault on a compressor, the staging algorithm will bypass that unit module and use the one with the next lowest run time. Units with faulted compressors will be placed at the back of the line in the sequencing order. This will still allow single compressor operation if one of the two compressors is disabled.

System Notifications and Failure Alarms

The supervisory controller monitors the operation of each unit module within the chiller plant, but also monitors a number of system functions in order to provide notification and or alarms over the BAS.

Scheduled Maintenance Notification: General system notification based upon accumulated run hours.

Sensor Failure Alarm: Controlling water temperature sensor failure shuts down system and initiates alarm. All other sensors will only initiate an alarm.

High Condenser Temperature Alarm: Adjustable alarm point based upon entering condenser/net energy water loop temperature at chiller.

Low Evaporator Temperature Alarm: Adjustable alarm point based upon leaving chilled water temperature at chiller.

Remote Stop Alarm: Alarm that the chiller plant operation has been halted by a BAS command.

Emergency Stop Alarm: Provides notification that the operation of a single unit module has been halted as a result of an operator depressing the unit’s emergency shut down push button. Can be configured, by a factory technician at the time of system commissioning, to halt entire system operation and initiate alarm in the event that a single unit module’s emergency shut down push button has been depressed.

Refrigerant Monitor Alarm (Field Provided and Wired): Upon receiving an input from a refrigerant monitor, the entire system operation is halted and initiates an additional system alarm.
Control Inputs and Outputs:
Six Pipe Dedicated Header Rack with Reversible Chiller

System Network Inputs

Six Pipe Header Rack Configuration
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Cooling” or “Heating”)
- Chilled Water Temperature Set Point
- Hot Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Chilled Water Temperature Reset (optional)
- Hot Water Temperature Reset (optional)
- Load Limiting Status (optional – applies equally to cooling & heating)
- Remote Plant Shutdown (optional)
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)

System Control Outputs

Six Pipe Header Rack Configuration
- Alarm Relay/Annunciator (optional)
- Remote Chilled Water Pump Speed Reference
- Chilled Water Bypass Valve*
- Remote Hot Water Pump Speed Reference
- Hot Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*

*Field installed in bypass header assembly if system configured for water bypass
Control Inputs and Outputs:
*Six Pipe Dedicated Header Rack with Reversible Chiller*

**System Network Outputs**

*Six Pipe Header Rack Configuration*
- Entering Chilled Water Temperature
- Leaving Chilled Water Temperature
- Estimated Chilled Water Flow Rate
- Chilled Water Bypass Valve Position*
- Estimated Chilled Water Plant Load
- Entering Hot Water Temperature
- Leaving Hot Water Temperature
- Estimated Hot Water Flow Rate
- Hot Water Bypass Valve Position*
- Estimated Hot Water Plant Load
- Entering Source/Net Energy Water Loop Temperature
- Leaving Source/Net Energy Water Loop Temperature
- Estimated Source/Net Energy Water Flow Rate
- Source/Net Energy Water Bypass Valve Position*
- Estimated Source/Net Energy Water Plant Load
- Active Module(s)
- Active Compressor(s)
- Active System and Unit Module Alarm(s)

*Field installed in bypass header assembly if system configured for water bypass*
Application Example:
Six Pipe Standard Header Rack with Fixed Capacity Scroll
Dedicated Chiller
The operation of this system allows it to be applied in a wide range of four pipe hydronic systems where the system change over between cooling and heating can be controlled either through the Building Automation System (BAS) or allowed to operate as a heat recovery chiller utilizing the units Aurora HydroLink controls. This system utilizes the three way water control valves within the header rack to reverse the water flow through the evaporator, condenser and Net Energy Water Loop which allows water to be mixed within the system.

**Primary Cooling** operation is based upon a chilled water temperature set point with the chillers evaporator fully opened to the chilled water piping and its condenser fully open to the hot water piping to reject the heat of compression. Upon sensing that the leaving chilled water temperature has risen above the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving chilled water temperature in the header rack. In Primary Cooling mode the three-way water valve will modulate the condenser water between the hot water piping and the Net Energy Water Loop in order to maintain the hot water temperature set point.

An optional field provided and installed chilled water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed chilled water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging. The temperature sensor located in the chilled water temperature header rack will be ignored for control, but will be monitored.
Primary Heating operation is based upon a hot water temperature set point with the chillers evaporator fully opened to the chilled water piping and its condenser fully open to the hot water piping to reject the heat of compression. Upon sensing that the leaving hot water temperature has dropped below the set point plus dead band value, the first unit module is placed into operational mode. The first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control begins to stage “up” or “down” based upon the leaving hot water temperature in the header rack. In Primary Heating mode the three-way water valve will modulate the evaporator water between the chilled water piping and the Net Energy Water Loop in order to maintain the chilled water temperature set point.

An optional field provided and installed hot water storage tank may be used in applications that require additional water volume due to the system piping. In this case, a field installed hot water temperature sensor is installed in the storage tank to control the modular chiller’s compressor staging. The temperature sensor located in the hot water temperature header rack will be ignored for control, but will be monitored.

The standard operational mode for the supervisory controller is Full Building Auto which is utilized to determine which of the two loads, cooling or heating, is greater to establish a Primary mode. In this mode, the three-way water valves are positioned such that the chillers evaporator is fully open to the chilled water piping and the condenser is fully open to the hot water piping. When the system is enabled, the unit module with the least amount of accumulated run time will be placed into Full Building Auto mode. Upon sensing that a chilled or hot water temperature has changed beyond one of the respective temperature set point plus dead band value, the first stage compressor enable command is provided after a 90 second delay allowing the internal motorized water valve to fully open. The compressor Proportional Integral & Differential (PID) control will stage “up” subsequent compressors and unit modules until the lesser of the two loads temperature set point is satisfied at which point the three-way water valve will modulate open to the Net Energy Water Loop to prevent “over shooting” the set point. It is at this time that the modular supervisory controller will place all of the unit modules into a Primary (either cooling or heating) mode of operation until the larger of the two loads temperature set point is satisfied. Once both temperature set points have been satisfied, the modular supervisory controller then returns all of the unit modules to Full Building Auto.

Economizer is a unique operational mode exclusively available to the six pipe standard header rack. When enabled, the first stage of cooling will be supplied by the Net Energy Water Loop so long as the temperature is at or below the chilled water temperature set point. Upon sensing that the leaving chilled water temperature has risen above the set point plus dead band value, the unit module with the least amount of accumulated run time will be placed into operational mode. The three-way water valves to the chillers evaporator will be fully opened between the chilled water and Net Energy Water Loop piping after a 90 second delay allowing the units internal motorized water valve to fully open. The economizer Proportional Integral & Differential (PID) control will modulate the three-way water valves proportionally as well as enable additional unit modules economizer mode to maintain the chilled water temperature set point. When mechanical cooling is required, the modular supervisory controller will return all of the unit modules to Full Building Auto.

Cooling Only operation is based upon a chilled water temperature set point with the chillers evaporator fully opened to the chilled water piping and its condenser fully open to the Net Energy Water Loop to reject the heat of compression. This commanded mode disables all other operational modes and only delivers cooling.

Heating Only operation is based upon a hot water temperature set point with the chillers evaporator fully opened to the Net Energy Water Loop and its condenser fully open to the hot water piping to reject the heat of compression. This commanded mode disables all other operational modes and only delivers heating.
Controller Configuration

The communications links (RS-485 and Ethernet) may be field configured for setting an address, device instance and baud rate where applicable. The staging can be scaled in the field to support 2 to 10 stages of compressor capacity. The run time equalization feature may be enabled or disabled in the field.

Operator Functions

The local display will support multiple access level users to allow read-only, Building User/Owner, and factory admin-level access. The Building User/Owner will be able to adjust the operating temperature set point, enable/disable the system, reset lockout alarms, and view detailed unit summaries.

Water Control

One of the primary functions of the supervisory controller is to manage the water flow through the modular chiller plant to maintain efficient system water circulation. When the system is enabled, the 2-way water isolation valve on a single specified unit module will be commanded open so that the water can circulate. When the staging algorithm starts the first unit module in the sequence, then the isolation valve that was opened for circulation will be allowed to close again and will remain closed until the associated unit is commanded on or until all other isolation valves have closed—provided that the System Enable command is still ON.

**Bypass Control:** The bypass control is to prevent dead heading of the system water circulating pumps in a variable volume system when all of the unit modules water control valves are closed and is required for use with all six pipe standard header racks. When the system is enabled, the 2-way water bypass valve will be commanded open so that the water can circulate through the bypass. When the staging algorithm starts the first unit module in the sequence, then the bypass valve that was opened for circulation will be allowed to close again and will remain closed until all other unit module isolation valves have closed.
**Temperature Control**

Another primary function of the supervisory controller is to provide control of the water temperature by staging on or off the compressors in the array of chillers based upon the commanded temperature set point communicated over the BAS. The compressor staging PID algorithm compares the chiller plant leaving water temperature*, trending over an adjustable time period, to the commanded water temperature set point in order to determine system demand. The sequencing logic will respond to changes in the system demand by initiating or terminating compressor “enable” or “disable” commands to the unit module(s). If the demand is increasing and crosses the threshold for starting another compressor, the sequencing logic will select and enable the unit module with the least amount of accumulated compressor run time and then issue an “enable” command to the compressor with the lowest run time. In the event that a unit module is already operating a lead compressor, the controller will issue an “enable” command to the lag compressor of that unit module. As the system demand decreases and crosses the threshold for halting compressor operation, the sequencing logic will issue a “disable” command to the compressor with the highest run time.

* Optional entering water temperature control available as an engineering special; contact factory.

**Chilled Water Reset Function:** a customer supplied external signal commanded over the BAS that shifts the chilled water temperature set point higher from 0 - 10°F to maximize plant efficiency.

**Hot Water Reset Function:** a customer supplied external signal commanded over the BAS that shifts the hot water temperature set point lower from 0 - 10°F to maximize plant efficiency.

**Load Limit Function:** a customer supplied external signal commanded over the BAS (0-100%) that limits the number of compressors that are available to be staged in order to limit electrical consumption of the central chiller plant.

**Run Time Equalization**

A run time equalization feature can be enabled or disabled. Run time is per unit module, and is the combined run time of both compressors in the unit. If the run time equalization feature is enabled, when an additional unit module is needed for increased capacity, the next compressor call will be issued to the unit with the lowest run time of the inactive unit modules. In the event of a lock-out fault on a compressor, the staging algorithm will bypass that unit module and use the one with the next lowest run time. Units with faulted compressors will be placed at the back of the line in the sequencing order. This will still allow single compressor operation if one of the two compressors is disabled.

**System Notifications and Failure Alarms**

The supervisory controller monitors the operation of each unit module within the chiller plant, but also monitors a number of system functions in order to provide notification and or alarms over the BAS.

**Scheduled Maintenance Notification:** General system notification based upon accumulated run hours.

**Sensor Failure Alarm:** Controlling water temperature sensor failure shuts down system and initiates alarm. All other sensors will only initiate an alarm.

**High Condenser Temperature Alarm:** Adjustable alarm point based upon entering condenser/net energy water loop temperature at chiller.

**Low Evaporator Temperature Alarm:** Adjustable alarm point based upon leaving chilled water temperature at chiller.

**Remote Stop Alarm:** Alarm that the chiller plant operation has been halted by a BAS command.

**Emergency Stop Alarm:** Provides notification that the operation of a single unit module has been halted as a result of an operator depressing the unit’s emergency shut down push button. Can be configured, by a factory technician at the time of system commissioning, to halt entire system operation and initiate alarm in the event that a single unit module’s emergency shut down push button has been depressed.

**Refrigerant Monitor Alarm (Field Provided and Wired):** Upon receiving an input from a refrigerant monitor, the entire system operation is halted and initiates an additional system alarm.
Control Inputs and Outputs:
Six Pipe Standard Header Rack with Fixed Capacity Scroll Dedicated Chiller

System Network Inputs

Six Pipe Header Rack Configuration
- “Hand/Off/Auto” Selection
- Plant “Enable”/“Disable” Command
- Plant Mode Command (“Primary Cooling” / “Primary Heating” / “Full Building Auto”)
- Chilled Water Temperature Set Point
- Hot Water Temperature Set Point
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)
- Chilled Water Temperature Reset (optional)
- Hot Water Temperature Reset (optional)
- Load Limiting Status (optional – applies equally to cooling & heating)
- Remote Plant Shutdown (optional)
- Differential Water Pressure Set Points (optional: chilled water/source/net energy water)

System Control Outputs

Six Pipe Header Rack Configuration
- Alarm Relay/Annunciator (optional)
- Remote Chilled Water Pump Speed Reference
- Chilled Water Bypass Valve*
- Remote Hot Water Pump Speed Reference
- Hot Water Bypass Valve*
- Remote Source/Net Energy Water Pump Speed Reference
- Source/Net Energy Water Bypass Valve*

*Field installed in bypass header assembly

System Network Outputs

Six Pipe Header Rack Configuration
- Entering Chilled Water Temperature
- Leaving Chilled Water Temperature
- Estimated Chilled Water Flow Rate
- Chilled Water Bypass Valve Position*
- Estimated Chilled Water Plant Load
- Entering Hot Water Temperature
- Leaving Hot Water Temperature
- Estimated Hot Water Flow Rate
- Hot Water Bypass Valve Position*
- Estimated Hot Water Plant Load
- Entering Source/Net Energy Water Loop Temperature
- Leaving Source/Net Energy Water Loop Temperature
- Estimated Source/Net Energy Water Flow Rate
- Source/Net Energy Water Bypass Valve Position*
- Estimated Source/Net Energy Water Plant Load
- Active Module(s)
- Active Compressor(s)
- Active System and Unit Module Alarm(s)

*Field installed in bypass header assembly
HydroLink2 Aurora Control Codes

Unit Status

1 = Normal
2 = Alarm
3 = Shutdown
4 = Load Shed A
5 = Load Shed B
6 = Load Shed A & B
7 = AXB A Communication Loss
8 = AXB B Communication Loss
9 = AXB A & B Communication Loss
10 = ABC A Communication Loss
11 = ABC B Communication Loss
12 = ABC A & B Communication Loss
13 = ABC A & ABC B DIP Switch Mismatch
14 = Load Entering Water Temperature Alarm
15 = Load Leaving Water Temperature Alarm
16 = Source Entering Water Temperature Alarm
17 = Source Leaving Water Temperature Alarm

Compressor Fault Status

1 = Normal
2 = E1-Input Error
3 = E2-High Pressure
4 = E3-Low Pressure
5 = E4-Freeze Protection 2
6 = E5-Freeze Protection 1
7 = E6-Loss of Charge
8 = E7-Condensate
9 = E8-Over/Under Voltage
11 = E10-Compressor Monitor
14 = E13-AXB Sensor Error - Non Critical
15 = E14-AXB Sensor Error - Critical
17 = E16-Variable Speed Pump Error
19 = E18-Non Critical Comm Error
20 = E19-Critical Comm Error
21 = E20-Loss of Communications
22 = E21-Low Loop Pressure
24 = E23-HA1 Fault
25 = E24-HA2 Fault
27 = E26-Entering Source Water Low Limit
28 = E27-Entering Source Water High Limit
29 = E28-Leaving Source Water Low Limit
30 = E29-Leaving Source Water High Limit
32 = E31-Source Flow
33 = E32-Load Flow
HMI Reloading/Rebooting Procedure

The following document should be referenced if the HydroLink 2 HMI tablets do not connect and communicate properly to the HydroLink 2 Controllers. This will guide you through the process of reconfiguring the router and the HMI.

1. Power on the tablet by pressing and holding the power button until the tablet turns on.
2. If the tablet connects to the HydroLink 2 Supervisory Controller, the following steps should be skipped. If it does not connect, the following screens may be displayed.

Fails to connect to wireless access point

1. Make sure the switch on the bottom of the router is set to “AP-Router”.
2. Make sure the Micro SD card is inserted into the tablet.
   a. *Do not proceed if Micro SD Card is not inserted.
3. Swiping up from the bottom of the screen will make a tool bar appear at the bottom of the screen, use the “ ” button to navigate to the tablets home page.
   a. Press the Apps button on the home page to navigate to the Apps page.
   b. On the Apps page, locate the HydroLink 2 app and press and hold the icon until it can be uninstalled by moving it to the trash can on the top of the page, and confirm the uninstall.
   c. Follow the same steps to uninstall the 123Go app if it is installed on the tablet.
   d. Return to the Home page.
4. From the home screen press the File manager Icon and navigate to the following location:

5. Installing Applications
   a. Select “File Manager” from the home screen.
   b. Select “SD Card”
   c. Select “HydroLink 2”
   d. Select 123GOXX-XX.apk. The XX-XX is the version number ex. 01-00.
      i. When popup appears select “NEXT”, then select “INSTALL”.
      ii. Once the install is complete, select “OPEN”.
HMI Reloading/Rebooting Procedure cont.

6. Router Setup will begin automatically.
   a. Follow on-screen prompts for Router Setup.
      i. Once the tablet is connected to the router, the Factory Initialization screen will be displayed.
      ii. Wait for HMI popup.
         1. Select “NEXT”
         2. Select “INSTALL”
         3. Select “ACCEPT”
         4. Once App is installed select “DONE”
      iii. Doc View popup
         1. Select “INSTALL”
         2. Select “DONE”
         3. Screen should turn green
         4. Touch anywhere on the green screen.
         5. The 123 Go prompt will appear asking if you want to uninstall.
         6. Select “OK”
         7. Once finished press at “ at the bottom of screen to return to the HOME Screen

7. Setup Tablets Home Screen
   a. Press the Apps button that is in the bottom center of the screen. The apps button is a round white button with six dots.
   b. Locate the “Doc View” icon. Press and hold the “Doc View” icon until the home screen and drop the icon onto the home screen.
   c. Repeat this process with the “HMI” app.
   d. Leave the File Manager icon on the home screen.

8. Start the HMI App by pressing it one time.
### System Points

<table>
<thead>
<tr>
<th>ID</th>
<th>Object ID</th>
<th>Object Name</th>
<th>Read/Write</th>
<th>Default Value</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MSV</td>
<td>SYS_SystemMode</td>
<td>R/W</td>
<td>Cooling Only</td>
<td>-</td>
<td>Selection of current operating mode for both header rack and non-header rack applications.</td>
</tr>
<tr>
<td>1</td>
<td>BV</td>
<td>SYS_SystemEnable</td>
<td>R/W</td>
<td>Disable</td>
<td>-</td>
<td>Allows supervisor to enable/disable units according to runtime &amp; capacity. Enables (True) or Disables (False) system operation. When this setting is disabled the compressor outputs will not be activated except for manual override operation.</td>
</tr>
<tr>
<td>2</td>
<td>BV</td>
<td>SYS_EmShutdown</td>
<td>R/W</td>
<td>Normal</td>
<td>-</td>
<td>Enable (True) or Disable (False) Emergency Shutdown.</td>
</tr>
<tr>
<td>3</td>
<td>BV</td>
<td>SYS_SystemMaintenance</td>
<td>R</td>
<td>Normal</td>
<td>-</td>
<td>Provides an alarm that will trigger every 90 calendar days, to remind owner to check and clean strainers. This requires a hard reset from the HMI.</td>
</tr>
<tr>
<td>4</td>
<td>BV</td>
<td>SYS_TempSensorFailure</td>
<td>R</td>
<td>Normal</td>
<td>-</td>
<td>Provides an alarm if any header rack temperature sensor be out of range or offline. (True(Alarm) if sensor out of range and False(Normal) if sensors are within range)</td>
</tr>
<tr>
<td>5</td>
<td>BV</td>
<td>SYS_HighHeaderTemp</td>
<td>R</td>
<td>Normal</td>
<td>-</td>
<td>This point will monitor the entering header fluid temperature. True (Alarm) if sensor out of range and temp is too HIGH, and a False (Normal) if sensors are within range.</td>
</tr>
<tr>
<td>6</td>
<td>BV</td>
<td>SYS_LowHeaderTemp</td>
<td>R</td>
<td>Normal</td>
<td>-</td>
<td>This point will monitor the entering header fluid temperature. True (Alarm) if sensor out of range and temp is too LOW, and a False (Normal)</td>
</tr>
<tr>
<td>7</td>
<td>BV</td>
<td>SYS_CapacityLimit_Enable</td>
<td>R/W</td>
<td>Disable</td>
<td>-</td>
<td>This variable will activate and disable the Capacity Limit functions.</td>
</tr>
<tr>
<td>1</td>
<td>AV</td>
<td>SYS_ColdSetpoint</td>
<td>R/W</td>
<td>45</td>
<td>°F</td>
<td>Cooling set point used for system capacity control in cooling modes.</td>
</tr>
<tr>
<td>2</td>
<td>AV</td>
<td>SYS_HotSetpoint</td>
<td>R/W</td>
<td>125</td>
<td>°F</td>
<td>Heating set point used for system capacity control in heating modes.</td>
</tr>
<tr>
<td>3</td>
<td>AV</td>
<td>SYS_HotSetpointReset</td>
<td>R/W</td>
<td>0</td>
<td>°F</td>
<td>Allows a reset value command ranging from [-6 to 6] to reset the system hotwater setpoint.</td>
</tr>
<tr>
<td>4</td>
<td>AV</td>
<td>SYS_ColdSetpointReset</td>
<td>R/W</td>
<td>0</td>
<td>°F</td>
<td>Allows a reset value command ranging from [-6 to 6] to reset the system coldwater setpoint.</td>
</tr>
<tr>
<td>5</td>
<td>AV</td>
<td>SYS_SystemCapacityLimit</td>
<td>R/W</td>
<td>-</td>
<td>%</td>
<td>This will limit the capacity of the system from 100% down to 20% (depending on number of units in system) by disabling Units allowed to run. Typically used to limit energy consumption during peak hours.</td>
</tr>
<tr>
<td>6</td>
<td>AV</td>
<td>SYS_ActiveCapacity</td>
<td>R</td>
<td>100</td>
<td>%</td>
<td>The percentage of units that are actively enabled and running.</td>
</tr>
<tr>
<td>7</td>
<td>AV</td>
<td>SYS_SystemTotalCurrent</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>Total amperage of operating compressors in the system.</td>
</tr>
<tr>
<td>8</td>
<td>AV</td>
<td>SYS_EffectiveColdSP</td>
<td>R</td>
<td>45</td>
<td>°F</td>
<td>A combination of the ColdSetpoint, and the ColdSetpointReset, used for system capacity control in cooling modes.</td>
</tr>
<tr>
<td>9</td>
<td>AV</td>
<td>SYS_EffectiveHotSP</td>
<td>R</td>
<td>125</td>
<td>°F</td>
<td>A combination of the HotSetpoint, and the HotSetpointReset, used for system capacity control in heating modes.</td>
</tr>
<tr>
<td>10</td>
<td>AV</td>
<td>SYS_SystemUnitCount</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>A total count of units that are piped together to make up (1) system for more system capacity control.</td>
</tr>
<tr>
<td>Object ID</td>
<td>Object Type</td>
<td>Object Name</td>
<td>Read / Write</td>
<td>Default Value</td>
<td>Units</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>--------------------------------------</td>
<td>--------------</td>
<td>---------------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>101</td>
<td>MSV</td>
<td>MSV Ch1_AlarStatus</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Displays the current overall unit fault status.</td>
</tr>
<tr>
<td>102</td>
<td>MSV</td>
<td>MSV Ch1_UnitStatus</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Displays the current overall unit operating status.</td>
</tr>
<tr>
<td>103</td>
<td>MSV</td>
<td>MSV Ch1_CompALockoutStatus</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Most recent fault detected by ABC A.</td>
</tr>
<tr>
<td>104</td>
<td>MSV</td>
<td>MSV Ch1_CompBLockoutStatus</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Most recent fault detected by ABC B.</td>
</tr>
<tr>
<td>101</td>
<td>BV</td>
<td>BV Ch1_EnableManualOverride</td>
<td>R</td>
<td>Off</td>
<td>-</td>
<td>Status of Local Manual Override at unit.</td>
</tr>
<tr>
<td>102</td>
<td>BV</td>
<td>BV Ch1_IsoValveStatus</td>
<td>R</td>
<td>Closed</td>
<td>-</td>
<td>Status of ABC A accessory relay output.</td>
</tr>
<tr>
<td>101</td>
<td>AV</td>
<td>AV Ch1_UnitRunTime</td>
<td>R</td>
<td>-</td>
<td>hr</td>
<td>Compressor A &amp; compressor B operating hours combined.</td>
</tr>
</tbody>
</table>

**Chiller 1 Points**

<table>
<thead>
<tr>
<th>Chiller 2</th>
<th>Analog Value = 201</th>
<th>Multi State Value = 201-204</th>
<th>Binary Value = 201-202</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiller 3</td>
<td>Analog Value = 301</td>
<td>Multi State Value = 301-304</td>
<td>Binary Value = 301-302</td>
</tr>
<tr>
<td>Chiller 4</td>
<td>Analog Value = 401</td>
<td>Multi State Value = 401-404</td>
<td>Binary Value = 401-402</td>
</tr>
<tr>
<td>Chiller 5</td>
<td>Analog Value = 501</td>
<td>Multi State Value = 501-504</td>
<td>Binary Value = 501-502</td>
</tr>
</tbody>
</table>

**Chiller 2 - 5 will all have the same points as Chiller 1.**

**Header Rack Onboard 34-IO**

<table>
<thead>
<tr>
<th>Object ID</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Read / Write</th>
<th>Default Value</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1101</td>
<td>AV</td>
<td>HDR_HotByPass_Vlv</td>
<td>R</td>
<td>-</td>
<td>%</td>
<td>Systems header rack hot/source water bypass valve. (Proportional with source/condenser 6pipe 3way valves).</td>
</tr>
<tr>
<td>1102</td>
<td>AV</td>
<td>HDR_ColdByPass_Vlv</td>
<td>R</td>
<td>-</td>
<td>%</td>
<td>Systems header rack cold/load water bypass valves. (Proportional with load/evaporator 6pipe 3way valves).</td>
</tr>
<tr>
<td>1103</td>
<td>AV</td>
<td>HDR_NetEnergyByPass_Vlv</td>
<td>R</td>
<td>-</td>
<td>%</td>
<td>Systems header rack geo water bypass valve. (Proportional with 6pipe 3way valves depending on mode).</td>
</tr>
<tr>
<td>1104</td>
<td>AV</td>
<td>HDR_SrcHotOutlet_Temp</td>
<td>R</td>
<td>-</td>
<td>°F</td>
<td>Systems header rack hot/source water outlet temperature.</td>
</tr>
<tr>
<td>1105</td>
<td>AV</td>
<td>HDR_SrcHotInlet_Temp</td>
<td>R</td>
<td>-</td>
<td>°F</td>
<td>Systems header rack hot/source water inlet temperature.</td>
</tr>
<tr>
<td>1106</td>
<td>AV</td>
<td>HDR_LoadColdOutlet_Temp</td>
<td>R</td>
<td>-</td>
<td>°F</td>
<td>Systems header rack cold/load water outlet temperature.</td>
</tr>
<tr>
<td>1107</td>
<td>AV</td>
<td>HDR_LoadColdInlet_Temp</td>
<td>R</td>
<td>-</td>
<td>°F</td>
<td>Systems header rack cold/load water inlet temperature.</td>
</tr>
<tr>
<td>1108</td>
<td>AV</td>
<td>HDR_NetEnergyOutlet_Temp</td>
<td>R</td>
<td>-</td>
<td>°F</td>
<td>Systems header rack geo water outlet temperature.</td>
</tr>
<tr>
<td>1109</td>
<td>AV</td>
<td>HDR_NetEnergyInlet_Temp</td>
<td>R</td>
<td>-</td>
<td>°F</td>
<td>Systems header rack geo water inlet temperature.</td>
</tr>
<tr>
<td>1101</td>
<td>BV</td>
<td>RefrigerantMonitorAlarm</td>
<td>R</td>
<td>Normal</td>
<td>-</td>
<td>Monitors the Refrigerant Leak Detection system (provided by others) and will send a True(Alarm)/False(Normal) alarm if triggered.</td>
</tr>
</tbody>
</table>

**TRUE FALSE**

State Text: TRUE FALSE

Chiller 2 and 3 will all have the same points as Chiller 1.
<table>
<thead>
<tr>
<th>Object ID</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Read / Write</th>
<th>Default Value</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>MSV-1</td>
<td>SYS_Mode</td>
<td>R/W</td>
<td></td>
<td>-</td>
<td>Possible values are: 1 = System Off- with Isolation valves open 2 = Cooling only - (Standard) 3 = Heating only - (Standard) 4 = Auto full building - (6-Pipe Header Rack) 5 = Full building - (Standard) 6 = Primary cooling - (6-Pipe Header Rack) 7 = Primary heating - (6-Pipe Header Rack) 8 = System Off- with Isolation valves closed</td>
</tr>
</tbody>
</table>
BACnet Pointslists cont.

<table>
<thead>
<tr>
<th>Object Name</th>
<th>Object Type</th>
<th>Object ID</th>
<th>Read</th>
<th>Write</th>
<th>Default Value</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Status</td>
<td>MSV</td>
<td>102</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td>Displays the current overall unit operating status. Possible values are:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>202</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Standby</td>
</tr>
<tr>
<td></td>
<td></td>
<td>302</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 = Single Compressor Cooling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>402</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 = Both Compressors Cooling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>502</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 = Single Compressor Heating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7 = Both Compressors Heating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10 = Emergency Shutdown</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11 = Load Shed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12 = Lockout A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13 = Test Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15 = Lockout B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18 = Single Compressor w/Lockout</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19 = Full Lockout</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31 = Source Flow Switch Fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32 = Load Flow Switch Fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>33 = Load &amp; Source Flow Switch Fault</td>
</tr>
</tbody>
</table>
## Compressor Lockout Status

<table>
<thead>
<tr>
<th>Object ID</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Read / Write</th>
<th>Default Value</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0</strong></td>
<td>****</td>
<td>ComplLockoutStatus</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>0</strong></td>
<td>****</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Most recent fault detected by ABC B. Possible values are:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 = E1-Input Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 = E2-High Pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 = E3-Low Pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 = E4-Freeze Protection 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 = E5-Freeze Protection 1</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>7 = E6-Loss of Charge</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>8 = E7-Condensate</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>9 = E8-Over/Under Voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11 = E10-Compressor Monitor</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>14 = E13-AXB Sensor Error - Non Critical</td>
</tr>
<tr>
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<td></td>
<td>15 = E14-AXB Sensor Error - Critical</td>
</tr>
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<td>17 = E16-Variable Speed Pump Error</td>
</tr>
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<td>19 = E18-Non Critical Comm Error</td>
</tr>
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<td>20 = E19-Critical Comm Error</td>
</tr>
<tr>
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<td></td>
<td>21 = E20-Loss of Communications</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>22 = E21-Low Loop Pressure</td>
</tr>
<tr>
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<td></td>
<td>24 = E23-HA1 Fault</td>
</tr>
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<td>25 = E24-HA2 Fault</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27 = E26-Entering Source Water Low Limit</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>28 = E27-Entering Source Water High Limit</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>29 = E28-Exiting Source Water Low Limit</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>30 = E29-Exiting Source Water High Limit</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>32 = E31-Source Flow</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>33 = E32-Load Flow</td>
</tr>
</tbody>
</table>

## System Capacity Limit

<table>
<thead>
<tr>
<th>Object ID</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Read / Write</th>
<th>Default Value</th>
<th>Units</th>
<th>System Capacity Limit Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>Chiller System</td>
<td></td>
<td></td>
<td></td>
<td>Capacity Limited</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Chiller System</td>
<td></td>
<td></td>
<td></td>
<td>Capacity Limited</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Chiller System</td>
<td></td>
<td></td>
<td></td>
<td>Capacity Limited</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Chiller System</td>
<td></td>
<td></td>
<td></td>
<td>Capacity Limited</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity Limited</th>
<th>1-Unit</th>
<th>2-Units</th>
<th>3-Units</th>
<th>4-Units</th>
<th>5-Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Unit</td>
<td>50%</td>
<td>33%</td>
<td>25%</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>2-Units</td>
<td>100%</td>
<td>66%</td>
<td>50%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>3-Units</td>
<td>-</td>
<td>100%</td>
<td>75%</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>4-Units</td>
<td>-</td>
<td>-</td>
<td>100%</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>5-Units</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
## Operating System Modes Based on Header Rack Selection

<table>
<thead>
<tr>
<th>Header Rack Configuration</th>
<th>Compressors Circuit Type</th>
<th>Control-To Temperature</th>
<th>Operating Modes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Select Chiller Type:</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 4 Pipe Standard</td>
<td>Non-Reversing Compressors</td>
<td>Hot/Cold</td>
<td>2,3,5</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>3 4 Pipe Reversing</td>
<td>Non-Reversing Compressors</td>
<td>Load</td>
<td>2,3,5</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>4 6 Pipe Standard</td>
<td>Non-Reversing Compressors</td>
<td>Hot/Cold</td>
<td>ALL</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5 6 Pipe Dedicated Source</td>
<td>Reversing Compressors</td>
<td>Hot/Cold</td>
<td>2,3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>6 4 Pipe Standard</td>
<td>Reversing Compressors</td>
<td>Load</td>
<td>2,3,5</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>7 No Header Rack</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

### System Mode Selection (BAS Mult-State Variable)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>(OFF) Iso Open</td>
<td>Cooling Only</td>
<td>Heating Only</td>
<td>(Auto) Full Building</td>
<td>Full Building</td>
<td>Primary Cooling</td>
<td>Primary Heating</td>
<td>(OFF) Iso Closed</td>
</tr>
</tbody>
</table>

**NOTE 1:** Header Rack (5) 6-Pipe Dedicated Source: Mode (4) & Mode (5) are Non-Applicable. If Mode (4) or (5) is selected, the unit will operate in Mode (1) OFF w/Iso Open.

**NOTE 2:** Header Rack (2), (3), & (6): Non-Applicable (NA). Modes selected will operate as stated below:

- **Mode (4)-Auto Full Building:** The system will operate in Mode (5)-Full Building. Units will modulate capacity to the Secondary load setpoint.
- **Mode (6)-Primary Cooling:** The system will operate in Mode (2)-Cooling Only. Units will modulate capacity to the Cold setpoint.
- **Mode (7)-Primary Heating:** The system will operate in Mode (3)-Heating Only. Units will modulate capacity to the Hot setpoint.
## Port Layout

### Front View

### Bottom View

### Top View

<table>
<thead>
<tr>
<th>ID#</th>
<th>Description</th>
<th>Port Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Comm 2</td>
<td>RS-485</td>
</tr>
<tr>
<td>2</td>
<td>Comm 1</td>
<td>RS-485</td>
</tr>
<tr>
<td>3</td>
<td>Secondary Ethernet Port</td>
<td>RJ-45</td>
</tr>
<tr>
<td>4</td>
<td>Primary Ethernet Port</td>
<td>RJ-45</td>
</tr>
<tr>
<td>5</td>
<td>Analogue Outputs</td>
<td>Wired</td>
</tr>
<tr>
<td>6</td>
<td>Mini B USB</td>
<td>USB</td>
</tr>
<tr>
<td>7</td>
<td>Universal Inputs</td>
<td>Wired</td>
</tr>
<tr>
<td>8</td>
<td>Micro USB</td>
<td>USB</td>
</tr>
<tr>
<td>9</td>
<td>Digital Outputs</td>
<td>Wired</td>
</tr>
<tr>
<td>10</td>
<td>Universal Inputs</td>
<td>Wired</td>
</tr>
<tr>
<td>11</td>
<td>Onyx Network</td>
<td>Wired</td>
</tr>
<tr>
<td>12</td>
<td>Power</td>
<td>Wired</td>
</tr>
</tbody>
</table>
System Configuration

There are several different modes of operation depending on the type of system present. Below we discuss the different header rack configuration and the system modes of operation.

Types of Header Racks
1 = Header Rack Not Configured
2 = 4 Pipe Standard - (Non-Reversing Compressors)
3 = 4 Pipe Reversing - (Non-Reversing Compressors)
4 = 6 Pipe Standard - (Non-Reversing Compressors)
5 = 6 Pipe Dedicated Source - (Reversing Compressors)
6 = 4 Pipe Standard - (Reversing Compressors)
7 = No Header Rack

Modes of operation for units with Header Racks
1 = Off with isolation valves open
2 = Cooling Only
3 = Heating Only
4 = Auto Full Building - (6-Pipe Only)
5 = Full Building
6 = Primary Cooling - (6-Pipe Only)
7 = Primary Heating - (6-Pipe Only)
8 = Off with isolation valves closed

<table>
<thead>
<tr>
<th>System Configuration</th>
<th>System Mode Selection (BAS Multi-State Variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headers Rack Config.</td>
<td>Compressors Circuit Type, Control-To-Temperature, Operating Modes</td>
</tr>
<tr>
<td></td>
<td>Off w/Isolation Valves Open, Heating Only, Cooling Only, Full Building, Primary Cooling, Primary Heating, Off w/Isolation Valves Closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Headers Rack Config.</th>
<th>Compressors Circuit Type, Control-To-Temperature, Operating Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Select Chiller Type</td>
<td>NA</td>
</tr>
<tr>
<td>2 4 Pipe Standard Non-Reversing</td>
<td>Hot/Cold, 2,3,5</td>
</tr>
<tr>
<td>3 4 Pipe Reversing Non-Reversing</td>
<td>Load, 2,3,5</td>
</tr>
<tr>
<td>4 6 Pipe Standard Non-Reversing</td>
<td>Hot/Cold, ALL</td>
</tr>
<tr>
<td>5 6 Pipe Dedicated Source Reversing</td>
<td>Hot/Cold, 2,3</td>
</tr>
<tr>
<td>6 4 Pipe Standard Reversing</td>
<td>Load, 2,3,5</td>
</tr>
<tr>
<td>7 No Header Rack</td>
<td>NA</td>
</tr>
</tbody>
</table>

NOTE: For (5) 6-Pipe Dedicated Source Header Rack ONLY: If (4)-Auto FB or (5)-FB is selected the unit will not operate and will be in a (1) OFF w/Isolation Open.

NOTE: If the system DOES NOT have a (4) 6-Pipe Standard Header Rack and a Non-ApPLICABLE (NA) Mode is selected, the system will operate as stated below:

If (6)-Primary Cooling is selected the system will operate in (2)-Cooling Only mode. Units will modulate capacity to the Cold setpoint.
If (7)-Primary Heating is selected, the system will operate in (3)-Heating Only mode. Units will modulate capacity to the Hot setpoint.
If (4)-Auto Full Building is selected, the system will operate in (5)-Full Building mode. Units will modulate capacity to the secondary load setpoint.

Network Configuration Chart

<table>
<thead>
<tr>
<th>Device</th>
<th>Supervisory to Building Automation System</th>
<th>Supervisory to Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BACnet IP</td>
<td>BACnet Mstp</td>
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<tr>
<td>Supervisory</td>
<td>Object Id</td>
<td>Primary Port</td>
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<tr>
<td></td>
<td>10</td>
<td>10.111.7.76</td>
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<td>Unit 1</td>
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<td>10.111.7.48/49</td>
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<td>2</td>
<td>10.111.7.48/49</td>
</tr>
<tr>
<td>Unit 3</td>
<td>3</td>
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</tr>
<tr>
<td>Unit 4</td>
<td>4</td>
<td>10.111.7.48/49</td>
</tr>
<tr>
<td>Unit 5</td>
<td>5</td>
<td>10.111.7.48/49</td>
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## Revision Guide

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<th>Pages:</th>
<th>Description:</th>
<th>Date:</th>
<th>By:</th>
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</thead>
<tbody>
<tr>
<td>All</td>
<td>Document Created</td>
<td>19 Oct 2017</td>
<td>MA</td>
</tr>
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