LF Chiller Controller
Technical Guide

LF Chiller Controller Code: Version 1.00 and later
WARNING

QUALIFIED INSTALLER

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE, OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE. INSTALLATION AND SERVICE MUST BE PERFORMED BY A TRAINED, QUALIFIED INSTALLER. A COPY OF THIS MANUAL SHOULD BE KEPT WITH THE UNIT AT ALL TIMES.
# LF Chiller Control System

<table>
<thead>
<tr>
<th>PART DESCRIPTION</th>
<th>AAON P/N</th>
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<tbody>
<tr>
<td>LF Chiller Main Controller</td>
<td>ASM02437</td>
</tr>
<tr>
<td>Chiller Refrigerant System Module</td>
<td>ASM02438</td>
</tr>
<tr>
<td>Chiller Pumping Module</td>
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</tr>
<tr>
<td>E-BUS Horizontal Outdoor Air Temp &amp; RH Sensor</td>
<td>ASM01836</td>
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<td>Prism 2 Software</td>
<td>ASM02249</td>
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<td>CommLink 5</td>
<td>ASM01874</td>
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<td>IP Module Kit</td>
<td>ASM01902</td>
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<tr>
<td>USB-Link 2</td>
<td>ASM02244</td>
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<tr>
<td>EBC E-BUS Cable Assembly</td>
<td>G029440 (1.5 Ft), G012870 (3 Ft), G029460 (10 Ft), G045270 (25 Ft), G029510 (50 Ft), G029530 (75 Ft), G029450 (100 Ft), G029470 (150 Ft), V36590 (250 Ft), G018870 (SPOOL)</td>
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<td>1.5 Ft, 3 Ft, 10 Ft, 25 Ft, 50 Ft, 75 Ft, 100 Ft, 150 Ft, 250 Ft, and 1000 Foot Spool</td>
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<td>E-BUS Adapter Hub with 1.5 Ft. EBC Cable</td>
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<td>E-BUS Adapter Board</td>
<td>ASM01878</td>
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**NOTE:** Before calling Technical Support, please have the model and serial number of the unit available.

**PARTS:** For replacement parts please contact your local AAON Representative.

**AAON Factory Technical Support:** 918-382-6450
techsupport@aaon.com

**AAON Controls Support:** 866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM central standard time

**NOTE:** Before calling Technical Support, please have the model and serial number of the unit available.

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## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERVIEW</td>
<td>6</td>
</tr>
<tr>
<td>Control System Features &amp; Applications</td>
<td>6</td>
</tr>
<tr>
<td>Manual Overview</td>
<td>6</td>
</tr>
<tr>
<td>LF CHILLER MAIN CONTROLLER SEQUENCE OF OPERATION</td>
<td>7</td>
</tr>
<tr>
<td>Chiller Mode of Operation</td>
<td>7</td>
</tr>
<tr>
<td>Controlling the Operator Modes</td>
<td>7</td>
</tr>
<tr>
<td>Off Mode</td>
<td>7</td>
</tr>
<tr>
<td>Running Mode</td>
<td>8</td>
</tr>
<tr>
<td>Sequences</td>
<td>9</td>
</tr>
<tr>
<td>Mechanical Cooling Sequence</td>
<td>9</td>
</tr>
<tr>
<td>Water Side Economizer Sequence</td>
<td>13</td>
</tr>
<tr>
<td>Chiller Pumping Sequence</td>
<td>15</td>
</tr>
<tr>
<td>Inputs and Safeties</td>
<td>17</td>
</tr>
<tr>
<td>Refrigeration Alarm Descriptions</td>
<td>19</td>
</tr>
<tr>
<td>INSTALLATION &amp; WIRING</td>
<td>22</td>
</tr>
<tr>
<td>LF Chiller Main Controller Inputs &amp; Outputs</td>
<td>22</td>
</tr>
<tr>
<td>Refrigerant Module Inputs &amp; Outputs</td>
<td>22</td>
</tr>
<tr>
<td>Chiller Pumping Module Inputs &amp; Outputs</td>
<td>23</td>
</tr>
<tr>
<td>LF Chiller Main Controller Input Wiring</td>
<td>24</td>
</tr>
<tr>
<td>LF Chiller Main Controller Output Wiring</td>
<td>25</td>
</tr>
<tr>
<td>Refrigeration A Module Input Wiring</td>
<td>26</td>
</tr>
<tr>
<td>Refrigeration A Module Output Wiring</td>
<td>27</td>
</tr>
<tr>
<td>Refrigeration B Module Input Wiring</td>
<td>28</td>
</tr>
<tr>
<td>Refrigeration B Module Output Wiring</td>
<td>29</td>
</tr>
<tr>
<td>Chiller Pumping Module Input Wiring</td>
<td>30</td>
</tr>
<tr>
<td>Chiller Pumping Module Output Wiring</td>
<td>31</td>
</tr>
<tr>
<td>TROUBLESHOOTING</td>
<td>32</td>
</tr>
<tr>
<td>LF Chiller Main Controller LED Diagnostics &amp; Locations</td>
<td>32</td>
</tr>
<tr>
<td>Refrigerant Module A &amp; B LED Diagnostics &amp; Locations</td>
<td>34</td>
</tr>
<tr>
<td>Chiller Pumping Module LED Diagnostics &amp; Locations</td>
<td>36</td>
</tr>
<tr>
<td>Thermistor Temperature Sensor Testing</td>
<td>38</td>
</tr>
<tr>
<td>Suction Pressure Transducer Testing</td>
<td>39</td>
</tr>
<tr>
<td>Discharge Pressure Transducer Testing</td>
<td>40</td>
</tr>
<tr>
<td>Important Wiring Considerations</td>
<td>41</td>
</tr>
<tr>
<td>Controller and Module Electrical and Environmental Specifications</td>
<td>42</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

APPENDIX A - LF CHILLER MAIN CONTROLLER LCD DISPLAY SCREENS ............................................. 43
APPENDIX B - REFRIGERANT SYSTEM MODULE LCD DISPLAY SCREENS ........................................ 48
APPENDIX C - CHILLER PUMPING MODULE LCD DISPLAY SCREENS .............................................. 54
APPENDIX D - BACnet® MS/TP CONNECTION TO NETWORK & BACnet® PARAMETERS ............. 63
APPENDIX E - PRISM 2 OPERATOR INTERFACE MONITORING ....................................................... 71
Control System Features & Applications

**LF Chiller Main Controller**
The LF Chiller Main Controller is used to control 1-2 circuit DX barrel chillers with an option for water circuit pumping and an option for water side economizer.

The LF Chiller Main Controller has an on-board BACnet® port for connection to a BACnet® MS/TP BAS network. There are also (2) E-BUS expansion ports which allow for the connection of the Chiller Refrigerant System Modules and Chiller Pumping Module via EBC E-BUS cables.

In addition, the LF Chiller Main Controller and its associated modules contain a 2 x 8 LCD character display with 4 buttons that allow for status and alarm display and BACnet® configuration for the Main Controller.

**Chiller Pumping Module**
The Chiller Pumping Module (CPM) offers two distinct optional services to a chiller system—water circuit pumping and water side economizer. Each of these two services can be independently enabled or disabled.

**Water Circuit Pumping**
The Chiller Pumping (CP) functionality is to provide operational control of all water circuit pumping, including primary only, primary/secondary and dual primary/secondary systems. The CP provides for water circulation through the chiller exchanger and is also capable of managing building water pressure differential if supplying building water. The CP operational sequence does not make the decision about when to run the water pumps, it is commanded by the main chiller controller. If the CP operation is enabled and the WSE operation is enabled, freeze protection can override the currently commanded operation.

**Waterside Economizer**
The Waterside Economizer (WSE) functionality is to provide cooling when the outside air temperature is able to provide cooling. The WSE provides cooling by means of a set of outdoor coils with fans. When cooling is to be provided, water or a water/glycol mix is pumped through the coils to cool the water. The temperature of the cooled water is managed by a 3-way mixing valve and variable speed fans. In the case of a water system with an isolated glycol outside coil system, an additional 3-way mixing valve on the isolated (secondary) side is used in combination with the fans to cool a water/glycol mix feeding a heat exchanger which then cools the main loop water. Each loop, as well as the fans, operate independently, but interlocks in their sequences ensure that fans and the associated 3-way valve do not compete in their temperature control operations. The WSE operational sequence does not make the decision about when to provide WSE cooling, it is commanded by the Main Chiller Controller. If the WSE operation is enabled, freeze protection can override the currently commanded operation.

Manual Overview

This guide will lead you through each section of the *LF Chiller Controller Technical Guide*. Below is a quick overview of each section of this manual.

**Section 1: Sequence of Operations - Page 7**—This section contains the sequence of operations for the LF Chiller Controller and its modules.

**Section 2: Wiring - Page 22**—This section contains the inputs, outputs, and wiring for the controller and modules.

**Section 3: Troubleshooting - Page 32**—This section contains sensor testing charts and controller LED diagnostics.

**Appendices A, B, C: LCD Display Screens - Page 43**—These appendices describe the controller and module LCD screens.

**Appendix D: BACnet® Configuration - Page 63**—This section lists BACnet® parameters, definitions, and ranges, if applicable.

**Appendix E: PRISM 2 User Interface - Page 71**—This section gives a brief overview of the Prism 2 user interface of the LF Chiller Control System.
SECTION 1: SEQUENCE OF OPERATIONS

LF Chiller Controller Main Operation Modes

Chiller Mode of Operation

The Chiller mode of operation shall be controlled based off the Chilled Water Out Temperature. There are 2 operational modes for the Chiller system:

1. Off Mode
2. Chiller (Run) Mode

The sequence is based primarily on “normal” operation, with extensions to operation where exceptional conditions are present (safeties).

Controlling the Operator Modes

The two operating modes are commanded by a combination of 4 mode control factors:

1. Remote Unit Enable/Disable Input
2. Internal Schedule
3. Run/Stop override via BACnet®
4. Run/Stop override via the User Interface

Remote Unit Enable/Disable Input

This input is a master override to disable the unit.

1. When this input is inactive, the chiller will not run regardless of the other 3 control factors.
2. When this input is active, the chiller will operate according to the condition of the other 3 factors. Since the schedule defaults to always active, and the overrides default to always inactive, activating this input will by default activate the Chiller.

Internal Schedule

The Chiller controls have an internal schedule which may be used to automate Chiller operations on a timed basis. This schedule defaults to always on and in combination with the Remote Unit Enable/Disable input can affect the electrical binary remote control of the chiller.

Regardless of the Internal Schedule commands, the Remote Unit Enable/Disable Input MUST be active for the Chiller to run. The schedule has no effect on operations otherwise. The internal schedule can be overridden by either of the Run/Stop override settings.

Run/Stop Override via BACnet® and Run/Stop Override via User Interface (UI)

These two override operations, issued from two possible sources, affect the same single internal conditional variable, meaning an override issued by BACnet® can be canceled via the UI and an override condition issued by the UI can be canceled or altered via BACnet®.

**NOTE:** Regardless of the override conditions, the Remote Unit Enable/Disable Input MUST be active for the chiller to run. These override conditions have no meaning if the input is not active.

There are 3 Run/Stop Override value settings:

0 = Automatic Operation: Operation will be based on internal schedule.
1 = Chiller Run: Chiller will operate in the Running Mode.
2 = Chiller Off: Chiller will operate in the Off Mode.

Off Mode

Stopping Setups

1. If Compressors are running:
   1.1. The expansion valves will close and the compressors will continue to operate at their present speed until the suction pressure drops below the Pump Down Suction Limit (default 95 psig) or 30 seconds has elapsed. **NOTE:** If there are multiple circuits, each circuit will pump down separately, yet simultaneously, and terminate independently.
   1.2. The Compressors will shut down.
   1.3. The Condenser Fans will shut down.
   1.4. The Water Side Economizer (if present and running) will shut down.
   1.5. The circuit pumping (if present) will shut down.

Stopped Sequence

There are no sequences run in the Chiller in off mode. (**NOTE:** The Chiller Pumping Module may have exceptional operations in off mode; however, this is not affected by nor does it affect Chiller operations).
SECTION 1: SEQUENCE OF OPERATIONS

LF Chiller Main Controller Operation Modes

Running Mode

The objective of the running mode is to generate cold water using Mechanical Cooling and Economizer Cooling if available. The economizing operation is commanded active or inactive by the Chiller. If the Chiller commands the Water Side Economizer to run, it will run regardless of whether the ambient conditions are suitable for operation or not.

Running Setups

1. If the Chiller Pumping Module is present and pumping operation is configured as enabled:
   1.1. The Chiller Pumping Module will activate pumping operations. \(\textbf{\textit{NOTE:}}\) The Chiller operation is still predicated on the mechanical Water Flow Switch and will not depend on any feedback or status from the Chiller Pumping Module.

Running Sequence

1. If circuit pumping is configured, the Circuit Pumping Sequence will run (runs on the Chiller Pumping Module).

2. If the Water Side Economizer is present and ambient temperatures are below the Entering Water Temperature by the adjustable Water Side Economizer Enable Deadband (defaulted to 5°F):
   2.1. The Water Side Economizer will be enabled. (See the Water Side Economizer Sequence for starting setup conditions).
   2.2. The Chiller Pumping Module will receive a signal that the Water Side Economizer is enabled.

3. If the Water Side Economizer is present and ambient temperatures are at or above the Entering Water Temperature:
   3.1. The Water Side Economizer will be disabled. (See the Water Side Economizer Sequence for stopping setup conditions).
   3.2. The Chiller Pumping Module will receive a signal that the Water Side Economizer is disabled.
   3.3. Note that the Water Side Economizer sequence has a shutdown operation which will continue to run on the Chiller Pumping Module until its shutdown is completed, even though the following call to “run the Water Side Economizer sequence” will not continue.

4. If the Water Side Economizer is configured and enabled, the Water Side Economizer Sequence will run (runs on the Chiller Pumping Module).

5. If the Water Side Economizer is not present or is not active or has reached its maximum:
   - The Mechanical Cooling may be blocked by the Ambient Compressor Lockout. (See Compressor Safeties for more details.)
   - The Mechanical Cooling may be blocked by the Water Flow Switch. (See Inputs and Protection Sequences for more details.)

5.1. If the Mechanical Cooling is not active and the Leaving Water Temperature is above the Leaving Water Temperature Setpoint by the Mechanical Cooling Enable Deadband:
   5.1.1. Mechanical Cooling will be enabled.
   5.1.2. The Chiller Pumping Module will receive a signal that mechanical cooling is active (this locks the Water Side Economizer at maximum position if operating).

5.2. If the Mechanical Cooling is active:
   5.2.1. The Mechanical Cooling Sequence will run.
   5.2.2. Note that operation of the Mechanical Cooling Sequence may itself result in terminating the Mechanical Cooling Sequence if conditions become oversatisfied.

6. The Inputs and Safeties Sequences will run.
**Sequences**

There are 4 main sequences for the Chiller system:

1. Mechanical Cooling Sequence
2. Water Side Economizer Sequence
3. Water Circuit Pumping Sequence
4. Inputs and Safeties Sequence

**Mechanical Cooling Sequence**

**Compressor/Module Configurations Supported**

<table>
<thead>
<tr>
<th>COMPRESSORS/CIRCUIT</th>
<th>CIRCUIT 1 COMPRESSOR(S)</th>
<th>CIRCUIT 2 COMPRESSOR(S)</th>
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<td>1</td>
<td>Fixed</td>
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<tr>
<td>1</td>
<td>Variable Capacity</td>
<td>Fixed</td>
</tr>
<tr>
<td>1</td>
<td>Fixed</td>
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<tr>
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<td>1</td>
<td>Variable Capacity</td>
<td>Variable Capacity</td>
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<tr>
<td>2 (Tandem)</td>
<td>Fixed/Fixed</td>
<td>Fixed/Fixed</td>
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<tr>
<td>2 (Tandem)</td>
<td>Variable Capacity/Fixed</td>
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</tr>
<tr>
<td>2 (Tandem)</td>
<td>Variable Capacity/Fixed</td>
<td>Variable Capacity/Fixed</td>
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**Table 1: Compressor/Module Configurations**

**Mechanical Cooling**

1. Turning Compressors On/Off
   1.1. If a compressor is enabled and is not locked out, the compressor will be started. The water flow switch will be evaluated before allowing Mechanical Cooling to run. If the water flow switch input is lost, then all compressors will shut off immediately regardless of the minimum run time, with no pump down.

1.2. Variable capacity compressors will be started at 100% for 1 minute and modulated to maintain the Chiller Leaving Water Temperature Setpoint.

1.3. Staging on Fixed Capacity Compressors
   1.3.1. Variable capacity compressor at 100% for a stage up delay.
   1.3.2. Leaving Water temp must be above the Leaving Water Temperature Setpoint.

1.4. Staging off Fixed Capacity Compressors
   1.4.1. Variable capacity compressor needs to be at minimum capacity for a stage down delay.
   1.4.2. Leaving Water Temperature must be below the Leaving Water Temperature Setpoint.

2. Compressor Modulation to maintain the Leaving Water Temperature
   2.1. May be on/off operation or variable capacity.
   2.2. Compressor Modulation
      2.2.1. The compressors will modulate to achieve the Leaving Water Temperature Setpoint.
      2.2.1.1. If the Leaving Water Temperature is above the setpoint, the compressor modulation signal will increase.
      2.2.1.2. If the Leaving Water Temperature is below the setpoint, the compressor modulation signal will decrease.
      2.2.1.3. Modulation interval rate is adjustable.

**Compressor Envelope Protection**

1. Cooling saturation temperature operational range protection.
   1.1. If the Saturation temperature is below 35°F:
      1.1.1. The compressors will modulate down until the saturation temperature is above 35°F.
      1.1.2. This is done to prevent the evaporator from freezing up.

1.2. If Saturation temperature is above 55°F:
      1.2.1. Modulate compressor up until saturation temperature is below 55°F.
      1.2.2. This is done to make sure the compressor stays in the envelope.
      1.2.3. If the compressor is at 100% and the evaporator saturation temperature is above 55°F for 5 minutes, an alarm will be generated and the compressor will shut down.
      1.2.3.1. The controller will wait for 5 minutes and retry the compressor and will lock after 3 tries in two hours.

1.3. These limits will reduce the compressor envelope.
1.4. Low Suction Pressure Protection

1.4.1. The Low Suction Pressure will be ignored for the first minute of compressor operation.

1.4.1.1. If the Suction Pressure is below the Low Suction Setpoint. This setpoint is based on glycol setting:

- 0% glycol has a low suction setpoint of 105 psi
- 15% glycol has a low suction setpoint of 90 psi
- 20% glycol has a low suction setpoint of 84 psi
- 25% glycol has a low suction setpoint of 75 psi
- 30% glycol has a low suction setpoint of 65 psi
- 35% glycol has a low suction setpoint of 55 psi

1.4.1.2. After 20 seconds:
- The Variable Compressor will modulate down 1% per second until the Suction Pressure rises above the Low Suction Setpoint.

1.4.1.3. After one minute:
- Compressor(s) will alarm and fail.
- If configured for a tandem, fixed compressors will stage down first.
- Retry after 5 minutes and only if the suction pressure is above 120 psig.

1.4.1.4. If the Suction Pressure is below the Low Suction Setpoint. This setpoint is based on glycol setting:

- 0% glycol has a low suction setpoint of 105 psi
- 15% glycol has a low suction setpoint of 90 psi
- 20% glycol has a low suction setpoint of 84 psi
- 25% glycol has a low suction setpoint of 75 psi
- 30% glycol has a low suction setpoint of 65 psi
- 35% glycol has a low suction setpoint of 55 psi

1.5. Unsafe Suction Pressure

1.5.1. The Suction Pressure will be ignored for the first 30 seconds of compressor operation.

1.5.2. If the Suction Pressure is below the Unsafe Suction Setpoint (default 50 psig) for 5 seconds:
- Compressor(s) will alarm and fail.
- If configured for a tandem, both compressors will fail on this refrigeration circuit.
- Retry after 5 minutes and only if the suction pressure is above 120 psig.

1.6. Low Suction Pressure Protection and Unsafe Suction Pressure Lockout

1.6.1. If the compressor fails 3 times in 2 hours due to a Low Suction Pressure Protection or an Unsafe Suction Pressure alarm:
- The compressor will be locked out.
- The compressor will be unlocked on a power cycle.

1.7. Compressor Start-up Low Suction Protection

An alarm will be generated.

The Suction pressure needs to be above 40 psig before starting the unsafe compressor.

1.8. Suction Pressure Sensor Not Detected

1.8.1. Normal sensor operation is:
- Input voltage is 0.5 volts to 4.5 volts and equals 0 psig to 250 psig.

1.8.2. The sensor fails if the input signal is:
- Less than 0.25 volts or more than 4.99 volts.

1.8.3. The compressor(s) will not be able to run.

2. Discharge Pressure Operational Range

2.1. When the compressors are running, the condenser fans will modulate to maintain the Discharge Pressure Setpoint—220 psig default.

2.2. If the Discharge Pressure drops 45 psig below the Discharge Pressure Setpoint and the condensers are at 0%, the condenser fan will cycle off after a minute.

2.2.1. Cycle the condenser fan back on when the Discharge Pressure reaches the Discharge Pressure Setpoint.

2.3. High Discharge Pressure Protection

2.3.1. If the discharge pressure rises above the High Discharge Pressure Setpoint 525 psig, the condenser fan signal goes to 100%.

2.3.2. If the discharge pressure reaches 550 psig:
- The compressor will modulate down 1% per second until it reaches 425 psig.
- Shut down 2nd tandem compressor.

2.4. Unsafe Discharge Pressure

2.4.1. If the Discharge Pressure is above the Unsafe Discharge Setpoint (default is 600 psig) for 1 second:
- The High Discharge Pressure Alarm will activate.
- The Compressor will fail and the system will be shut down.
- Retry after 5 minutes and lock after 3 incidents within 2 hours. Retry only if Discharge Pressure drops below 475 psig.
- The compressor will be unlocked on a power cycle.
SECTION 1: SEQUENCE OF OPERATIONS

Mechanical Cooling Sequence

2.5. Low Discharge Pressure
2.5.1. If the Discharge pressure is below setpoint (default 200 psig) for duration setpoint (default 120 sec), the compressors will be locked out. The compressors will be unlocked on a power cycle.

2.6. Discharge Line Temperature Protection
2.6.1. If the Discharge Line Temperature rises above the High Discharge Temperature Set point of 225°F for 30 seconds.
2.6.1.1. An alarm will be generated and the compressor will fail.
2.6.1.1.1. Retry after 5 minutes and lock after 3 incidents within 2 hours. Retry only if Discharge Line Temperature is below 150°F.

2.7. Discharge Pressure Not Detected
2.7.1. Normal sensor operation is:
If the input voltage is 0.5 volts to 4.5 volts and equals 0 psig to 667 psig.
2.7.2. The Sensor fails if the input signal is:
Less than 0.25 volts.
More than 4.99 volts.
2.7.3. The Condenser will be forced to 100% and an alarm will be generated.

Chiller Refrigeration System Protection

1. Electronic Expansion Valve (EXV) Control and Safeties
1.1. Electronic Expansion Valves
2500 step Sporlan Valves driven from 0 – 10 volt analog output signal to MCS battery backed module.
1.2. EXV Configuration
One EXV per module
1.3. Superheat Calculation
Superheat A = Suction Line Temperature Sensor A – Saturation Temperature Calculated from Suction Pressure Sensor A
Superheat B = Suction Line Temperature Sensor B – Saturation Temperature Calculated from Suction Pressure Sensor B

1.4. When the compressors are running
1.4.1. EXV initializes to a starting position for a starting duration
1.4.1.1. EXV startup time 30 seconds (adjustable)
1.4.1.2. EXV Startup position 30% (adjustable)

1.5. EXVs will modulate to maintain the Superheat Setpoint (adjustable setpoint 10 - 20°F, default 12°F.)

1.6. High Superheat
1.6.1. If superheat is above 25 degrees for 2 minutes:
1.6.1.1. An alarm will be generated
1.6.2. If superheat is above 40 degrees for 1 minute:
1.6.2.1. An alarm will be generated and associated compressor(s) will fail on that refrigerant circuit.
1.6.2.2. Reset after 5 minutes and lock after 3 incidents within 2 hours.

1.7. Low Superheat
1.7.1. The first 2 minutes of operation are ignored.
1.7.2. If superheat is below 4 degrees for 2 minutes:
1.7.2.1. An alarm will be generated and associated compressor(s) will fail on that refrigerant circuit.
1.7.2.2. Reset after 5 minutes and lock after 3 incidents within 2 hours.

2. Chiller Circuit Pump down
2.1. Before the refrigerant circuit’s compressors are both off, a pump-down sequence is performed.
2.2. For a pump-down, the EXVs will close and the Compressors will run at current speed until the PSI drops below 95 (adjustable), or 30 seconds has elapsed.

3. Subcooling
3.1. Subcooling is currently calculated for informational purposes only.
3.2. The Liquid Line Pressure and Liquid Line Temperature are measured to calculate Subcooling.

4. Discharge Superheat
4.1. Discharge Superheat is currently calculated for informational purposes only.
4.2. The Discharge Pressure and Discharge Line Temperature are measured to calculate Discharge Superheat.
5. Binary Input Signals

5.1. Comp A1 Running Status

5.1.1. Indicates Compressor A1 is running.

5.1.2. Compressor 1 Not Running Alarm

5.1.2.1. An alarm will be generated if Compressor 1 Running Binary input does not become active for longer than 45 seconds after the compressor 1 relay is activated.

5.1.2.2. An alarm will be generated and the Compressor will fail. Retry after failure time period.

5.1.3. Compressor 1 False Active Alarm

5.1.3.1. An alarm will be generated if Compressor 1 Running Binary input is active but Compressor 1 Relay is not.

5.1.3.2. If Compressor is considered running, force Condenser Fan to 100% as a safety. **NOTE:** If current sensors are used to measure compressor current, the LF Chiller will use the current readings to determine if compressors are running instead of binary input signals.

5.2. Comp A2 Running Status

5.2.1. Indicates Compressor A2 is running.

5.2.2. Compressor 2 Not Running Alarm

5.2.2.1. An alarm will be generated if Compressor 2 Running Binary input does not become active for longer than 45 seconds after the compressor 2 relay is activated.

5.2.2.2. An alarm will be generated and the Compressor will fail. Retry after failure time period

5.2.3. Compressor 2 False Active Alarm

5.2.3.1. An alarm will be generated if Compressor 2 Running Binary input is active but Compressor 2 Relay is not.

5.2.3.2. If Compressor is considered running, force Condenser Fan to 100% as a safety. **NOTE:** If current sensors are used to measure compressor current, the LF Chiller will use the current readings to determine if compressors are running instead of binary input signals.

5.3. Circuit Disable

5.3.1. Disable Circuit Compressors if open.

6. Refrigeration Module Alarms

6.1. Low Suction Pressure

6.2. Unsafe Suction Pressure

6.3. Suction Sensor not detected

6.4. Discharge Pressure Sensor not detected

6.5. Liquid Pressure Sensor not detected - warning indication only

6.6. Low Discharge Pressure

6.7. High Discharge Temperature

6.8. High Discharge Pressure

6.9. Suction Line Temp Not Detected

6.10. Discharge Line Temp Not Detected - warning indication only

6.11. Liquid Line Temp failure - warning indication only

6.12. High Superheat

6.13. Low Superheat

6.14. Compressor 1 not running

6.15. Compressor 1 False Active

6.16. Compressor 2 not running

6.17. Compressor 2 False Active
**Water Side Economizer (WSE) Operation**

### Power Up Delay

Once power is applied to the unit, the control algorithm will not start until 30 seconds has expired. **NOTE:** 100% valve position equals max valve position that can be less than full open.

### Cooling Mode

**WSE Cooling**

1. If the ambient temperature is below the entering water temperature by the WSE Enable Offset Setpoint (adjustable), then the WSE will be used as the primary source of cooling.

   1.1. If the Mixed Water Temperature Out (MWTO) is above the MWTO setpoint, then the 3-way valve will start modulating open until the MWTO reaches the MWTO setpoint. The modulation rate will be adjustable.

   1.2. If the 3-way valve is at 100% and MWTO is above setpoint, then the WSE VFD controlled fans are turned on at minimum speed, and the 3-way valve will modulate until the MWTO reaches the MWTO setpoint.

   1.3. If the 3-way valve is at 100% and the WSE VFD controlled fans are at minimum speed and the MWTO is above the MWTO setpoint, the WSE fans shall modulate up until the MWTO reaches the MWTO setpoint. The time when the 3-way valve is at 100% and the WSE VFD controlled fans are at minimum speed will be adjustable. The fan modulation rate will be adjustable.

   1.4. The WSE fans will modulate up until the MWTO reaches the MWTO setpoint.

   1.5. If the WSE fans reach 100% and the MWTO is still above the MWTO setpoint, then Compressor Cooling will be enabled.

   1.6. The WSE fans and the 3-way valve will stay at 100% when Compressors are running.

2. If Compressor Cooling is active and the ambient temperature drops below the entering water temperature by the WSE Enable Offset Setpoint, the WSE should be enabled.

   2.1. The WSE Fans will start at 100%.

   2.2. The 3-way valve should modulate open over a field adjustable time from 1-30 minutes (default is 30 mins). This allows the Compressors to respond to the reduced entering water temp without tripping.

   2.3. The WSE Fans and 3-way valve should stay at 100% until the compressors stage off.

   2.4. Once compressors are off, the WSE fans can modulate to maintain the MWTO setpoint.

   2.5. If the WSE Fans are at minimum and the MWTO is below setpoint, the WSE Fans will de-energize.

   2.6. The 3-way valve will then modulate to maintain the MWTO setpoint.

3. If the WSE and Compressor Cooling is active and the ambient temperature rises above the entering water temperature by the WSE Enable Offset Setpoint, the WSE will be disabled.

   3.1. The 3-way valve should modulate closed over a field adjustable time from 1-30 minutes (default is 1 minute). This allows the Compressors to respond to the increased entering water temp without tripping.

   3.2. The WSE Fans will stay at 100% while 3-way valve is closing.

   3.3. Once the 3-way valve is closed, then WSE Fans will de-energize.
SECTION 1: SEQUENCE OF OPERATIONS

Water Side Economizer Sequence

Controlling Sensors

The following sensors are needed:

**WSE Outlet Temperature**
Measures the temperature of the water coming out of the WSE.

**WSE Valve Outlet Mixed Temperature**
Measures the temperature of the water after the 3-way mixing valve.

Alarms & Faults

**WSE VFD Fault**
1. If the VFD is indicating a fault:
   1.1. An alarm will indicate the VFD fault.
   1.2. Operations will continue as if the VFD were operational.

**Freeze Protection**
1. If the WSE Outlet Temperature drops below the freeze protection temperature setpoint:
   1.1. An alarm will indicate the WSE is in freeze protection operation.
   1.2. The WSE Fans will be disabled.
   1.3. The 3-way mixing valve will open to pass 100% water to the WSE coils.
   1.4. Additionally, if the water circuit pumping is enabled, it will be forced active to circulate water through the Water Side Economizer. This action for the water circuit pumping operation is configurable and can be disabled.

2. If the WSE Outlet Temperature rises 5°F above the freeze protection temperature setpoint:
   2.1. The freeze protection alarm will clear.

**WSE Valve Outlet Mixed Temperature Sensor Failure**
1. An alarm will indicate the sensor failure.

2. If the Leaving Water Temperature (LWT) for the chiller is available to the WSE controller:
   2.1. Normal operations will continue substituting the LWT for the primary mixing valve outlet temperature in the control sequences.
   2.2. **NOTE:** It will be up to the controller commanding the WSE operation to make any operate/don’t operate decisions or to adjust target temperatures to cause operation to continue in conjunction with chiller operations which will also be affecting LWT.

3. If the Leaving Water Temperature for the chiller is not available to the WSE controller:
   3.1. The WSE is forced to the off mode condition.
   3.2. An additional alarm is set indicating the WSE is not operating.
SECTION 1: SEQUENCE OF OPERATIONS

Chiller Pumping Sequence

Chiller Pumping (CP) Sequence

The pumping section of an LF Chiller is capable of managing the pumping in a primary only chilled water circuit arrangement. The operation has two basic modes of operation:

1. Off Mode
2. Pumping Mode

Off Mode

Stopping Setup

1. All pumps will turn off.

Running Sequence

1. If the WSE enabled, the WSE freeze protection is active, the CP operation in freeze protection is enabled, and a system lockout is not present:

1.1. The off mode command will be overridden, and the CP will run in pumping mode.

Pumping Mode

There are 2 distinct sequences that are run based on pump configuration. Each sequence has additional handling for backup and lead/lag operations:

1. Primary Circuit Only with Fixed Speed Pumping
2. Primary Circuit Only with Variable Speed Pumping

Primary Circuit Only with Fixed Speed Pumping

1. Primary A Pump 1 is enabled.
2. Wait 30 seconds for the proof of water flow (POWF).
2.1. If POWF is made, the pump will continue to run.
2.2. If POWF is not made, the pump will turn off.
2.2.1. The Pump will be locked out, and a Pump Lockout Alarm will occur.
3. If the POWF Switch deactivates for more than 30 seconds:
3.1. The currently selected pump will shut down.
3.2. The Pump will be locked out, and a Pump Lockout Alarm will occur.

Primary Circuit Only with Variable Speed Pumping

1. Primary A Pump 1 with VFD at minimum speed is enabled.
2. Wait 30 seconds for (1) the building pressure differential to become greater than 1 psi and for (2) POWF to be made.
2.1. If both conditions are met, then the pump will continue to run.
2.1.1. The Pump VFD will modulate to maintain the differential pressure setpoint.
2.2. If either of these conditions are not met, the pump will turn off.
3. If the POWF Switch deactivates for more than 30 seconds or a VFD fault occurs:
3.1. The currently selected pump will shut down.
3.2. The Pump will be locked out, and a Pump Lockout Alarm will occur.

Backup Pump & Lead Lag Operation

1. If not configured for Lead Lag Operation:
   1.1. Backup pumps will come on if Lead Pump is locked out.
   1.1.1. Uses the same start up sequence as Lead Pump.
2. If configured for Lead Lag Operation:
   2.1. Pump with the least amount of run time will activate first.
   2.2. Lag Pump will only activate if Lead Pump is locked out.

Freeze Protection

1. If the Automatic Pump in Freeze Protection is enabled and the WSE section goes into freeze protection, the pumping mode will be forced active. The freeze protection operation cannot override a system lockout, which will keep any pumps from running.
SECTION 1: SEQUENCE OF OPERATIONS

Chiller Pumping Sequence

Alarms & Faults

1. Discharge Sensor Fail
   1.1. If the analog input for the pressure sensor measures above 4.5vdc or below 0.5vdc, then the sensor is considered to have failed.

2. Discharge Sensor Fault
   2.1. This fault occurs if the discharge pressure is above the maximum discharge pressure setpoint for more than 5 seconds.

3. Discharge Initial Startup Fail
   3.1. This fault occurs if the discharge pressure does not change by 1 psi in the first 30 seconds of running.

4. Suction Sensor Fail
   4.1. If the analog input for the pressure sensor measures above 4.5vdc or below 0.5vdc, then the sensor is considered to have failed.

5. Suction Sensor Fault
   5.1. This fault occurs if the suction pressure is below the minimum suction pressure setpoint.

6. Differential Pressure Fault
   6.1. This fault occurs if the differential pressure is less than 0 psi for 30 seconds when the pump is active.

7. Pump Lockout
   7.1. This lockout will occur if POWF does not occur or is lost for 30 seconds.
   7.2. This lockout will also occur if a VFD Fault occurs.
   7.3. This lockout will occur if a Discharge or Suction Pressure Sensor Fails or Fault occurs.
   7.4. This lockout will occur if a Differential Pressure Fault occurs.

8. Chiller Pumping System Lockout
   8.1. If all pumps are in a lockout condition, then the pumping system will lockout.

9. If a system lockout condition is present, pumping cannot operate and the off mode is effectively enforced regardless of the current chiller command. (NOTE: A system lockout can only be cleared by a power cycle or module fault reset).
Inputs and Safeties Sequences
Each of these sub-sequences is run collectively to evaluate various inputs and internal conditions for status and alarming/faulting purposes.

Chiller Entering Water Temperature (EWT) Input
1. The Chiller Entering Water Temperature (EWT) is monitored.

Safeties
1. If the EWT sensor has failed (measurement outside the accepted normal operating range for the given sensor):
   1.1. An EWT Sensor Failure alarm will be generated.
2. The EWT is used in the reverse flow safety which is not operated if this sensor fails (see Chiller Leaving Water Temperature Input below).

Chiller Leaving Water Temperature (LWT) Input
1. The Chiller Leaving Water Temperature (LWT) is monitored.
2. The LWT is the target for the chiller operations and is thus used in controlling the operation of the chiller.

Safeties
1. If the LWT sensor has failed (measurement outside the accepted normal operating range for the given sensor):
   1.1. The chiller is shut down and locked out.
   1.2. An LWT sensor failure alarm will be generated.
   1.3. All chiller running operations are locked out (the Chiller Pumping Module may have independent freeze protection operations that may continue to run).
   1.4. A power cycle or specific command sent via BACnet® is required to restore operations, at which point operations will start as if the unit had just been powered up.
2. If the water drops below the Leaving Water Freeze Limit (default 35°F, adjustable based on glycol %):
   2.1. The chiller is shut down and locked out.
   2.2. A freeze protection alarm will be generated.
   2.3. All chiller running operations are locked out (the Chiller Pumping Module may have independent freeze protection operations that may continue to run).
   2.4. A power cycle or specific command sent via BACnet® is required to restore operations, at which point operations will start as if the unit had just been powered up.
3. If the EWT is below the LWT by a difference of 4°F or more for a duration of 1 minute:
   3.1. The chiller is shut down and locked out.
   3.2. A reverse flow alarm will be generated.
   3.3. All chiller running operations are locked out (the Chiller Pumping Module may have independent freeze protection operations that may continue to run).
   3.4. A power cycle or specific command sent via BACnet® is required to restore operations, at which point operations will start as if the unit had just been powered up.

Compressor Current Sensor Inputs (1-4)
There are 4 compressor current inputs, one associated with each compressor. Each input is only monitored and acted upon if the associated compressor is configured and active.

1. The compressor current will be measured and shared with the refrigeration module controlling that compressor.

Safeties
These safeties operate in the individual refrigeration modules, based on the current measurement information provided by the main controller.

1. For each individual compressor:
   1.1. If the current is less than 20% of the Running Load Amps (RLA) for the given compressor for more than 30 seconds:
      1.1.1. The given compressor will shut down.
      1.1.2. An alarm will generate, indicating the failed condition.
      1.1.3. A 5 minute recovery delay will occur before a lock out is issued.
      1.1.4. If this shutdown is the 3rd to occur within a 2 hour window:
         1.1.4.1. The compressor will be locked out.
         1.1.4.2. An alarm will be generated to indicate a lockout has occurred.
         1.1.4.3. The lockout can only be cleared by cycling power to the module or via a clearing command issued through BACnet®.
      1.1.5. Following the recovery delay (no lockout):
         1.1.5.1. The failure alarm will be cleared.
         1.1.5.2. The compressor can be restarted if still called for.
SECTION 1: SEQUENCE OF OPERATIONS

Inputs and Safeties Sequences

1.2. If the current is more than 120% of the RLA for 10 seconds:
   1.2.1. The given compressor will shut down.
   1.2.2. An alarm will generate, indicating the failed condition.
   1.2.3. A 5 minute recovery delay will occur before a lock out is issued.
   1.2.4. If this shutdown is the 3rd to occur within a 2 hour window:
      1.2.4.1. The compressor will be locked out.
      1.2.4.2. An alarm will be generated to indicate a lockout has occurred.
      1.2.4.3. The lockout can only be cleared by cycling power to the module or via a clearing command issued through BACnet®.

1.2.5. Following the recovery delay (no lockout):
   1.2.5.1. The failure alarm will be cleared.
   1.2.5.2. The compressor can be restarted if still called for.

1.3. RLA is configurable in the controller for each compressor.

Ambient Temperature Input
1. The ambient temperature is monitored.
2. The ambient temperature sensor is used in determining when to operate the water side economizer if present.
3. The ambient temperature may be used by the water side economizer for freeze protection operations.

Safeties
1. If ambient temperature sensor is determined to have failed (measurement outside the accepted normal operating range for the given sensor):
   1.1. An ambient temperature sensor failure alarm will be generated.
   1.2. If the water side economizer is present, its operation will be disabled.

Water Flow Switch Input
1. The water flow switch is monitored to control when mechanical cooling may operate.
2. Mechanical cooling cannot be started until the water flow switch is active for a minimum of 30 seconds.

Safeties
1. Once running, if the water flow switch is inactive for more than 10 seconds:
   1.1. An emergency shut down of running compressors will occur (no pump down).
2. Once the switch is reactivated, mechanical cooling may restart as needed.

Emergency Shutdown Input
1. This is a direct safety input and must be active for the chiller to operate, including pumping operations if circuit pumping is configured.

Safeties
1. If this input is deactivated for a period of 2 seconds:
   1.1. All chiller operations will be shut down immediately. This includes an immediate shut down of any running compressors without a pump down occurring. (Freeze protection operations in the Chiller Pumping Module may continue to operate even if the emergency shutdown input is deactivated).
   1.2. All EXVs will be closed immediately.
   1.3. An emergency shutdown alarm will be generated. The alarm may be cleared when the input is reactivated.
   1.4. Once reactivated, the chiller may restart operations from the beginning as if just powered up.

Phase Brownout Input
1. This is a direct safety input and must be active for the chiller to operate, including pumping operations if circuit pumping is configured.

Safeties
1. If this input is deactivated for a period of 2 seconds:
   1.1. All chiller operations will be shut down immediately. This includes an immediate shut down of any running compressors without a pump down occurring. (Freeze protection operations in the Chiller Pumping Module may continue to operate even if the emergency shut down input is deactivated).
   1.2. All EXVs will be closed immediately.
   1.3. A Phase Brownout alarm will be generated. The alarm may be cleared when the input is deactivated.
   1.4. Once reactivated, the chiller may restart operations from the beginning as if just powered up.
Refrigeration Alarm Descriptions

Alarm Warnings Descriptions

1. Low suction pressure warning:
   1.1. Low suction pressure will be ignored for the first minute of initial compressor operation.
   1.2. If suction pressure is below glycol adjusted setpoint for 20 seconds digital compressor will modulate down 1% per second. Default 105 psi.
   1.3. Warning will clear once suction pressure rises above setpoint.

2. Low suction pressure – startup warning:
   2.1. Initial compressor on circuit cannot start unless suction pressure is above 40 psig.
   2.2. Warning occurs if circuit is off and suction pressure is below 40 psig.

3. High discharge pressure – level 1 warning:
   3.1. If discharge pressure rises above 525 psig condenser fan is forced to 100%

4. High discharge pressure – level 2 warning:
   4.1. If discharge pressure rises above 550 psig
      4.1.1. Compressor will modulate down 1% per second until discharge pressure drops below 425 psig.
      4.1.2. 2nd tandem compressor will be shut down (this is a fault described below)

5. Discharge pressure not detected warning:
   5.1. If discharge pressure sensor is not detected and a compressor is running
      5.1.1. Copeland Digital Scroll will be forced to 50% based on Copeland Requirements.

6. High superheat warning:
   6.1. If a compressor is active and the superheat is above 25 for two minutes or longer.

7. Condenser Fault Binary Input:
   7.1. If the connection to the condenser binary input is lost, an alarm will be generated.

8. Discharge line temp sensor not detected:
   8.1. If discharge line temperature analog input sensor is not detected by module.
   8.2. Condenser fan will be forced to 100%

9. Liquid Pressure sensor not detected:
   9.1. If liquid pressure sensor is not detected and a compressor is running.
   9.2. Alarm only.

10. Liquid Line Temperature sensor not detected.
    10.1. If liquid line temperature sensor is not detected.
    10.2. Alarm only.

Alarm Faults Description

1. Low suction pressure fault:
   1.1. Low suction pressure detection will be ignored for first minute of initial compressor operation.
   1.2. If suction pressure is below setpoint for one minute. Default 105. Glycol determines setpoint.
      1.2.1. Compressor(s) will turn off.
      1.2.2. After five minutes will be retried and only if the suction pressure is above restart setpoint. Default 115 psi. Glycol determines setpoint.

2. Unsafe suction pressure fault:
   2.1. Unsafe suction pressure detection will be ignored for first 30 seconds of initial compressor operation.
   2.2. If suction pressure is below setpoint for five seconds. Default 50 psig. Glycol determines setpoint.
      2.2.1. Compressor(s) will be turned off.
      2.2.2. After five minutes will be retried and only if the suction pressure is above restart setpoint. Default 115 psi. Glycol determines setpoint.

3. High discharge pressure fault:
   3.1. Single compressor circuit
      3.1.1. If discharge pressure is above 600 psig:
         3.1.1.1. Compressor will turn off.
         3.1.1.2. After five minutes will retry.
   3.2. Compressor will not be allowed to reactivate until pressure is below 475 psig.

4. Compressor 2 high discharge pressure fault
   4.1. Tandem compressor circuit
      4.1.1. If discharge pressure is above 550 psig:
         4.1.1.1. Second compressor will turn off
         4.1.1.2. After stage up delay, minimum off time will be retried

5. Compressor 1 or Compressor 2 not running fault:
   5.1. If compressor has been activated for at least 45 seconds but the running verification signal is not active.
SECTION 1: SEQUENCE OF OPERATIONS

Refrigeration Alarm Descriptions

5.1.1. Compressor signal will turn off.
5.1.2. After five minutes will retry.
5.2. Running verification is a binary input signal to the module.

6. Low superheat fault:
6.1. Low superheat detection will be ignored for first two minutes of initial compressor operation.
6.2. If superheat is below four degrees for two minutes:
   6.2.1. Compressor signal will turn off.
   6.2.2. After five minutes will retry.

7. High discharge line temperature:
7.1. Sensor is installed for digital scroll compressors only.
7.2. If discharge line temperature is above 225 degrees for 30 seconds:
   7.2.1. Compressor will fail.
   7.2.2. If the discharge line temperature is below 150 degrees and five minutes has lapsed will retry.

8. Communications loss fault:
8.1. If E-BUS communications are lost for at least 15 seconds
   8.1.1. Compressor(s) will turn off.
8.2. When communication is reestablished, fault will clear.

9. Compressor 1 false active warning:
9.1. If compressor is not activated but the running verification signal is active for at least 45 seconds, the condenser fan will be forced to 100%
9.2. Running verification is a binary input signal to the module.

10. Compressor 2 false active warning:
10.1. If compressor is not activated but the running verification signal is active for at least 45 seconds. Force condenser fan to 100%
10.2. For fixed on/off compressors, running verification is a binary input signal to the module.

11. High superheat fault:
11.1. If a compressor is active and the superheat is above 40 for 1 minute or longer.
   11.1.1. Compressor(s) will turn off.
   11.1.2. After five minutes will retry.

12. Suction Line Temperature Sensor not detected:
12.1. Circuit is disabled until sensor is detected.

13. Suction Pressure Sensor not detected:
13.1. Circuit is disabled until sensor is detected.

14. High Saturation Temperature Fault:
14.1. If compressor is at 100% and Saturation Temperature is above 55 degrees for 5 minutes.
14.2. Both Compressors will fail.

15. Compressor 1 or Compressor 2 Overcurrent Fault:
15.1. If the current is more than 120% of the RLA for 10 seconds:
   15.1.1. Compressor will shut down.

16. Compressor 1 or Compressor 2 Undercurrent Fault:
16.1. If the current is less than 20% of the RLA for 30 seconds:
   16.1.1 Compressor will shut down.

Alarm Lockouts Description

1. Low/unsafe suction pressure lockout:
   1.1. If a low suction pressure fault or unsafe suction pressure fault occurs three times in a two-hour time period:
      1.1.1. Circuit is disabled and locked out until module is reset.

2. Low discharge pressure lockout:
   2.1. If discharge pressure is below 200 psig for 2 minutes:
      2.1.1. Circuit is disabled and locked out until module is reset.

3. High discharge pressure lockout:
   3.1. If a high discharge pressure fault occurs three times in a two-hour time period:
      3.1.1. Circuit is disabled and locked out until module is reset.
4. Low superheat lockout:
   4.1. If a low superheat fault occurs three times in a two-hour time period:
       4.1.1. Circuit is disabled and locked out until module is reset.

5. High superheat lockout:
   5.1. If a high superheat fault occurs three times in a two-hour time period:
       5.1.1. Circuit is disabled and locked out until module is reset.

6. High discharge line temperature lockout:
   6.1. If a high discharge line temperature fault occurs three times in a two-hour time period:
       6.1.1. Circuit is disabled and locked out until module is reset.

7. Compressor 1 Overcurrent
   7.1. If compressor overcurrent fault occurs three times in a two-hour time period:
       7.1.1. Compressor is disabled and locked out until module is reset.

8. Compressor 2 Overcurrent
   8.1. If compressor overcurrent fault occurs three times in a two-hour time period:
       8.1.1. Compressor is disabled and locked out until module is reset.

9. High Saturation Temperature
   9.1. If a high saturation temperature fault occurs three times in a two-hour time period:
       9.1.1. Circuit is disabled and locked out until module is reset.

10. Compressor 1 Undercurrent
    10.1. If compressor undercurrent fault occurs three times in a two-hour time period:
        10.1.1. Compressor is disabled and locked out until module is reset.

11. Compressor 2 Undercurrent
    11.1. If compressor undercurrent fault occurs three times in a two-hour time period:
        11.1.1. Compressor is disabled and locked out until module is reset.
## SECTION 2: WIRING

### LF Chiller Main Controller & Refrigerant Module Input/Output Maps

#### Input/Output Maps

See Table 2 for the LF Chiller Main Controller Inputs/Outputs and Table 3 for the Refrigerant System Module Inputs/Outputs.

##### LF CHILLER MAIN CONTROLLER

<table>
<thead>
<tr>
<th>Analog Inputs</th>
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<tbody>
<tr>
<td>1</td>
<td>Entering Water Temperature Sensor (AI1)</td>
</tr>
<tr>
<td>2</td>
<td>Leaving Water Temperature Sensor (AI2)</td>
</tr>
<tr>
<td>3</td>
<td>Compressor A1 Amps (AI3)</td>
</tr>
<tr>
<td>4</td>
<td>Compressor A2 Amps (AI4)</td>
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<tr>
<td>5</td>
<td>Compressor B1 Amps (AI5)</td>
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<td>6</td>
<td>Compressor B2 Amps (AI6)</td>
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<td>7</td>
<td>Outside Air Temperature Sensor (AI7)</td>
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<td>8</td>
<td>Leaving Water Temperature Reset (AI8)</td>
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<tr>
<th>Binary Inputs</th>
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<tbody>
<tr>
<td>1</td>
<td>Remote Start/Stop (BIN1)</td>
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<tr>
<td>2</td>
<td>Water Flow Switch 1 (BIN2)</td>
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<tr>
<td>3</td>
<td>Emergency Shutdown (BIN3)</td>
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<td>4</td>
<td>Not Used (BIN4)</td>
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<td>Phase Brownout (BIN5)</td>
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<td>Not Used (BIN6)</td>
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<td>7</td>
<td>Not Used (BIN7)</td>
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<tr>
<td>8</td>
<td>Not Used (BIN8)</td>
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<td>1</td>
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<td>Alarm (RLY4)</td>
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<td>Chiller Enabled (RLY5)</td>
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<td>Not Used (RLY7)</td>
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<tr>
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<td>Not Used (RLY8)</td>
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<tr>
<th>Communication Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAC-NET Communication Terminal Block</td>
</tr>
<tr>
<td>RS-485 COMM Prism User Interface Terminal Block</td>
</tr>
<tr>
<td>DUAL E-BUS 2 EBC E-BUS Ports</td>
</tr>
</tbody>
</table>

##### REFRIGERATION SYSTEM MODULE

<table>
<thead>
<tr>
<th>Analog Inputs</th>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>Suction Pressure Sensor (SP-1)</td>
</tr>
<tr>
<td>2</td>
<td>Discharge Line Pressure Sensor (HP-1)</td>
</tr>
<tr>
<td>3</td>
<td>Liquid Line Pressure Sensor (SP-2)</td>
</tr>
<tr>
<td>4</td>
<td>Not Used</td>
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</table>

<table>
<thead>
<tr>
<th>Binary Inputs</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Compressor 1 Status (BIN1)</td>
</tr>
<tr>
<td>2</td>
<td>Compressor 2 Status (BIN2)</td>
</tr>
<tr>
<td>3</td>
<td>Condenser Fault (BIN3)</td>
</tr>
<tr>
<td>4</td>
<td>Circuit Disable (BIN4)</td>
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</table>

<table>
<thead>
<tr>
<th>Temperature Inputs</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Suction Line Temperature (TEMP1)</td>
</tr>
<tr>
<td>2</td>
<td>Discharge Line Temperature 2 (TEMP2)</td>
</tr>
<tr>
<td>3</td>
<td>Liquid Line Temperature 3 (TEMP3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compressor 1 Enable (RLY1)</td>
</tr>
<tr>
<td>2</td>
<td>Compressor 2 Enable (RLY2)</td>
</tr>
<tr>
<td>3</td>
<td>Condenser Enable (RLY3)</td>
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<tr>
<td>4</td>
<td>Not Used (RLY4)</td>
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<tr>
<td>5</td>
<td>Not Used (RLY5)</td>
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<table>
<thead>
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<th>Analog Outputs</th>
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<tr>
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<td>Condenser (AOUT1)</td>
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<tr>
<td>2</td>
<td>Expansion Valve (AOUT2)</td>
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<th>Additional Inputs</th>
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<tr>
<td>DUAL E-BUS 2 EBC E-BUS Ports</td>
</tr>
<tr>
<td>MODBUS MODBUS Communication Terminal Block</td>
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</tbody>
</table>

Table 2: LF Chiller Main Controller Inputs & Outputs

Table 3: Chiller Refrigerant Module Inputs & Outputs
## Input/Output Maps

See Table 4 for the Chiller Pumping Module Inputs/Outputs.

### CHILLER PUMPING MODULE

<table>
<thead>
<tr>
<th>Analog Inputs - 10K @ 77 Deg F Type 3 Thermistors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Mixing Valve Water Outlet Temperature Sensor (AIN1)</td>
</tr>
<tr>
<td>2 Mixing Valve Water Feed Temperature Sensor (AIN2)</td>
</tr>
<tr>
<td>3 Heat Exchanger Secondary Inlet Temperature Sensor (AIN3)</td>
</tr>
<tr>
<td>4 Heat Exchanger Secondary Outlet Temperature Sensor (AIN4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 WSE VFD Fault (BIN1)</td>
</tr>
<tr>
<td>4 Chiller Pump VFD 1 Fault (BIN4)</td>
</tr>
<tr>
<td>5 Chiller Pump VFD 2 Fault (BIN5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 WSE VFD Speed (AO1)</td>
</tr>
<tr>
<td>2 Primary 3-Way Mixing Valve Actuator (AO2)</td>
</tr>
<tr>
<td>3 Secondary 3-Way Mixing Valve Actuator (AO3)</td>
</tr>
<tr>
<td>4 Chiller Pump VFD (AO4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Outputs (24 VAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 WSE Fan Enable (RLY1)</td>
</tr>
<tr>
<td>2 Glycol Pump (RLY2)</td>
</tr>
<tr>
<td>3 Primary A Pump 1 (RLY3)</td>
</tr>
<tr>
<td>4 Primary A Pump 2 (RLY4)</td>
</tr>
<tr>
<td>5 Secondary Pump 1 (RLY5)</td>
</tr>
<tr>
<td>6 Secondary Pump 2 (RLY6)</td>
</tr>
<tr>
<td>7 Primary B Pump 1 (RLY7)</td>
</tr>
<tr>
<td>8 Primary B Pump 2 (RLY8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-BUS</td>
</tr>
</tbody>
</table>

Table 4: Chiller Pumping Module Inputs & Outputs
**SECTION 2: WIRING**

**LF Chiller Main Controller Input Wiring**

The LF Chiller Main Controller is used to control 1-2 circuit DX barrel chillers with an option for water circuit pumping and an option for water side economizer.

The Controller is designed with 8 analog inputs, 4 analog outputs, 8 binary inputs, and 8 relay outputs.

The Controller has an on-board BACnet® port for connection to a BACnet® MS/TP network. There are also 2 E-BUS Expansion Ports which allow the connection of communicating sensors and future E-BUS Modules via modular cable assemblies.

The Controller contains a 2 x 8 LCD character display and 4 buttons that allow for status and alarm display as well as BACnet® configuration.

See Figure 1 below for input wiring.
LF Chiller Main Controller Output Wiring

The LF Chiller Controller has (2) E-BUS Expansion Ports which allow for the connection of the Chiller Refrigerant Modules and the Chiller Pumping Module via EBC E-BUS Cables.

The LF Chiller Controller must be connected to an 18-30 VAC power source. Please see **Table 9, page 42** for correct VA requirements to use when sizing the transformer(s) used for powering the Controller and its associated modules.

Also, please note that when wiring the LF Chiller Controller, its contacts must be wired as wet contacts (connected to 24 VAC).

See **Figure 2** below for output wiring.
Chiller Refrigerant A Module Input Wiring

The Chiller Refrigerant A Module provides control of the compressors and condenser fans on an LF Chiller.

The Chiller Refrigerant A Module provides 3 analog inputs, 4 binary inputs, 5 relays, and 2 analog outputs.

The Module has a Dual E-BUS Expansion Port which allows the connection of communicating sensors and future E-BUS Modules via modular cable assemblies.

The Module contains a 2 x 8 LCD character display and 4 buttons that allow for status and alarm display.

The Chiller Refrigerant Module must be connected to an 18-30 VAC power source. When wiring the Refrigerant Module, its relay outputs must be wired as wet contacts (connected to 24 VAC).

See Figure 3 below for input wiring.

Figure 3: Chiller Refrigerant A Module Input Wiring

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards.
Chiller Refrigerant A Module Output Wiring

See Figure 4 below for output wiring.

NOTE:
ALL RELAY OUTPUTS ARE NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY - 1 AMP MAXIMUM LOAD

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards.

Figure 4: Chiller Refrigerant A Module Output Wiring
Chiller Refrigerant B Module Input Wiring

The Chiller Refrigerant B Module provides control of the compressors and condenser fans on an LF Chiller.

The Chiller Refrigerant B Module provides 3 analog inputs, 4 binary inputs, 5 relays, and 2 analog outputs.

The Module has a Dual E-BUS Expansion Port which allows the connection of communicating sensors and future E-BUS Modules via modular cable assemblies.

The Module contains a 2 x 8 LCD character display and 4 buttons that allow for status and alarm display.

The Chiller Refrigerant Module must be connected to an 18-30 VAC power source. When wiring the Refrigerant Module, its relay outputs must be wired as wet contacts (connected to 24 VAC).

See Figure 5 below for input wiring.
Chiller Refrigerant B Module Output Wiring

See Figure 6 below for output wiring.

NOTE:
ALL RELAY OUTPUTS ARE NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY - 1 AMP MAXIMUM LOAD

Figure 6: Chiller Refrigerant B Module Output Wiring

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards.
Chiller Pumping Module Input Wiring

The Chiller Pumping Module offers two distinct optional services to a chiller system—water circuit pumping and water side economizer. Each of these two services can be independently enabled or disabled.

The Chiller Pumping Module is connected to the LF Chiller Main Controller. Only (1) module can be connected.

The Chiller Pumping Module provides a 2 x 8 LCD character display and 4 buttons that allow for status of system operation, system setpoints, system configurations, sensors, and alarms and to change the module's address, if necessary.

See Figure 7 below for input wiring.

**WARNING!!**
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

Figure 7: Chiller Pumping Module Input Wiring
Chiller Pumping Module Output Wiring

See Figure 8 below for output wiring.

![Diagram of Chiller Pumping Module Output Wiring]

Figure 8: Chiller Pumping Module Output Wiring

**WARNING!!**
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.
LF Chiller Main Controller LED Diagnostics

LF Chiller Main Controller LEDs
The LF Chiller Main Controller is equipped with LEDs that can be used to verify operation and perform troubleshooting. See Figure 9, page 33 for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

Operation LEDs - Factory Troubleshooting
- **POWER** - This green LED will light up to indicate that 24 VAC power has been applied to the controller.
- **APP HB** - This green LED will light up and blink continuously to indicate the application software is working properly.
- **OS HB** - This green LED will light up and blink continuously to indicate the operating system is working properly.
- **WDOG** - This green LED will light up and stay lit to indicate the operating system is working properly.

Diagnostic LEDs
- **ALARM** - This red LED is a diagnostic blink code LED. It will light up and stay lit when there is an alarm present. The type of alarm will display on the LCD display.
- **STATUS 1** - This red LED is a diagnostic blink code LED. Under normal operation, it should not be blinking. If the LED is blinking non-stop along with Status 2 LED, the controller is resetting factory defaults or there is an output force mode active.
- **STATUS 2** - This red LED is a diagnostic blink code LED. If the software is running, this LED should blink at a rate of 1 blink every 10 seconds. If the LED is blinking non-stop along with Status 1 LED, the controller is resetting factory defaults or there is an output force mode active.

Communication LEDs
- **EBUS** - This yellow LED will blink to signal E-BUS communications.
- **BACNET** - This yellow LED will light up and blink continuously to indicate BACnet® communications.

Relay LEDs
- **RLY4, RLY5** - These green LEDs will light up when the relays are enabled and will stay lit as long as they are active.

Binary Input LEDs
- **BIN1** - This green LED will light up when the Remote Start/Stop contact is closed.
- **BIN2** - This green LED will light up when the Water Flow Switch 1 is closed.
- **BIN3** - This green LED will light up when the Emergency Shutdown contact is closed.
- **BIN5** - This green LED will light up when the Phase Brownout contact is closed.
SECTION 3: TROUBLESHOOTING
LF Chiller Main Controller LED Locations

Figure 9: LF Chiller Main Controller LED Locations
Refrigerant A & B Module LED Diagnostics

Refrigerant A & B Module LEDs

The Chiller Refrigerant A & B Modules are equipped with LEDs that can be used to verify operation and perform troubleshooting. See Figure 10, page 35 for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

Diagnostic LEDs

**STATUS** - If the software is running, this LED should blink at a rate of 1 blink per second.

**ALARM (on board)** - If the module does not receive communications for more than 1 minute, this LED will light up, the relays will turn off, and the Analog Outputs will go to 0 VDC.

**ALARM (above LCD display)** - This red LED will light up and stay lit when there is an alarm present. The type of alarm will display on the LCD display. The ALARM LED also blinks when the expansion valve is initializing at startup.

**COMM** - Every time the module receives a valid E-BUS request from the VCCX2 Controller, this LED will blink on and then off, signifying that it received a valid request and responded.

**POWER** - This LED will light up to indicate that 24 VAC power has been applied to the controller.

Relay LEDs

**RLY1 - RLY3** - These green LEDs will light up when the relays are enabled and will stay lit as long as they are active.

Digital Compressor LEDs

**COMP1** - This green LED will light up when Digital Compressor 1 is unloading.

**COMP2** - This green LED will light up when Digital Compressor 2 is unloading.

Refrigerant A Module Binary Input LEDs

**BIN1** - This green LED will light up when the Compressor A1 Status Switch is closed.

**BIN2** - This green LED will light up when the Compressor A2 Status Switch is closed.

**BIN3** - This green LED will light up when the Condenser A VFD Fault contact is closed.

**BIN4** - This green LED will light up when the Circuit A Disable Switch is closed.

Refrigerant B Module Binary Input LEDs

**BIN1** - This green LED will light up when the Compressor B1 Status Switch is closed.

**BIN2** - This green LED will light up when the Compressor B2 Status Switch is closed.

**BIN3** - This green LED will light up when the Condenser B VFD Fault contact is closed.

**BIN4** - This green LED will light up when the Circuit B Disable Switch is closed.
Figure 10: Refrigerant Module A & B LED Locations
**SECTION 3: TROUBLESHOOTING**

**Chiller Pumping Module LED Diagnostics**

**Chiller Pumping Module LEDs**

The Chiller Pumping Module is equipped with LEDs that can be used to verify operation and perform troubleshooting. See Figure 11, page 37 for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

**Operation LEDs - Factory Troubleshooting**

**POWER** - This green LED will light up to indicate that 24 VAC power has been applied to the controller.

**APP HB** - This green LED will light up and blink according to what mode the controller is in. See Table 5.

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>APP HB LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off Mode</td>
</tr>
<tr>
<td>2</td>
<td>Economizer Mode</td>
</tr>
<tr>
<td>3</td>
<td>Freeze Mode</td>
</tr>
</tbody>
</table>

Table 5: APP HB LED Blink Codes

**OS HB** - This green LED will light up and blink continuously to indicate the operating system is working properly.

**WDOG** - This green LED will light up and stay lit to indicate the operating system is working properly.

**Diagnostic LEDs**

**ALARM** - This red LED is a diagnostic blink code LED. It will light up and blink the number of alarms present when there is an alarm(s) present. The type of alarm will display on the LCD display.

**STATUS 1** - This red LED is not used.

**STATUS 2** - This red LED is not used.

**Communication LED**

**EBUS** - This yellow LED will blink to signal E-BUS communications.

**COMM1** - When Comm1 is communicating, this yellow LED will turn on to indicate an error condition, either forced on or forced off.

**COMM2** - When Comm2 is communicating, this yellow LED will turn on to signal economizer max out.

**Relay LEDs**

**RLY1** - This green LED will light up when the relay is enabled and will stay lit as long as it is active.

**Binary Input LEDs**

**BIN1** - This green LED will light up when the WSE VFD Fault Switch 1 is closed.

**BIN4** - This green LED will light up when the Chiller Pump VFD Fault Switch A is closed.

**BIN5** - This green LED will light up when the Chiller Pump VFD Fault Switch B is closed.
Figure 11: Chiller Pumping Module LED Locations
Thermistor Sensor Testing

Temperature/Resistance for Thermistor Sensors

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>-23.33</td>
<td>93333</td>
<td>4.51</td>
</tr>
<tr>
<td>-5</td>
<td>-20.55</td>
<td>80531</td>
<td>4.45</td>
</tr>
<tr>
<td>0</td>
<td>-17.77</td>
<td>69822</td>
<td>4.37</td>
</tr>
<tr>
<td>5</td>
<td>-15</td>
<td>60552</td>
<td>4.29</td>
</tr>
<tr>
<td>10</td>
<td>-12.22</td>
<td>52500</td>
<td>4.2</td>
</tr>
<tr>
<td>15</td>
<td>-9.44</td>
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<tr>
<td>20</td>
<td>-6.66</td>
<td>40147</td>
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<td>25</td>
<td>-3.88</td>
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<td>11652</td>
<td>2.691</td>
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<td>21.66</td>
<td>11379</td>
<td>2.661</td>
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<td>72</td>
<td>22.22</td>
<td>11136</td>
<td>2.635</td>
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<tr>
<td>73</td>
<td>22.77</td>
<td>10878</td>
<td>2.605</td>
</tr>
</tbody>
</table>

Table 6, cont.: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Thermistor Sensor Testing Instructions

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.88 VDC, then the sensor or wiring is open. If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.
0 - 250 PSI Suction Pressure Transducer Testing for R410A Refrigerant

The Evaporator Coil Temperature is calculated by converting the Suction Pressure to Temperature. The Suction Pressure is obtained by using the 0 - 250 PSI Suction Pressure Transducer, which is connected into the Suction Line of the Compressor.

Use the voltage column to check the Suction Pressure Transducer while connected to the Refrigeration Module(s). The LF Chiller Main Controller and the Refrigeration Module(s) must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the +5V terminal located on the Module(s) terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the +5V terminal on the Module(s) terminal block. Use a refrigerant gauge set and/or an accurate electronic thermometer to measure the temperature or suction line pressure near where the Suction Pressure Transducer is connected to the suction line. Measure the Voltage at the +5V and GND terminals and compare it to the appropriate chart depending on the refrigerant you are using. If the temperature/voltage or pressure/voltage readings do not align closely with the chart, your Suction Pressure Transducer is probably defective and will need to be replaced.

See the 0 - 250 PSI Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R410A Refrigerant testing. The charts show a temperature range from 20°F to 80°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and pressures.

### Table 7: Coil Pressure/Voltage/Temp for 0-250 PSI Suction Pressure Transducers - R410A Refrigerant

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>Pressure PSI</th>
<th>Signal DC Volts</th>
<th>Temperature °F</th>
<th>Pressure PSI</th>
<th>Signal DC Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.19</td>
<td>80.94</td>
<td>1.8</td>
<td>59.03</td>
<td>168.10</td>
<td>3.2</td>
</tr>
<tr>
<td>24.49</td>
<td>87.16</td>
<td>1.9</td>
<td>61.17</td>
<td>174.32</td>
<td>3.3</td>
</tr>
<tr>
<td>27.80</td>
<td>93.39</td>
<td>2.0</td>
<td>63.19</td>
<td>180.55</td>
<td>3.4</td>
</tr>
<tr>
<td>30.99</td>
<td>99.62</td>
<td>2.1</td>
<td>65.21</td>
<td>186.78</td>
<td>3.5</td>
</tr>
<tr>
<td>33.89</td>
<td>105.84</td>
<td>2.2</td>
<td>67.23</td>
<td>193.00</td>
<td>3.6</td>
</tr>
<tr>
<td>36.80</td>
<td>112.07</td>
<td>2.3</td>
<td>69.24</td>
<td>199.23</td>
<td>3.7</td>
</tr>
<tr>
<td>39.71</td>
<td>118.29</td>
<td>2.4</td>
<td>71.15</td>
<td>205.46</td>
<td>3.8</td>
</tr>
<tr>
<td>42.30</td>
<td>124.52</td>
<td>2.5</td>
<td>72.95</td>
<td>211.68</td>
<td>3.9</td>
</tr>
<tr>
<td>44.85</td>
<td>130.75</td>
<td>2.6</td>
<td>74.76</td>
<td>217.91</td>
<td>4.0</td>
</tr>
<tr>
<td>47.39</td>
<td>136.97</td>
<td>2.7</td>
<td>76.57</td>
<td>224.14</td>
<td>4.1</td>
</tr>
<tr>
<td>49.94</td>
<td>143.2</td>
<td>2.8</td>
<td>78.37</td>
<td>230.36</td>
<td>4.2</td>
</tr>
<tr>
<td>52.23</td>
<td>149.42</td>
<td>2.9</td>
<td>80.18</td>
<td>236.59</td>
<td>4.3</td>
</tr>
<tr>
<td>54.50</td>
<td>155.65</td>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56.76</td>
<td>161.88</td>
<td>3.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discharge Thermistor Temperature/Sensor Testing

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the table. Please follow the notes and instructions that appear after the chart when checking sensors.

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (K Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>194</td>
<td>90</td>
<td>7.87</td>
<td>2.19</td>
</tr>
<tr>
<td>203</td>
<td>95</td>
<td>6.77</td>
<td>2.01</td>
</tr>
<tr>
<td>212</td>
<td>100</td>
<td>5.85</td>
<td>1.84</td>
</tr>
<tr>
<td>221</td>
<td>105</td>
<td>5.09</td>
<td>1.68</td>
</tr>
<tr>
<td>230</td>
<td>110</td>
<td>4.45</td>
<td>1.53</td>
</tr>
<tr>
<td>239</td>
<td>115</td>
<td>3.87</td>
<td>1.39</td>
</tr>
<tr>
<td>248</td>
<td>120</td>
<td>3.35</td>
<td>1.25</td>
</tr>
<tr>
<td>257</td>
<td>125</td>
<td>2.92</td>
<td>1.12</td>
</tr>
<tr>
<td>266</td>
<td>130</td>
<td>2.58</td>
<td>1.02</td>
</tr>
<tr>
<td>275</td>
<td>135</td>
<td>2.28</td>
<td>0.92</td>
</tr>
<tr>
<td>284</td>
<td>140</td>
<td>2.02</td>
<td>0.83</td>
</tr>
<tr>
<td>293</td>
<td>145</td>
<td>1.80</td>
<td>0.76</td>
</tr>
<tr>
<td>302</td>
<td>150</td>
<td>1.59</td>
<td>0.68</td>
</tr>
<tr>
<td>311</td>
<td>155</td>
<td>1.39</td>
<td>0.61</td>
</tr>
<tr>
<td>320</td>
<td>160</td>
<td>1.25</td>
<td>0.55</td>
</tr>
<tr>
<td>329</td>
<td>165</td>
<td>1.12</td>
<td>0.50</td>
</tr>
<tr>
<td>338</td>
<td>170</td>
<td>1.01</td>
<td>0.45</td>
</tr>
<tr>
<td>347</td>
<td>175</td>
<td>0.92</td>
<td>0.42</td>
</tr>
<tr>
<td>356</td>
<td>180</td>
<td>0.83</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Table 8, cont.: Discharge Thermistor Temperature/Resistance

Thermistor Sensor Testing Instructions

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.98 VDC, then the sensor or wiring is “open.” If the voltage is less than 0.38 VDC, then the sensor or wiring is shorted.
WARNING: When using a single transformer to power more than one controller or expansion module, the correct polarity must always be maintained between the boards. Failure to observe correct polarity will result in damage to the LF Chiller Controller and its associated modules.

Please carefully read and apply the following information when wiring the LF Chiller Main Controller and its associated modules.

1. All wiring is to be in accordance with local and national electrical codes and specifications.
2. All 24 V AC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the controller and connected devices.
3. Minimum wire size for 24 V AC wiring should be 18-gauge.
4. Minimum wire size for all sensors should be 24-gauge. Some sensors require 2-conductor wire and some require 3-or 4-conductor wire.
5. Minimum wire size for 24 V AC thermostat wiring should be 22 gauge.
6. Be sure that all wiring connections are properly inserted and tightened into the terminal blocks. Do not allow wire strands to stick out and touch adjoining terminals which could potentially cause a short circuit.
7. When communication wiring is to be used to interconnect LF Chiller Main Controllers together or to connect to other communication devices, all wiring must be plenum-rated, minimum 18-gauge, 2-conductor, twisted pair with shield. AAON can supply communication wire that meets this specification and is color coded for the network or local loop. Please consult your AAON distributor for information. If desired, Belden #82760 or equivalent wire may also be used.
8. Before applying power to the LF Main Chiller Controller and its associated modules, be sure to recheck all wiring connections and terminations thoroughly.
SECTION 3: TROUBLESHOOTING

Important Wiring Considerations

General

Correct wiring of the LF Chiller Main Controller and its modules is the most important factor in the overall success of the controller installation process. The LF Chiller Main Controller and Modules are factory installed and wired at the AAON® factory. Some of the following information may not apply to your installation if it was pre-wired at the factory. However, if troubleshooting of the controller is required, it is a good idea to be familiar with the system wiring.

Wiring

The LF Chiller Main Controller and associated modules must be connected to an 18-30 VAC power source of the proper size for the calculated VA load requirements. All transformer sizing should be based on the VA rating listed in Tables 9, 10 & 11.

### Table 9: LF Chiller Main Controller Electrical and Environmental Requirements

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Voltage</th>
<th>VA Load</th>
<th>Operating Temperature</th>
<th>Humidity (Non-Condensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main LF Chiller Controller</td>
<td>18-30VAC (25%/-15%), Class 2</td>
<td>15</td>
<td>-30°F to 150°F</td>
<td>0-95% RH</td>
</tr>
</tbody>
</table>

**Inputs**
- Resistive Inputs require 10KΩ Type 3 Thermistor
- 24VAC Inputs provide 4.7kΩ Load

**Outputs**
- Relay Outputs: 1 Amp maximum per output

### Table 10: Chiller Pumping Module Electrical and Environmental Requirements

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Voltage</th>
<th>VA Load</th>
<th>Operating Temperature</th>
<th>Humidity (Non-Condensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiller Pumping Module</td>
<td>18-30VAC (25%/-15%), Class 2</td>
<td>15</td>
<td>-30°F to 150°F</td>
<td>0-95% RH</td>
</tr>
</tbody>
</table>

**Inputs**

**Outputs**
- Relay Outputs: 1 Amp maximum per output

### Table 11: Chiller Refrigerant Module Environmental Requirements

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Voltage</th>
<th>VA Load</th>
<th>Operating Temperature</th>
<th>Humidity (Non-Condensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiller Refrigerant Module</td>
<td>18-30VAC (25%/-15%), Class 2</td>
<td>18</td>
<td>-30°F to 150°F</td>
<td>0-95% RH</td>
</tr>
</tbody>
</table>

**Inputs**

**Outputs**
- Relay Outputs: 1 Amp maximum per output
APPENDIX A - LF CHILLER MAIN CONTROLLER LCD SCREENS

Navigation Keys & Editing Keys

LCD Display Screen & Navigation Keys

The LCD display screens and buttons allow you to view status and alarms, enable force modes, and make BACnet® configuration changes. See Figure 12, below and refer to Table 12 for Navigation Key functions. The keys also have editing functions. Refer to Table 13 for Editing functions.

Table 12: Navigation Key Functions

<table>
<thead>
<tr>
<th>NAVIGATION KEY</th>
<th>KEY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU</td>
<td>Use the MENU key to move through screens within Main Menu categories and return to the Main Menu while at other screens.</td>
</tr>
<tr>
<td>UP</td>
<td>Use this key to adjust setpoints and change configurations.</td>
</tr>
<tr>
<td>DOWN</td>
<td>Use this key to adjust setpoints and change configurations.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Use the ENTER key to navigate through the Main Menu Screen categories.</td>
</tr>
</tbody>
</table>

Table 13: Editing Key Functions

<table>
<thead>
<tr>
<th>EDITING KEY</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP or DOWN</td>
<td>Use the UP or DOWN key to enter editing mode on a user-adjustable screen. Edit Mode is indicated by the underscore appearing on the screen.</td>
</tr>
<tr>
<td></td>
<td>NOTE: Entering Edit Mode will also adjust the value up one (UP key) or down one (DOWN key), so you may have to readjust the value.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Use the ENTER key to move through the digits in the screen when editing a numeric value. An extended press of the ENTER key saves your edits no matter the location of the editing cursor within the digits.</td>
</tr>
<tr>
<td></td>
<td>Press the ENTER key to save a non-numeric value - such as Hi Speed Network.</td>
</tr>
<tr>
<td>MENU</td>
<td>The MENU key cancels editing when in Edit Mode. The screen you were editing will return to its original value and the underscore will disappear.</td>
</tr>
<tr>
<td></td>
<td>A second press of the MENU key will return you to the Main Menu.</td>
</tr>
</tbody>
</table>

Figure 12: LCD Display and Navigation/Editing Keys
Main Screens Map

Refer to the following map when navigating through the *LF Chiller Main Controller Screens*. The first screen is an initialization screen. To scroll through the rest of the screens, press the `<MENU>` button.

Press **M** to go to the *Settings Screen*.

Press **✓** to scroll through the *Settings Screens*.

Press **M** to go to the *Glycol Screen*.

Press **✓** to scroll through the *Glycol Screens*.

Press **M** to go to the *Status Screen*.

Press **✓** to scroll through the *Status Screens*.

Press **M** to go to the *Alarms Screen*.

Press **✓** to scroll through the *Alarms*.

Press **M** to return to the first *Main Menu Screen*.

Settings Screens

Refer to the following map when navigating through the *Settings Screens*. From the *Settings Screen*, press `<ENTER>` to scroll through the screens.

**Settings**

**Unit ID#**

Addr #1-59

**UNIT ADDRESS**

Unit address. Valid range is 1-59. Default is 1.

**485-Baud**

Hi Speed or Lo Speed

**BAUD RATE SPEED**

485 baud rate speed. Valid range Hi Speed or Lo Speed. Default is Hi Speed.

**MAC Addr**

0 T0 127

**BACnet® - CURRENT MAC ADDRESS**

Valid range is 0 to 127. Default is 1.

The `<ENTER>` key moves the cursor between the digit fields starting with the ones field. Once the cursor is under a field, use the `<UP>` & `<DOWN>` arrow keys to select a number between 0 and 9.
**APPENDIX A - LF CHILLER MAIN CONTROLLER LCD SCREENS**

**Settings Screens & Glycol Screens**

- **DEVICEID**
  
  LCD SCREEN:
  
  DEVICEID
  15000

- **BACnet® - CURRENT DEVICE ID**
  
  A Device ID of up to 7 digits can be entered.
  
  The **<ENTER>** key moves the cursor between the digit fields starting with the ones field. Once the cursor is under a field, use the **<UP>** & **<DOWN>** arrow keys to select a number between 0 and 9.

- **MSTPBaud**
  
  LCD SCREEN:
  
  MSTPBaud
  38400

- **BACnet® - CURRENT BAUD RATE**
  
  9600, 19200, 38400, 57600, 76800. Default is 38400.

- **E-BUS COMMUNICATIONS**
  
  LCD SCREEN:
  
  Lo Speed or Hi Speed

- **GLYCOL PERCENTAGE**
  
  Valid percentages are 0, 15, 20, 25, 30. Default is 0%.

- **KEY CODE**
  
  LCD SCREEN:
  
  Key Code
  12345678

- **HASH CODE**
  
  LCD SCREEN:
  
  Hash Code
  0

---

**Glycol Screens**

Refer to the following map when navigating through the Glycol Screens. From the **Glycol Screen**, press **<ENTER>** to scroll through the screens.

- **GLYCOL PERCENTAGE**
  
  LCD SCREEN:
  
  Glycol at 0%

- **KEY CODE**
  
  LCD SCREEN:
  
  Key Code
  12345678

- **HASH CODE**
  
  LCD SCREEN:
  
  Hash Code
  0
Status Screens

Refer to the following map when navigating through the Status Screens. From the Status Screen, press <ENTER> to scroll through the screens.

**Status**

**OperMode**

**OFF MODE**

**OPERATION MODE**

This screen displays the current mode of operation. Options are:

- OFF MODE
- RUN MODE
- HOL OFF
- HOL RUN
- START-UP
- SHUTDOWN
- LOCKOUT

**CHILLER WATER INLET TEMPERATURE**

**CHILLER WATER OUTLET TEMPERATURE**

**OUTDOOR AIR TEMPERATURE**
Alarm Screens

If there are no Alarms, the Alarm Screen will display “No Alarms.” If there are alarms present, the screen will display, “Alarms.” You can press <ENTER> to scroll through the alarms or you can let the alarms automatically scroll on the screen.

NO ALARMS
This will be shown if there are no current alarms.

ACTIVE ALARMS!
This will display if there are active alarms.

Inlet SENSOR: The chiller water inlet temperature sensor has failed.

Outlet SENSOR: The chiller water outlet temperature sensor has failed.

OAT SENSOR: The outdoor air temperature sensor has failed.

PHASE LOSS: A phase loss has occurred.

EMG SHUTDOWN: An emergency shutdown has occurred.

SEC OUT NO SENSE: The secondary heat exchanger outlet temperature sensor has failed.

H2OProof ALARM: Water flow switch 1 or 2 has been disabled.

WaterOut TOO HIGH: The chiller water outlet temperature has risen above the chiller water temperature setpoint.

WaterOut CUTOFF: The chiller water outlet temperature has risen above the chiller water temperature cutoff setpoint.

REFRIG 1 MISSING: Refrigeration Module 1 is not communicating.

REFRIG 2 MISSING: Refrigeration Module 2 is not communicating.

CPM Mod MISSING: The Chiller Pumping Module is not communicating.

REFRIG 1 ALARM: Refrigeration Module 1 has an alarm.

REFRIG 2 ALARM: Refrigeration Module 2 has an alarm.

CPM Mod ALARM: Chiller Pumping Module has an alarm.

UNKNOWN ALARM: There is an unknown alarm.
Main Screens Map

Refer to the following map when navigating through the Chiller Refrigerant Module LCD Main Screens. To scroll through the screens, press the <MENU> button.

Press ✅ to scroll through the CHILLER REFRIG Screens.

Press M to go to STATUS MENU Screen.

Press ✅ to scroll through STATUS MENU Screens.

Press M to go to SENSOR MENU Screen.

Press ✅ to scroll through SENSOR MENU Screens.

Press M to return to the SETPOINT STATUS Screen.

Press ✅ to scroll through SETPOINT STATUS Screens.

Press M to go to ALARM WARNINGS Screen.

Press ✅ to scroll through ALARM WARNINGS Screens.

Press M to go to ALARM FAULTS Screen.

Press ✅ to scroll through ALARM FAULTS Screens.

Press M to return to the ALARM LOCKOUTS Screen.

Press ✅ to scroll through ALARM LOCKOUTS Screens.
Module Screens

Refer to the following map when navigating through the Chiller Refrigerant Module Screens. From the CHILLER Main Screen, press <ENTER> to scroll through the screens.

Status Menu Screens

Refer to the following map when navigating through the Status Screens. From the STATUS MENU Screen, press <ENTER> to scroll through the screens.
APPENDIX B - REFRIGERANT MODULE LCD SCREENS

Status Menu & Sensor Menu Screens

Sensor Menu Screens

Refer to the following map when navigating through the Sensor Screens. From the SENSOR MENU Screen, press <ENTER> to scroll through the screens.
Sensor Menu Screens

- **LIQDCALC XX.X°F**
  - Liquid line temperature sensor calculation

- **EVAPTEMP XX.X°F**
  - Evaporation temperature reading from input

- **DISCTEMP XXX.X°F**
  - Discharge temperature reading from input

- **LIQDTEMP XXX.X°F**
  - Liquid line temperature reading from input

- **LVGH20 XXX.X°F**
  - Leaving water temperature

- **DISCH SH XX.X°F**
  - Discharge superheat temperature

- **SUBCOOL XX.X°F**
  - Subcool temperature

- **SUBRHEAT XX.X°F**
  - Superheat temperature
Setpoint Status & Alarm Menu Screens

Setpoint Status Screens

Refer to the following map when navigating through the Screens. From the SETPOINT STATUS Screen, press <ENTER> to scroll through the screens.

### ALARM WARNINGS
This will be shown if there are no current warnings.

### NO WARNINGS
This will display if there are active warnings.

Low Suction Pressure

Low Suction Pressure Startup

High Discharge Pressure Level 1

High Discharge Pressure Level 2

Discharge Pressure not detected

High Superheat

Discharge Line Temperature Sensor not detected

Condenser VFD Overcurrent

Alarm Screens

If an alarm is present, the ALARM LED above the LCD display will light up red and blink. The Alarms will display and scroll automatically from the ALARMS screen when alarms are present.
APPENDIX B - REFRIGERANT MODULE LCD SCREENS

Alarm Menu Screens

**ALARM FAULTS**

NO FAULTS
This will be shown if there are no current faults.

FAULTS!
This will display if there are active faults.

**ALARM LOCKOUTS**

NO LOCKOUTS
This will be shown if there are no current lockouts.

LOCKOUTS!
This will display if there are active lockouts.

**LOW SUCT PRESSURE**: Low Suction Pressure

**UNSAFE SUCT PSI**: Unsafe Suction Pressure

**HIGH PSI TRIP**: High Discharge Pressure Trip

**HIGH PSI TRIP C2**: Compressor 2 Fail from High Discharge Pressure

**C1 NO START**: Compressor 1 not running

**C2 NO START**: Compressor 2 not running

**LOW SUPRHEAT**: Low Superheat

**HIGH DISCTEMP**: High Discharge Line Temperature

**C1 FALSE ACTIVE**: Compressor 1 False Active

**C2 FALSE ACTIVE**: Compressor 2 False Active

**COMM TIMEOUT**: Communication Loss

**HIGH SUPRHEAT**: High Superheat

**SLT NODETECT**: Cannot detect Suction Line Temperature Sensor

**SUCT PSI NODETECT**: Cannot detect Suction Pressure Temperature Sensor

**HIGH SAT TEMP**: High Saturation Temperature

**C1 OVER CURRENT**: Compressor 1 Overcurrent

**C2 OVER CURRENT**: Compressor 2 Overcurrent

**C1 LOW CURRENT**: Compressor 1 Undercurrent

**C2 LOW CURRENT**: Compressor 2 Undercurrent

**SUFT PSI LOCKOUT**: Low/Unsafe Suction Pressure

**LOW DISC PSI L/O**: Low Discharge Pressure Lockout

**HIGHDISC PSI L/O**: High Discharge Pressure Lockout

**LOW SH LOCKOUT**: Low Superheat Lockout

**HIGH SH LOCKOUT**: High Superheat Lockout

**HIGHDISC TEMP L/O**: High Discharge Line Temperature

**C1 >AMPS LOCKOUT**: Compressor 1 Overcurrent

**C2 >AMPS LOCKOUT**: Compressor 2 Overcurrent

**HIGH SAT LOCKOUT**: High Saturation Temperature

**C1 <AMPS LOCKOUT**: Compressor 1 Undercurrent Lockout

**C2 <AMPS LOCKOUT**: Compressor 2 Undercurrent Lockout
Main Screens Map

Refer to the following map when navigating through the Chiller Pumping Module Main Screens. To scroll through the screens, press the <MENU> button.

Press ✓ to scroll through the CPM Screens.
Press M to go to SYSTEM STATUS Screen.
Press ✓ to scroll through SYSTEM STATUS Screens.
Press M to go to SENSOR STATUS Screen.
Press ✓ to scroll through SENSOR STATUS Screens.
Press M to go to ALARMS Screen.
Press ✓ to scroll through the ALARMS Screens.
Press M to go to ALARM HISTORY Screen.
Press ✓ to scroll through the ALARM HISTORY Screens.
Press M to go to SETPOINT STATUS Screen.
Press ✓ to scroll through the SETPOINT STATUS Screens.

Module Screens

Refer to the following map when navigating through the Chiller Pumping Module Screens. From the WSE Main Screen, press <ENTER> to scroll through the screens.

Press ✓ to go to the SETPOINT STATUS Screen.
Press ✓ to scroll through the SETPOINT STATUS Screens.
Press ✓ to go to E-BUS COMMUNICATION DIAGNOSTICS.
Number of COMM packets received. This value will count up to 65535 and rollover to 0.
Press ✓ to go to SOFTWARE AND SOFTWARE VERSION.
Press ✓ to go to SOFTWARE.
Press ✓ to go to ADDRESS.
Press ✓ to go to CURRENT EBUS ADDRESS.
Press ✓ to go to WSE OPERATION STATUS.
Press ✓ to go to ISOLATED GLYCOL LOOP.
This screen will be present if WSE is enabled. It will display Yes if the module is configured to control an isolated (glycol) loop.
APPENDIX C - CHILLER PUMPING MODULE LCD SCREENS

Module Screens

**TEMP CFG**
- F or C

FAHRENHEIT OR CELSIUS
This screen will be present if WSE is enabled.

**CP**
- Enabled/Disabled

CHILLER PUMP OPERATION STATUS

**CP CFG**

CHILLER PUMP CONFIGURATION
This screen will be present only if the Chiller Pump is enabled.
- PRIM FIXED = Primary only with Fixed Speed Pump
- PRIM VAR = Primary only with Variable Speed Pump
- PRIM+SEC = Primary + Secondary Pumps
- A+B+SEC = Primary A + Primary B + Secondary Pumps

**MAX BLDG**
- XXX PSI

MAXIMUM BUILDING PUMP PRESSURE
This screen will be present only if the Chiller Pump is enabled and configuration is not primary fixed speed pump. It indicates the maximum pressure allowed out of the building pump before failing.

**DIF BLDG**
- XXX PSI

TARGET DIFFERENTIAL PRESSURE
This screen will be present only if the Chiller Pump is enabled and configuration is not primary fixed speed pump. It indicates the target differential pressure for the variable speed pump control.

**FRZ PROT**
- Enabled/Disabled

FREEZE PROTECTION STATUS
This screen will be present only if both the WSE and Chiller Pump are enabled. It indicates if the pumps will be enabled to self operation when the WSE goes into freeze protection.

**SECONDARY SINGLE/DUAL**

SECONDARY PUMP CONFIGURATION
This screen will be present only if the Chiller Pump is enabled and configured to have a secondary pump.
- SINGLE = Only one Secondary Pump
- DUAL = Has Backup Pump

**PRIMARY SINGLE/DUAL**

PRIMARY A PUMP CONFIGURATION
This screen will be present only if the Chiller Pump is enabled.
- SINGLE = Only one Primary A Pump
- DUAL = Has Backup Pump

PRIMARY B PUMP CONFIGURATION
This screen will be present only if the Chiller Pump is enabled.
- SINGLE = Only one Primary B Pump
- DUAL = Has Backup Pump
System Status Screens

Refer to the following map when navigating through the System Status Screens. From the SYSTEM STATUS Screen, press <ENTER> to scroll through the screens.

- **SYSTEM STATUS**
- **WSE MODE**
- **CURRENT OPERATING MODE**
  - Possible values are OFF or ECONO
- **PRIM VLV XXX%**
- **PRIMARY 3-WAY VALVE POSITION**
  - This screen will only be present if WSE is enabled.
- **CP MODE**
- **CURRENT FAN VFD DRIVE LEVEL**
  - This screen will only be present if WSE is enabled.
- **FAN VFD X.X%**
- **FAN STAT OFF/ON**
- **FAN OPERATING STATUS**
  - This screen will only be present if WSE is enabled.
- **SEC VLV XXX%**
- **SECONDARY 3-WAY VALVE POSITION**
  - This screen will only be present if WSE is enabled and is configured to have an isolated (glycol) loop.
- **PRMA PMP ON/OFF**
- **PRIMARY A PUMP CURRENT RUN STATUS**
  - This screen will be present only if the Chiller Pump is enabled.
  - Will display OFF or PUMPING.
- **PRIM VLV XXX%**
- **CURRENT CHILLER RUN COMMAND**
  - This screen will be present only if the Chiller Pump is enabled.
  - OFF = No Pump command is currently active.
  - PRIM A = Primary A is commanded to run
  - PRIM B = Primary B is commanded to run
  - PRIM A+B = Both A & B are commanded to run.
- **SEC PMP ON/OFF**
- **SECONDARY PUMP CURRENT RUN STATUS**
  - This screen will be present only if the Chiller Pump is enabled and configured to have a secondary pump.
  - Will display OFF or PUMPING.
APPENDIX C - CHILLER PUMPING MODULE LCD SCREENS

System Status & Sensor Status Screens

Sensor Status Screens

Refer to the following map when navigating through the Sensor Status Screens. From the SENSOR STATUS Screen, press <ENTER> to scroll through the screens.

**Sensor Status Screens**

- **PRMB PMP ON/OFF**
  
  PRIMARY B PUMP CURRENT RUN STATUS
  This screen will be present only if the Chiller Pump is enabled and configured for Primary A + Primary B + Secondary.
  Will display OFF or PUMPING.

- **BLDG PMP VFD XXX%**
  
  BUILDING PUMP VFD CURRENT DRIVE STATUS
  This screen will be present only if the Chiller Pump is enabled and configured as Primary Only with Fixed Speed Pump.
  Will display OFF or PUMPING.

- **BLDG DIF XXX PSI**
  
  CALCULATED DIFFERENTIAL BUILDING PRESSURE
  This screen will be present only if the Chiller Pump is enabled and configured as Primary Only with Fixed Speed Pump.
  Will display OFF or PUMPING.

**Primary Mixing Valve Outlet Temperature**
This screen is only present if WSE is enabled.

**Primary Mixing Valve Feed Temperature**
This screen is only present if WSE is enabled.

**Heat Exchanger Secondary Side Inlet Temperature**
This screen is only present if WSE is enabled and the module is configured for isolated operation. It shows the heat exchanger secondary side inlet temperature (F/C).

**Heat Exchanger Secondary Side Outlet Temperature**
This screen is only present if WSE is enabled and the module is configured for isolated operation. It shows the heat exchanger secondary side outlet temperature (F/C).
Sensor Status Screens

**APPENDIX C - CHILLER PUMPING MODULE LCD SCREENS**

**PRIMARY A FLOW SWITCH INPUT STATUS**
This screen is only present if CP is enabled. It shows the Primary A flow switch input status as “FLOWING” or “NO FLOW”.

**PRIMARY B FLOW SWITCH INPUT STATUS**
This screen is only present if CP is enabled. It shows the Primary B flow switch input status as “FLOWING” or “NO FLOW”.

**BUILDING SUCTION PRESSURE SENSOR TEMPERATURE**
This screen is only present if CP is enabled and not configured for primary only w/fixed speed pumps. It shows the building suction pressure sensor temperature reading.

**BUILDING DISCHARGE PRESSURE SENSOR TEMPERATURE**
This screen is only present if CP is enabled and not configured for primary only w/fixed speed pumps. It shows the building discharge pressure sensor.

**OUTDOOR AIR TEMPERATURE READING FROM MAIN CONTROLLER**

**LEAVING WATER TEMPERATURE READING FROM MAIN CONTROLLER**
Alarms Screen

If an alarm is present, the ALARM LED above the LCD display will light up red and blink. The Alarms will display and scroll automatically from the ALARMS screen when alarms are present.

**NO ALARMS**
This will be shown if there are no current alarms.

**ACTIVE ALARMS!**
This will display if there are active alarms.

**WSE NOT OPERATE:** The WSE is not operating.

**IN FRZ PROTECT:** In Freeze Protection Mode.

**PRIM OUT NO SENSE:** The primary mixing valve outlet temperature sensor has failed.

**PRIM IN NO SENSE:** The primary mixing valve feed temperature sensor has failed.

**SEC IN NO SENSE:** The secondary heat exchanger inlet temperature sensor has failed.

**SEC OUT NO SENSE:** The secondary heat exchanger outlet temperature sensor has failed.

**FAN VFD FAULT:** Fan VFD Fault detected.

**SUC SNSR FAULT:** The building suction pressure sensor is determined to be faulty.

**DIS SNSR FAULT:** The building discharge pressure sensor is determined to be faulty.

**PMP1 VFD FAULT:** First VFD pump fault detected.

**PMP2 VFD FAULT:** Second VFD pump fault detected.

**PAP1 LOCKOUT:** Primary A Pump 1 locked out.

**PAP2 LOCKOUT:** Primary A Pump 2 locked out.

**SEC1 LOCKOUT:** Secondary Pump 1 locked out.

**SEC2 LOCKOUT:** Secondary Pump 2 locked out.

**PBP1 LOCKOUT:** Primary B Pump 1 locked out.

**PBP2 LOCKOUT:** Primary B Pump 2 locked out.

**CP SYSTM LOCKOUT:** Chiller pumping system is locked out.

**COMM FAULT:** Communications have failed. For testing purposes, the comm fault trigger can be disabled. The disable is not stored and self-clears when power is removed.
Alarm History Screen

The ALARM HISTORY screen will display the last occurrence of the given alarm in minutes if the last occurrence was 60 minutes or less, hours if the last occurrence was 72 hours or less, days if the last occurrence was 30 days or less and 0 if the last occurrence was over 30 days or the alarm has not been triggered since power up. Alarm histories are only kept as long as the unit is powered; they clear on loss of power.

**WSE NOOP ## MIN:** This screen is only present if WSE is enabled. Last occurrence of WSE is not operating alarm.

**FRZ PROT ## HR:** This screen is only present if WSE is enabled. Last occurrence of freeze protection mode alarm.

**PRIM OUT ## DAY:** This screen is only present if WSE is enabled. Last occurrence of primary mixing valve outlet temperature sensor failure detection.

**PRIM IN ## MIN:** This screen is only present if WSE is enabled. Last occurrence of primary mixing valve feed temperature sensor failure detection.

**SEC IN ## MIN:** This screen is only present if WSE is enabled and the module is configured for isolated operation. It shows last occurrence of secondary heat exchanger inlet temperature sensor failure.

**SEC OUT ## DAY:** This screen is only present if WSE is enabled and the module is configured for isolated operation. It shows last occurrence of secondary heat exchanger inlet temperature sensor failure.

**FAN VFD ## MIN:** This screen is only present if WSE is enabled. Last occurrence of a fan VFD fault.

**PMP1 VFD ## HR:** This screen is only present if CP is enabled. Time since occurrence of a VFD pump 1 fault.

**PMP2 VFD ## DAY:** This screen is only present if CP is enabled and not configured for primary only w/fixed speed pump. Time since occurrence of a VFD pump 2 fault.

**PAP1 LCK ## MIN:** This screen is only present if CP is enabled. Time since occurrence of a primary A, pump 1 lockout.

**PAP2 LCK ## HR:** This screen is only present if CP is enabled and primary A is configured for backup. Time since occurrence of a primary A, pump 2 lockout.

**SEC1 LCK ## DAY:** This screen is only present if CP is enabled and configured for a secondary. Time since occurrence of a secondary pump 1 lockout.

**SEC2 LCK ## MIN:** This screen is only present if CP is enabled, configured for a secondary and the secondary is configured for backup. Time since occurrence of a secondary pump 2 lockout.

**CP LCK ## MIN:** This screen is only present if CP is enabled. Time since occurrence of a chiller pumping system lockout.

**COMM FLT ## HR:** Last occurrence of a communications fault.
Setpoint Status Screens

Refer to the following map when navigating through the Screens. From the SETPOINT STATUS Screen, press <ENTER> to scroll through the screens.

- **VFD MIN**
  - SETPOINT STATUS
  - FAN VFD MINIMUM OPERATING SPEED IN PERCENT
  - This screen is only present if WSE is enabled.
  - Range is 10 to 50%

- **MIN VLV FAN**
  - PRIM OUT XX.X°F
  - PRIMARY MIXING VALVE OUTLET TEMPERATURE TARGET SETPOINT
  - This screen is only present if WSE is enabled.
  - Range is 0.0 to 70.0°F

- **FRZ PROT XX.X°F**
  - FREEZE PROTECT SETPOINT FOR THE PRIMARY FEED SENSOR
  - This screen is only present if WSE is enabled.
  - Range is 0.0 to 50.0°F

- **FAN DLY ## SEC**
  - FAN STAGE UP DELAY SETPOINT
  - This screen is only present if WSE is enabled.
  - Range is 0 to 30 seconds

- **MIN VLV**
  - SLW OPEN RATE ## M
  - PRIMARY MIXING VALVE SLOW OPENING RATE USED IN BRINGING WSE ON-LINE WITH COMPRESSORS RUNNING
  - This screen is only present if WSE is enabled.
  - Range is 1 to 30 minutes

- **SLW CLOS RATE ## M**
  - PRIMARY MIXING VALVE SLOW CLOSING RATE USED IN DISABLING WSE WHILE COMPRESSORS ARE RUNNING
  - This screen is only present if WSE is enabled.
  - Range is 1 to 30 minutes
APPENDIX C - CHILLER PUMPING MODULE LCD SCREENS

Setpoint Status Screens

- **HEAT EXCHANGER SECONDARY SIDE INLET TEMPERATURE SETPOINT**
  This screen is only present if WSE is enabled and the module is configured for isolated operation. Range is 0.0 to 50.0°F

- **SEC IN XX.X°F**

- **HEAT EXCHANGER SECONDARY SIDE INLET TEMPERATURE SETPOINT**
  This screen is only present if WSE is enabled and the module is configured for isolated operation. Range is 0.0 to 50.0°F

- **SEC OUT XX.X°F**

- **TARGET DIFFERENTIAL BUILDING PRESSURE**
  This screen is only present if CP is enabled and not configured for primary only w/ fixed speed pumps. Range is 0 to 100 PSI.

- **BLDG DIF XX PSI**

- **MAXIMUM BUILDING PRESSURE**
  This screen is only present if CP is enabled and not configured for primary only w/ fixed speed pumps. It sets the maximum allowed building pressure from 0 to 200 PSI.

- **BLDG MAX XXX PSI**
**LF CHILLER MAIN CONTROLLER**

**Programming Note:**
Use Settings Menu In LCD Display To Program The BACnet® Settings.

**MS/TP Connection To BACnet®**

Typical Terminal Blocks. All Wiring To Be R+ To R+, SH (G) To SH (G) & T- To T-

Size Transformer For Correct Total Load. Main LF Chiller Controller = 15 VA

**Wiring Notes:**
1.) All wiring to be in accordance with local and national electrical codes and specifications.
2.) All communication wiring to be 18 gauge minimum, 2 conductor twisted pair with shield. Use Belden #82760 or equivalent.

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Figure 13: BACnet® Connection to MS/TP Network
### BACnet® Analog Inputs

#### Table 13: BACnet® MS/TP Parameter Analog Inputs

<table>
<thead>
<tr>
<th>Point Type</th>
<th>Number</th>
<th>BACnet® Point Name</th>
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</thead>
<tbody>
<tr>
<td>AI</td>
<td>1</td>
<td>Application Version</td>
</tr>
<tr>
<td>AI</td>
<td>2</td>
<td>Entering Water Temperature</td>
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<tr>
<td>AI</td>
<td>3</td>
<td>Leaving Water Temperature</td>
</tr>
<tr>
<td>AI</td>
<td>4</td>
<td>Leaving Water Setpoint</td>
</tr>
<tr>
<td>AI</td>
<td>5</td>
<td>Outdoor Air Temperature</td>
</tr>
<tr>
<td>AI</td>
<td>6</td>
<td>WSE Primary Feed Temperature</td>
</tr>
<tr>
<td>AI</td>
<td>7</td>
<td>WSE Primary Outlet Temperature</td>
</tr>
<tr>
<td>AI</td>
<td>8</td>
<td>WSE Primary 3-Way Valve</td>
</tr>
<tr>
<td>AI</td>
<td>9</td>
<td>WSE VFD Speed</td>
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<tr>
<td>AI</td>
<td>10</td>
<td>Pump Discharge Pressure</td>
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<tr>
<td>AI</td>
<td>11</td>
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<td>AI</td>
<td>12</td>
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<tr>
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<td>19</td>
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<td>29</td>
<td>A-Compressor A1 Percentage</td>
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<td>A-Compressor A2 Percentage</td>
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<td>B-Compressor B2 Current</td>
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Table 13: BACnet® MS/TP Parameter Analog Inputs
### BACnet® Analog Values

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<tr>
<th>BACnet® Point Type</th>
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<th>Limit Range</th>
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Table 14: BACnet® MS/TP Parameter Analog Values
## BACnet® Binary Inputs

<table>
<thead>
<tr>
<th>BACnet® Point Type</th>
<th>Number</th>
<th>BACnet® Name</th>
<th>Value</th>
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<tbody>
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<td>BI</td>
<td>2</td>
<td>Proof of Water Flow</td>
<td>Status</td>
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<tr>
<td>BI</td>
<td>3</td>
<td>Emergency Shutdown</td>
<td>Status</td>
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<td>BI</td>
<td>4</td>
<td>Phase Loss</td>
<td>Status</td>
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<td>BI</td>
<td>5</td>
<td>WSE Fan Run Status</td>
<td>Status</td>
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<tr>
<td>BI</td>
<td>6</td>
<td>WSE at Maximum Capacity</td>
<td>Status</td>
</tr>
<tr>
<td>BI</td>
<td>7</td>
<td>WSE Enable Status</td>
<td>Status</td>
</tr>
<tr>
<td>BI</td>
<td>8</td>
<td>WSE Alarm Not Operating</td>
<td>Alarm</td>
</tr>
<tr>
<td>BI</td>
<td>9</td>
<td>WSE Alarm Free Freeze Protection</td>
<td>Alarm</td>
</tr>
<tr>
<td>BI</td>
<td>10</td>
<td>WSE Alarm Primary Outlet Sensor</td>
<td>Alarm</td>
</tr>
<tr>
<td>BI</td>
<td>11</td>
<td>WSE Alarm Primary Feed Sensor</td>
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</tr>
<tr>
<td>BI</td>
<td>12</td>
<td>WSE Alarm Heat Exchange Inlet</td>
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<td>13</td>
<td>WSE Alarm Heat Exchange Outlet</td>
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<td>BI</td>
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<td>WSE Alarm VFD Fault</td>
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<td>BI</td>
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<td>Primary A Pump 1 Status</td>
<td>Status</td>
</tr>
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<td>BI</td>
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<td>Primary A Pump 2 Status</td>
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<td>Status</td>
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</tr>
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<td>BI</td>
<td>19</td>
<td>For Future Use</td>
<td></td>
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<td>A-Fault Trip High Discharge Pr.</td>
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<td>A-Fault Compressor A2 Not Running</td>
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</tr>
<tr>
<td>BI</td>
<td>30</td>
<td>A-Fault No Suction Pr. Sensor</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>31</td>
<td>A-Fault Emergency Shutdown</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>32</td>
<td>A-Fault MODBUS Slave Timeout</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>33</td>
<td>A-Fault High Superheat</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>34</td>
<td>A-Fault High Saturation Temperature</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>35</td>
<td>A-Fault Compressor A1 Over Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>36</td>
<td>A-Fault Compressor A2 Over Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>37</td>
<td>A-Fault Compressor A1 Under Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>38</td>
<td>A-Fault Compressor A2 Under Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>39</td>
<td>For Future Use</td>
<td></td>
</tr>
</tbody>
</table>

Table 15: BACnet® MS/TP Parameter Binary Inputs
## BINARY INPUTS

<table>
<thead>
<tr>
<th>BACnet® Point Type</th>
<th>Number</th>
<th>BACnet® Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>40</td>
<td>A-Warning Low Suction Pressure</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>41</td>
<td>A-Warning Low Suction Pr. Startup</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>42</td>
<td>A-Warning High Discharge Pressure 1</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>43</td>
<td>A-Warning No Discharge Pr. Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>44</td>
<td>A-Warning No Discharge Temp Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>45</td>
<td>A-Warning High Superheat</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>46</td>
<td>A-Warning Condenser Fault</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>47</td>
<td>A-Warning Condenser Over Current</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>48</td>
<td>A-Warning No Liquid Line Pr. Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>49</td>
<td>A-Warning No Liquid Line Temp Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>50</td>
<td>A-Warning High Discharge Pressure 2</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>51</td>
<td>A-Lockout Suction Pressure</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>52</td>
<td>A-Lockout Low Discharge Pressure</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>53</td>
<td>A-Lockout Compressor A1 Over Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>54</td>
<td>A-Lockout Compressor A2 Over Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>55</td>
<td>A-Lockout High Discharge Temp</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>56</td>
<td>A-Lockout High Discharge Pressure</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>57</td>
<td>A-Lockout Low Superheat</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>58</td>
<td>A-Lockout High Superheat</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>59</td>
<td>A-Lockout High Saturation Temp</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>60</td>
<td>A-Lockout Compressor A1 Under Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>61</td>
<td>A-Lockout Compressor A2 Under Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>62</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>63</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>64</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>65</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>66</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>67</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>68</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>69</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>70</td>
<td>B-Fault Low Suction</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>71</td>
<td>B-Fault Unsafe Suction</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>72</td>
<td>B-Fault Trip High Discharge Pr.</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>73</td>
<td>B-Fault Compressor B1 Not Running</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>74</td>
<td>B-Fault Compressor B2 Not Running</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>75</td>
<td>B-Fault No Suction Line Temp Sensor</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>76</td>
<td>B-Fault Low Superheat</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>77</td>
<td>B-Fault High Discharge Temp</td>
<td>Fault</td>
</tr>
</tbody>
</table>

Table 15, continued: BACnet® MS/TP Parameter Binary Inputs
### BINARY INPUTS

<table>
<thead>
<tr>
<th>BACnet® Point Type</th>
<th>Number</th>
<th>BACnet® Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>78</td>
<td>B-Fault Compressor B1 False Active</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>79</td>
<td>B-Fault Compressor B2 False Active</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>80</td>
<td>B-Fault No Suction Pr. Sensor</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>81</td>
<td>B-Fault Emergency Shutdown</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>82</td>
<td>B-Fault MODBUS Slave Timeout</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>83</td>
<td>B-Fault High Superheat</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>84</td>
<td>B-Fault High Saturation Temperature</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>85</td>
<td>B-Fault Compressor B1 Over Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>86</td>
<td>B-Fault Compressor B2 Over Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>87</td>
<td>B-Fault Compressor B1 Under Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>88</td>
<td>B-Fault Compressor B2 Under Current</td>
<td>Fault</td>
</tr>
<tr>
<td>BI</td>
<td>89</td>
<td>For Future Use</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>90</td>
<td>B-Warning Low Suction Pressure</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>91</td>
<td>B-Warning Low Suction Pr. Startup</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>92</td>
<td>B-Warning High Discharge Pressure 1</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>93</td>
<td>B-Warning No Discharge Pr. Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>94</td>
<td>B-Warning No Discharge Temp Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>95</td>
<td>B-Warning High Superheat</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>96</td>
<td>B-Warning Condenser Fault</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>97</td>
<td>B-Warning Condenser Over Current</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>98</td>
<td>B-Warning No Liquid Line Pr. Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>99</td>
<td>B-Warning No Liquid Line Temp Sensor</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>100</td>
<td>B-Warning High Discharge Pressure 2</td>
<td>Warning</td>
</tr>
<tr>
<td>BI</td>
<td>101</td>
<td>B-Lockout Suction Pressure</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>102</td>
<td>B-Lockout Low Discharge Pressure</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>103</td>
<td>B-Lockout Compressor B1 Over Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>104</td>
<td>B-Lockout Compressor B2 Over Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>105</td>
<td>B-Lockout High Discharge Temp</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>106</td>
<td>B-Lockout High Discharge Pressure</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>107</td>
<td>B-Lockout Low Superheat</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>108</td>
<td>B-Lockout High Superheat</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>109</td>
<td>B-Lockout High Saturation Temp</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>110</td>
<td>B-Lockout Compressor B1 Under Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>111</td>
<td>B-Lockout Compressor B2 Under Current</td>
<td>Lockout</td>
</tr>
<tr>
<td>BI</td>
<td>112</td>
<td>Chiller Fully Loaded</td>
<td>Status</td>
</tr>
</tbody>
</table>

*Table 15, continued: BACnet® MS/TP Parameter Binary Inputs*
### Table 16: BACnet® MS/TP Parameter Multi-State Value

<table>
<thead>
<tr>
<th>BACnet® Point #</th>
<th>BACnet® Point Name</th>
<th>BACnet® Description</th>
<th>Limits</th>
</tr>
</thead>
</table>
| MV: 1           | Operating Status   | Current Unit Mode   | 1 = OFF_MODE  
|                 |                    |                     | 2 = RUN MODE  
|                 |                    |                     | 3 = Holiday OFF MODE  
|                 |                    |                     | 4 = Holiday RUN MODE  
|                 |                    |                     | 5 = Startup Delay  
|                 |                    |                     | 6 = Emergency Shutdown  
|                 |                    |                     | 7 = High Leaving Water  |
Prism 2 Software: Version 4.9.0 and later
LF Chiller Main Controller Code: Version 1.0 and up
Prism 2 Requirements

PLEASE NOTE
This appendix gives a brief overview of the Prism 2 software. For more information, refer to the Prism 2 Technical Guide, the CommLink 5 Technical Guide, the IP Module Technical Guide, the USB-Link 2 Technical Guide, and/or the MiniLink PD 5 Technical Guide. All can be found on the AAON website at www.aaon.com/controlsmanuals.

Prism 2 is a complete Windows®-based graphical interface controls and management program that allows you to interact with your digital controls. The program provides standard, easy-to-understand status, setpoint, and configuration screens for the LF Chiller Main Controller and other controllers in your system.

Prism 2 allows you to access trend logs and alarm conditions. The program can be configured for direct on-site installation or TCP/IP Internet connection.

Feature Summary
Prism 2 provides a broad set of features:
- Easy to use
- On-site or TCP/IP communications
- User programmable description for every piece of equipment and user-defined custom screens
- Automatic retrieval of trend logs and export capability to spreadsheet and database programs
- Alarm Logs maintained on disk
- Alarm E-mail/texting capability when using a CommLink
- Encrypted History Logs

System Requirements
To use Prism 2 you must have a computer that meets or exceeds the following requirements:

Operating System
- Microsoft® Windows® 10

NOTE: Prism 2 is not intended for a server/client environment nor for any version of Windows Server.

Minimum Hardware
- Windows® compatible computer
- CommLink 5 or USB Link 2 for direct, on-site connection
- IP Module for remote connection
- Prism is NOT supported in a server environment. It does not support client/server systems. Prism is a LAPTOP/DESKTOP ONLY system.

WARNING: Older operating systems, while they still might be capable of running Prism, are not recommended due to security updates being obsoleted by Microsoft®. We also do not support troubleshooting of any version of Windows® operating the Prism program. Some new models of laptops running the latest release of Windows® 10 have also experienced issues running Prism, and we cannot troubleshoot customer computer issues.

Software License
Prism 2 does not require any license agreement and may be freely copied and distributed.

Support Information
AAON Controls provides Prism 2 installation and configuration support. Call (866) 918-1100 for free, direct telephone support or (816) 505-1100 to talk to a Controls Support Representative. Support for all telephone services is available Monday through Friday, 7:00 AM to 5:00 PM central standard time.

NOTE: AAON Controls Support cannot troubleshoot internal PC and/or Windows®-based operating system problems.

NOTE: AAON Controls Support cannot troubleshoot firewalls, routers, and/or problems on a customer’s internal or external network. An IT professional may need to be consulted.
Prism 2 Technical Guide Overview

The Prism 2 Technical Guide will lead you through each step in configuring Prism 2—from entering passcodes to searching and selecting units for troubleshooting. Below is a quick overview of each step of the guide that pertains to the LF Chiller Control System.

**Step 1: Installing Prism 2**—This section explains how to install the Prism 2 software, initiate communications, navigate the program, and enter and edit passcodes.

**Step 2: Setting Up Job Sites**—This section provides instructions for setting up each job site’s name, port, or IP address, CommLink type and configuration, alarm notification, and custom screen designation.

**Step 3: Configuring Prism 2**—This section describes how to have Prism 2 automatically restart after a power failure and broadcast time to all controllers. It also explains how to set up the main screen display picture.

**Step 4: Setting Up Communications**—This section explains how to establish communications via TCP/IP connection through your CommLink.

**Step 5: Searching for Installed Units**—This section explains how to perform a unit search per job-site.

**Step 6: Selecting and Renaming Loops and Units**—This section explains how to select and rename loops and units.

**Step 7: Configuring Units**—This section describes how to configure controller setpoints. It also explains how to configure units while off-line.

**Appendices**—The appendices include examples of status and setpoint screens, instructions for DEMOMODE, and a list of controllers, E-BUS modules, and other devices that can be updated using Prism 2.
After successful Prism 2 installation and job-site setup, you will be able to access the LF Chiller Controller Status Screen. See Figure 14 below.

Besides displaying the current operating status and inputs and outputs, from this screen you can set schedules, force modes, run BACnet® commands, view alarms, print status reports, chart modules, and access and change setpoints and configurations.

**NOTE:** Only the Administrator and top level users can access and change setpoints and schedules.
Controller Setpoint Screens

Setpoints are accessed by clicking on <Setpoints> at the top left of the LF Chiller Main Controller Status Screen (Figure 14, page 74). The Temperature Setpoints Screen will display. See Figure 15, below.

At the bottom of any Setpoints Screen, you can access all other Setpoint Screens by clicking the icons, Temperatures, Staging Delays, Miscellaneous, Calibration, Configuration, RSM Module, WSE Module, and Pump Module.

The figures that follow show the rest of the screens available under Setpoints.

![Figure 15: Temperatures Setpoints Screen](image)
Controller Setpoint Screens

Figure 16: Staging Delays Setpoints Screen

<table>
<thead>
<tr>
<th>Staging Delays &amp; Timing Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Min</td>
</tr>
<tr>
<td>1 Min</td>
</tr>
<tr>
<td>5 Min</td>
</tr>
<tr>
<td>3 Min</td>
</tr>
<tr>
<td>60 Sec</td>
</tr>
<tr>
<td>30 Sec</td>
</tr>
<tr>
<td>30 Sec</td>
</tr>
<tr>
<td>60 Sec</td>
</tr>
</tbody>
</table>

Figure 17: Miscellaneous Setpoints Screen

<table>
<thead>
<tr>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Figure 18: Calibration Setpoints Screen

<table>
<thead>
<tr>
<th>Sensor Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0°</td>
</tr>
<tr>
<td>0.0°</td>
</tr>
<tr>
<td>0.0°</td>
</tr>
</tbody>
</table>

Figure 19: Configuration Setpoints Screen

<table>
<thead>
<tr>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>Has Waterside Economizer</td>
</tr>
<tr>
<td>Has Building Pump Module</td>
</tr>
</tbody>
</table>

Figure 20: WSE Module Setpoints Screen

<table>
<thead>
<tr>
<th>Water Side Economizer Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.0°</td>
</tr>
<tr>
<td>50.0°</td>
</tr>
<tr>
<td>40.0°</td>
</tr>
<tr>
<td>35.0°</td>
</tr>
<tr>
<td>32.0°</td>
</tr>
<tr>
<td>0 Sec</td>
</tr>
<tr>
<td>0 Sec</td>
</tr>
<tr>
<td>30%</td>
</tr>
<tr>
<td>95%</td>
</tr>
<tr>
<td>30 Min</td>
</tr>
<tr>
<td>1 Min</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
**Figure 21:** Refrigeration Module Configuration Screen

**Figure 22:** Pumping Module Setpoints Screen
Changing, Saving & Restoring Setpoints, Printing & Charting

Setpoint Help & Changing Setpoints

If you position the cursor over the top of a setpoint box, a Help Window will pop up indicating how that setpoint is used by the controller.

If you enter a setpoint that is either too high or too low or if you don’t have Level 3 access, Prism 2 will not accept the new value and will restore the previous value in that field. When you enter a value, you must press <Enter> to have Prism 2 save the value.

Saving and Restoring Setpoints

At the top of each setpoint screen, you can select <Save> or <Restore>. These two functions save and copy over ALL of the setpoints for a controller, not only those on a single setpoint screen.

Saving all setpoints from the controller to a file on your computer for use in restoring the setpoints or for copying to another specific controller will save time in configuring your controller and save valuable time in having to reenter setpoints for another controller.

Restore Factory Defaults

To restore factory configuration and setpoint defaults for the DX Chiller Controller, select <Restore Factory Defaults> at the top of any setpoint screen.

WARNING: AAON does not assume any responsibility or liability due to misuse or misunderstanding of this feature. Restore Factory Defaults wipes out ALL current configuration and setpoints for a single controller.

The following message will display:

Select <Yes> to clear all configuration and settings and restore factory defaults. Select <No> to cancel this operation.

Printing & Charting

At the top of the LF Chiller Main Controller Status Screen (Figure 14, page 74), are the options <Print> and <Charting>.

Select <Print> to print a status report for the Controller for the current date. See Figure 23, below for an example. The printers you have set up for your computer will show in the printer selection box at the bottom of the screen.

Figure 23: Status Report Screen

Select <Charting> to display a chart for the Main Chiller Controller or the Refrigeration Modules. See Figure 24, below for an example. You have the option to clear the graph, chart the colors, or save the graph.

Figure 24: Refrigeration Module Chart
**Schedules & Holidays**

When you select the `<Schedules>` icon found on the LF Controller Status Screen (Figure 14, page 74), the Schedules Screen will appear. See Figure 26, below.

The Controller has two event start and stop times per day and two event start and stop times for holidays. The holiday start and stop times will override the standard operating hours.

When you enter a time in any field, you must designate AM or PM and press `<ENTER>`.

To schedule holidays, press the `<Holidays>` button. The Holiday Schedule Screen will appear. See Figure 27.

Click on the date to highlight it and tag it as a holiday. Days selected as holidays are indicated with a green background and white text.

There are 14 holiday periods available for each year. These holiday periods can span a single day or they can span weeks or even months.

If your job-site has days during the year when you need to override the standard operating hours to accommodate holidays or other special events, you can use this window to select the holidays.

You cannot program holidays for the next year, and holidays do not automatically adjust for the new year, so you will need to access this screen after the new year and make necessary adjustments to the days that float, such as Memorial Day.

**Saving and Restoring Schedules & Holidays**

While at the Schedules Screen (Figure 26), select `<Save>` to save your schedule. Select `<Restore>` to restore a previously saved schedule. Select `<Erase Schedules>` to completely erase the schedule appearing in the window.

**WARNING:** `<Erase Schedules>` will clear ALL entered stopstart times, so use with caution.

While at the Holiday Schedule Screen (Figure 27), select `<Save>` to save the Holidays. Select `<Restore>` to restore previously saved Holidays. Select `<Erase>` to completely erase the holidays appearing in the window.

Saving all schedules from the controller to a file on your computer for use in restoring the schedules or for copying to another specific controller will save time in configuring your controller and save valuable time in having to reenter schedules for another controller.
**Schedule Override**

You can override the schedule mode of operations by clicking on the button under Chiller Mode of Operation. The *Overrides Dialog Box* will appear. See Figure 28.

You can choose **Auto Scheduling**, **Force Schedule ON** or **Force Schedule OFF**.

A scheduled force override will remain in effect until cancelled. To cancel an override, select the **Auto Scheduling** option.

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**Viewing Alarm Status**

The *Unit Alarm Screen* is accessed from the controller’s status screen by clicking the `<ALARM>` button. This button will be a dull red and display `<No Alarms>` when there are no alarms present or will be bright red and display `<ALARM>` if active alarms exist.

Click the `<ALARM>` button when bright red or the `<No Alarms>` button when dull red. The *Chiller Alarm Status Screen* will appear. See Figure 29.

Each individual `<ALARM>` button will be bright red if an alarm exists and will be gray if no alarm exists.

Click the blue `<Manual Lockout Reset>` button to immediately reset an alarm once it has cleared.

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**Figure 29: Unit Alarm Status Screen**
Figure 30: CommLink 5 Connection
Figure 31: IP Module Connection
Connect the USB-Link 2 Mini-DIN Cable to the female Mini-DIN plug connector on controllers that are supplied with them. **NOTE:** This allows communications with all controllers that are connected to the system when network communication is chosen.

**NOTE:**
1. In order to view a single controller using Prism 2, you must disconnect the communication loop from the controller. Your USB-Link is plugged into. Set the USB-Link configuration switch to stand alone, set the type of CommLink in Prism 2 to USB Link Stand Alone, and cycle power by disconnecting and reconnecting the USB power supply cable.

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**Figure 32:** USB-Link 2 Connection
AAON Factory Technical Support: 918-382-6450
techsupport@aaon.com

AAON Controls Support: 866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM
central standard time

NOTE: Before calling Technical Support, please have the model and serial number of the unit available.

PARTS: For replacement parts please contact your local AAON Representative.