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.
**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.

<table>
<thead>
<tr>
<th>PART DESCRIPTION</th>
<th>AAON P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Chiller Controller</td>
<td>G015540</td>
</tr>
<tr>
<td>Chiller Expansion Module</td>
<td>G015550</td>
</tr>
<tr>
<td>Compressor Circuit Module</td>
<td>G015560</td>
</tr>
<tr>
<td>Economizer Subcool Module</td>
<td>G015570</td>
</tr>
<tr>
<td>Touch Screen Computer PPC</td>
<td>V99840</td>
</tr>
<tr>
<td>Touch Screen Software</td>
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</tr>
<tr>
<td>CommLink 5 Interface</td>
<td>V32950</td>
</tr>
<tr>
<td>IP Module Kit</td>
<td>R66770</td>
</tr>
<tr>
<td>Prism2 Software</td>
<td>G019180</td>
</tr>
<tr>
<td>E-BUS Cable Assembly E-BUS</td>
<td></td>
</tr>
<tr>
<td>Power &amp; Comm 1.5 Ft, 3 Ft, 10 Ft, 25 Ft, 50 Ft, 75 Ft, 100 Ft, 150 Ft, 250 Ft, and 1000 Foot Spool</td>
<td>V16720 (1.5 Ft), V16730 (3 Ft), V16740 (10 Ft), V16750 (25 Ft), V16760 (50 Ft), V16770 (75 Ft), V16780 (100 Ft, V36580 (150 Ft), V36590 (250 Ft)</td>
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<tr>
<td>E-BUS Adapter Hub with 1.5 Ft. EBC Cable</td>
<td>V17180</td>
</tr>
<tr>
<td>E-BUS Adapter Board</td>
<td>V15840</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS

OVERVIEW ........................................................................................................................................... 6
   Control System Features & Applications .......................................................................................... 6
   Manual Overview ............................................................................................................................. 6

TOUCH SCREEN INTERFACE ............................................................................................................ 7
   Main Screen, Overview Screen & Trending Screen ........................................................................ 8
   Status Screens .................................................................................................................................. 9
   Password & Login Screens ............................................................................................................. 10
   Setpoint Screens ............................................................................................................................. 11
   Faults/Alarms Screens .................................................................................................................... 13
   Lists of Status Points, Setpoints, and Faults / Alarms ................................................................. 14
   Troubleshooting ............................................................................................................................. 17
      Touch Screen .............................................................................................................................. 17
      Unit Run/Stop & Compressor Disable ...................................................................................... 17

MAIN CHILLER CONTROLLER SEQUENCE OF OPERATION .......................................................... 18
   Refrigeration Loop Control ........................................................................................................ 18
      Compressor Control ................................................................................................................... 18
         Run-Time Accumulation ........................................................................................................ 18
      Condenser Control .................................................................................................................... 18
         Start-Up .................................................................................................................................. 18
         Modulation .............................................................................................................................. 18
         Shutdown ................................................................................................................................. 18
      Expansion Valve Control ......................................................................................................... 20
         Start-Up .................................................................................................................................. 20
         Modulation .............................................................................................................................. 20
         Shutdown ................................................................................................................................. 20
      Compressor Faults .................................................................................................................... 20
   Economizer Subcool Module Management ............................................................................... 21

VESTIBULE FAN-COIL SEQUENCE OF OPERATION ..................................................................... 21

COMPRESSOR CIRCUIT MODULE SEQUENCE OF OPERATION ................................................. 22
   Points of Information and Control ............................................................................................. 22
      Commands .................................................................................................................................. 22
      Status ......................................................................................................................................... 22
   Sequence ....................................................................................................................................... 22
      Load Balance Startup Valve Control .......................................................................................... 22
      Isolation Valve Control ............................................................................................................. 22
      Compressor Control ................................................................................................................. 23
         Economizer Subcool Module Management ........................................................................ 23
TABLE OF CONTENTS

ECONOMIZER SUBCOOL MODULE SEQUENCE OF OPERATION ................................................. 24
  Points of Information and Control .................................................................................... 24
  Sequence ......................................................................................................................... 24

FAULTS........................................................................................................................ 24

INSTALLATION & WIRING......................................................................................... 26
  Main Chiller Controller Inputs & Outputs ......................................................................... 26
  Chiller Expansion Module Inputs & Outputs ................................................................. 26
  Compressor Circuit Module Inputs & Outputs ............................................................ 27
  Economizer Subcool Module Inputs & Outputs ........................................................... 27
  Main Chiller Controller Input Wiring .............................................................................. 28
  Main Chiller Controller Output Wiring ........................................................................... 28
  Chiller Expansion Module Wiring .................................................................................. 30
  Compressor Circuit Module Wiring ................................................................................ 31
  Economizer Subcool Module Wiring .............................................................................. 32

TROUBLESHOOTING ............................................................................................ 33
  Main Chiller Components ............................................................................................... 33
  Main Chiller Controller & Chiller Expansion Module LED Locations ............................. 34
  Compressor Circuit Module & Economizer Subcool Module LED Locations ................ 36
  Thermistor Temperature Sensor Testing ...................................................................... 37
  Suction Pressure Transducer Testing .......................................................................... 38
  Discharge Pressure Transducer Testing ..................................................................... 39
  Important Wiring Considerations ................................................................................ 40

APPENDIX A - LCD DISPLAY SCREENS ................................................................ 42
  Main Chiller Controller LCD Screens ............................................................................ 42
  Compressor Circuit Module LCD Screens ..................................................................... 46
  Economizer Subcool Module LCD Screens ................................................................... 47

APPENDIX B - BACnet® Connection to MS/TP Network, BACnet® Parameters ....... 54
Features & Applications

The G015540 Main Chiller Controller is only used with Turbocor® Compressors in Chiller Operation. The Controller is designed with 8 analog inputs, 4 analog outputs, 8 binary inputs, and 8 relay outputs.

The Main Chiller 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 G015550 Chiller Expansion Module, (3) G015560 Compressor Circuit Modules, and (3) G015570 Economizer Subcool Modules via EBC E-BUS Cables.

The main operator interface to the Turbocor® Chiller Controller is a Panel PC (PPC) with a touchscreen overlay with pre-loaded Chiller control software. This Panel PC is connected to the Controller with a CommLink IP Ethernet connection and allows for configuration of setpoints and viewing status screens and alarms.

In addition, the Controller, Compressor Circuit Module, and Economizer Subcool Module 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.

The Main Chiller Controller provides Compressor demand management, Condenser control, and Expansion Valve control of the Turbocor® Compressor in Chiller operation. It also provides Temperature control of the vestibule.

Manual Overview

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

Section 1: Chiller Touch Screen Navigation - Page 7—This section provides instructions for navigating the Chiller Touch Screen program. In it you will find status screens, password/login screens, setpoint screens, and alarm screens. Each setpoint screen includes minimum and maximum values to make configuration easy.

Section 2: Sequence of Operations - Page 18—This section contains the sequence of operations for the Main Chiller Controller and its modules.

Section 3: Wiring - Page 26—This section contains the inputs, outputs, and wiring for the controller and modules.

Section 4: Troubleshooting - Page 33—This section contains testing charts to troubleshoot sensors and transducers and LED locations and definitions for troubleshooting.

Appendix A: LCD Display Screens - Page 42—The appendix describes the controller and module LCD screens.

Appendix B: BACnet® Configuration - Page 54—This section lists BACnet® parameters, definitions, and ranges, if applicable.
Main Chiller Controller Technical Guide

SECTION 1: TOUCH SCREEN INTERFACE

Features

The main operator interface to the Turbocor Chiller Controller is a Panel PC (PPC) with a touch screen overlay. The Turbocor Touch Screen interface contains a Java™-based software program that is displayed on a 13” screen in the vestibule. It provides a direct, graphic-enhanced, menu-driven link to allow the end user to view status points, change Setpoints, and view alarms on the Turbocor system.

Directly below the Touch Screen is a Rocker Switch Panel with switches to shut down the Unit and/or each Compressor. See Troubleshooting on page 17 for more information.

The Touch Screen provides the following useful functions:

- Utilizes a graphical touch screen menu system with easy-to-understand menu options
- Graphical screens provide easy setup and operation without the need for specialized training
- Provides protection from unauthorized users through passcode authorization
- Comes equipped with real-time clock backup power supply for short power losses
- Contains a USB port for software updates

Figure 1: Panel PC with Touch Screen Interface
SECTION 1: TOUCH SCREEN INTERFACE

Main Screen, Overview Screen & Trending Screen

Chiller Touch Screen Program

Once the Chiller Touch Screen program has been successfully installed, the program will run continuously on your panel PC. The Chiller Status Screen is the screen that will first appear and will be the screen that the program returns to when you press <DONE> from any other screen. See Figure 2.

The Chiller Status Screen displays the main elements you need to know about the state of the chiller and its associated modules.

The top right of the screen should display the Current Time, the Current Day of the Week, the Current Month, Day, and Year, the Screen ID, and the Software Version (of the Main Controller). If these items show all zeros, contact AAON Technical Support. The <Sync Clocks> button below the time and date display will broadcast the touch screen time to the Main Controller. Sync Clocks will need to be done if the Main controller is powered down for a week or longer.

From the bottom of the Chiller Status Screen, you can access all other screens in the program by clicking the icons System Overview, Compressors, Economizers, Vestibule, Setpoints, and Alarms/Faults.

The Alarms/Faults icon’s normal appearance will be blue, but will turn red and display, Fault, when there are one or more faults or alarms present.

System Overview Screen

Press the <System Overview> icon to access the System Overview Screen. See Figure 3. Press <DONE> to return to the Chiller Status Screen.

Trending Screen

From the bottom of the System Overview Screen, press the <Trending> icon to access the Trending Screen. See Figure 4. Enter a number between 1 and 120. The touch screen will trend data at this rate. Trend logs can be found in the Chiller folder in a folder called, TrendLogs. Press <DONE> to return to the System Overview Screen.


### Compressor Status Screens

Press the `<Compressors>` icon to access the Compressor Status Screens. See Figure 5. There are 2 Compressor Status Screens. Press `<PAGE 2>` to access the second screen. See Figure 6. Press `<DONE>` to return to the Chiller Status Screen.

![Figure 5: Compressors Screen - Page 1](image)

![Figure 6: Compressors Screen - Page 2](image)

### Economizer Status Screen

Press the `<Economizers>` icon to access the Economizer Status Screen. See Figure 7. Press `<DONE>` to return to the Chiller Status Screen.

![Figure 7: Economizer Status Screen](image)

### Vestibule Status Screen

Press the `<Vestibule>` icon to access the Vestibule Status Screen. See Figure 8. Press `<DONE>` to return to the Chiller Status Screen.

![Figure 8: Vestibule Status Screen](image)
SECTION 1: TOUCH SCREEN INTERFACE

Password Setup and Login Screen

Accessing Setpoint Screens

Press the <Setpoints> icon to access the Setpoints Screens. See Figure 9. Press <DONE> to return to the Chiller Status Screen.

From the bottom of any Setpoints Screen, you can access all other Setpoint Screens by clicking the icons Temperature, Staging, Miscellaneous, Calibration, Exp Modules, and Configurations.

When you first access any Setpoints Screen, the program will request that you create a username and password. See Figure 10.

Please note: You DO NOT have to setup a password or username. You can, optionally, press <Cancel> at the Password Setup Screen; however, this will leave the setpoints unprotected.

Touch the Username field and use the pop-up keyboard to enter a username and press <Enter>. See Figure 11. Touch the Usercode field and use the pop-up keyboard to enter a password and press <Enter>.

Once you have established a username and password, the program will ask you to enter them every time you access the setpoints. See Figure 12. The login has a 10 minute timer associated with it that gets reset every time something is touched on the screen. So you will need to log in again 10 minutes after no activity on the touch screen. If you do not wish to enter your username and password, press <Cancel>. Without entering your credentials, you will be able to view the setpoints, but not change them.

Figure 9: Temperature Setpoints Screen

Figure 10: Password Setup Screen

Figure 11: Keyboard

Figure 12: Login Screen
When you access a setpoint field in any Setpoints Screen, the data entry screen for that setpoint will appear, allowing you to use the data entry keypad to change the value. The screen displays the name of the setpoint, gives a brief description, and includes the Minimum and Maximum values. See Figure 13.

**Figure 13: Data Entry Screen**

Press **<OK>** to have the system accept the new value. If you enter a setpoint that is not in the valid range, the setpoint will remain as is and will not change.

### Temperature Setpoint Screen

Press the **<Temperatures>** icon to access the Temperature Setpoint Screen. See Figure 14. Press **<DONE>** to return to the Chiller Status Screen or select another setpoint screen.

**Figure 14: Temperature Setpoints Screen**

### Staging Setpoint Screen

Press the **<Staging>** icon to access the Staging Setpoint Screen. See Figure 15. Press **<DONE>** to return to the Chiller Status Screen or select another setpoint screen.

**Figure 15: Staging Setpoints Screen**
SECTION 1: TOUCH SCREEN INTERFACE

Setpoint Screens

Press the <Miscellaneous> icon to access the Miscellaneous Setpoint Screens. See Figure 16. Click the right arrow at the top right of the screen to access the second screen. See Figure 17. Press <DONE> to return to the Chiller Status Screen or select another setpoint screen.

Figure 16: Miscellaneous Setpoints Screen - Page 1

Press the <Calibration> icon to access the Calibration Setpoint Screen. See Figure 18. Press <DONE> to return to the Chiller Status Screen or select another setpoint screen.

Figure 18: Calibration Setpoints Screen

Press the <Exp Modules> icon to access the Expansion Modules Setpoint Screen. See Figure 19. Press <DONE> to return to the Chiller Status Screen or select another setpoint screen.

Figure 19: Expansion Modules Setpoints Screen
SECTION 1: TOUCH SCREEN INTERFACE

Setpoint & Alarm Screens

Configurations Setpoint Screen

Press the **<Configurations>** icon to access the Expansion Modules Setpoint Screen. See Figure 20. Press **<DONE>** to return to the Chiller Status Screen or select another setpoint screen.

![Figure 20: Configuration Setpoints Screen](image)

Main Faults Screen

Press the blue **<Alarms/Faults>** or red **<Fault>** icon at the bottom of the Chiller Status Screen (Figure 2, page 8) to access the Main Faults Screen. See Figure 21. Press **<DONE>** to return to the Chiller Status Screen.

![Figure 21: Main Faults Screen](image)

On the Main Faults Screen, if there are one or more faults present, the box next to each active fault will appear red. From the bottom of this screen you can access the Compressor alarms. The **<Compressors>** icon will be red if there are Compressor Alarms present.

Compressor Alarms

Press the blue **<Compressors>** icon, yellow **<Compressor Alarm>** icon, or red **<Compressor Fault>** icon at the bottom of the Main Faults Screen to access the Compressor Alarms 1 Screen. See Figure 22. From the bottom of the Compressor Alarms 1 Screen, you can select the **<Compressor 2>** and **<Compressor 3>** icons to access these compressor’s alarms screens. These icons, too, will be yellow to specify alarms or red to specify faults. Press **<DONE>** to return to the Chiller Status Screen.

![Figure 22: Compressor 1 Alarms Screen](image)

The green box in each fault row will appear red if there is a fault. The green box in each alarm row will appear yellow if there is an alarm. Touch each red box to reveal the alarm/fault category. The list of compressor alarms and faults are found on pages 15 & 16.
SECTION 1: TOUCH SCREEN INTERFACE

Status Points & Setpoints List

**NOTE:** The lists that follow are all of the status, setpoints, and alarm items categorized per each screen in the Touch Screen Program.

### Status Points

**Chiller Status / Main Screen**
- Entering Water Temp
- Water Setpoint
- Butterfly Valve
- Chiller Run Status
- Compressor 2 Status
- Compressor 3 Status

**System Overview**
- Boiler Remote Start/Stop
- Water Setpoint Reset
- Level Setpoint
- Lowest Discharge Superheat
- Line Temp Calc
- Line Subcooling
- Phase Brownout
- Highest Press Ratio
- Condenser Fault

**Compressor Status**
- Total Requested Demand
- Compressors 1-3
- Mode
- Actual RPM
- Power
- Pressure Ratio
- Suction Temp
- Discharge Pressure
- Discharge Line
- Load Balancing
- Compressor Speed
- IGV Position
- Current
- Suction Pressure
- Suction Line
- Discharge Temp
- Discharge Superheat
- Isolation Valve

**Economizers**
- Expansion Valve Position
- Calculated Temp
- Superheat
- Coil Temp
- Suction Pressure

**Vestibule**
- Vestibule Temp
- Heating Setpoint
- Fan Coil Heat Enable
- Refrigerant Leak Detect
- Cooling Setpoint
- Fan Coil Cool Enable
- Fan Fns - Inlet/Exhaust

### Adjustable Setpoints

**Temperatures**
- Minimum Leaving Water Temp Setpoint
- Maximum Leaving Water Temp Setpoint
- Leaving Water Setpoint Staging Window
- Freeze Limit
- Maximum Outdoor Air Temp Reset Limit for Condenser Fan Starting Speed
- Minimum Outdoor Air Temp Reset Limit for Condenser Fan Starting Speed
- Lowest Superheat to Override Barrel Level
- Vestibule Cooling Setpoint
- Vestibule Heating Setpoint
- Vestibule Heat/Cool Deadband

**Staging**
- Cooling Stage Up
- Cooling Min Run Time
- Cond Fan Stagger Delay
- Compressor Mod Rate
- Trend Logging Interval
- Butterfl y Valve Opening Delay
- Condenser Fan Stabilizing Delay
- Expansion Valve Stabilizing Delay
- Cooling Stage Down
- Cooling Min Off Time
- Cond Fan Mod Rate
- Exp Valve Mod Rate
### Miscellaneous
- 1 Compressor On Max Speed Reset Limit
- 1 Compressor On Min Speed Reset Limit
- 1 Compressor On Max Liquid Level Limit
- 1 Compressor On Min Liquid Level Limit
- 2 Compressors On Max Speed Reset Limit
- 2 Compressors On Min Speed Reset Limit
- 2 Compressors On Max Liquid Level Limit
- 2 Compressors On Min Liquid Level Limit
- 3 Compressors On Max Speed Reset Limit
- 3 Compressors On Min Speed Reset Limit
- 3 Compressors On Max Liquid Level Limit
- 3 Compressors On Min Liquid Level Limit
- 1 Compressor On Start Up Speed
- 2 Compressors On Start Up Speed
- 3 Compressors On Start Up Speed
- Compressor Staging Down Min Demand
- Compressor Maximum Allowed Demand
- Pressure Sensor Averaging Weight
- Ratio Setpoint for Condenser Fan
- Starting Ratio for Compressor Activation
- EXV Minimum Position
- Level Average for Refrigeration Sensor

### Expansion Modules
- Compressor Pre-Start Delay
- Load Balance EXV Steps per Second

### Calibration
- Leaving Water Offset
- Outdoor Air Offset
- Entering Water Offset
- Vestibule Sensor Offset

### Configuration
- 1, 2, 3 Compressor Modules Installed
- Has Compressor Lead/Lag Enabled

### Alarms & Faults

#### Main Faults
- Water Flow Fault
- Expan Board Missing
- Condenser Fault
- Shutdown Fault
- Compressor Faults
- Compressor Disabled
- Freeze Protection
- EM1 Board Missing
- Comp Mod 1 Missing
- Comp Mod 2 Missing
- Comp Mod 3 Missing
- Econo Mod 1 Missing
- Econo Mod 2 Missing
- Econo Mod 3 Missing

#### Compressor 1-3 Alarms & Faults
- Faults
- Alarms
- Bearing Faults
- Bearing Alarms
- Faults Word 2
- Alarms Word 2

#### Compressor 1-3 Faults
- Inverter Temperature Fault (0)
- Discharge Temperature Fault (1)
- Suction Pressure Fault (2)
- Discharge Pressure Fault (3)
- 3-Phase Overcurrent Fault (4)
- Cavity Temperature Fault (5)
- Invalid Fault (6)
- Pressure Ratio Fault (7)
- Bearing/Motor Controller Fault (8)
- Sensor Fault (9)
- SCR Temperature Fault (10)
- Lock Out Fault (11)
- Motor Winding Temperature Fault (12)
- High Suction Superheat Fault (13)
- Earth Leakage Fault (14)
- Soft Start Temperature Fault (15)
SECTION 1: TOUCH SCREEN INTERFACE

Alarms & Faults List

Compressor 1-3 Alarms
- Inverter Temperature Alarm (0)
- Not Valid (1)
- Suction Pressure Alarm (2)
- Discharge Pressure Alarm (3)
- 3-Phase Overcurrent Alarm (4)
- Cavity Temperature Alarm (5)
- Invalid Fault (6)
- Pressure Ratio Alarm (7)
- Not Valid (8), (9)
- SCR Temperature Alarm (10)
- Not Valid (11), (12), (13), (14), (15)

Compressor 1-3 Bearing Faults
- Not Valid (0), (1), (2), (3)
- Calibration Failed (4)
- Bearing Self Test Failed (5)
- Axial Displacement Fault (6)
- Axial Static Load Fault (7)
- Front Radial Displacement X Fault (8)
- Front Radial Displacement Y Fault (9)
- Front Radial Static Load X Fault (10)
- Front Radial Static Load Y Fault (11)
- Rear Radial Displacement X Fault (12)
- Rear Radial Displacement Y Fault (13)
- Rear Radial Static Load X Fault (14)
- Rear Radial Static Load Y Fault (15)

Compressor 1-3 Bearing Alarms
- Not Valid (0), (1), (2), (3), (4), (5), (6)
- Axial Static Load Alarm (7)
- Not Valid (8), (9)
- Front Radial Static Load X Alarm (10)
- Front Radial Static Load Y Alarm (11)
- Not Valid (12), (13)
- Rear Radial Static Load X Alarm (14)
- Rear Radial Static Load Y Alarm (15)

Compressor 1-3 Bearing Motor Faults
- Motor Single Phase Overcurrent Fault (0)
- DC Bus Overvoltage Fault (1)
- Motor High Current Warning (2)
- Motor High Current Fault (3)
- Inverter Error Signal Active (4)
- Rotor May Be Locked Fault (5)
- Bearing Fault (6)
- Bearing Warning (7)
- Motor Voltage Generates No Current (8)
- DC Bus Under/Over Voltage Fault (9)
- 24 VDC Out of Range Fault (10)
- Low Motor Back EMF Fault (11)
- EEPROM Checksum Fault (12)
- Generator Mode Status Fault (13)
- SCR Phase Loss Fault (14)
- Compressor is Booting Up (15)

Compressor 1-3 Faults Word 2
- Inverter Temperature Sensor Error Fault (0)
- Cavity Temperature Sensor Error Fault (1)
- Suction Temperature Sensor Error Fault (2)
- Discharge Temperature Sensor Error Fault (3)
- Suction Pressure Sensor Error Fault (4)
- Discharge Pressure Sensor Error Fault (5)
- Invalid Bearing Calibration Fault (6)
- Inverter Cooling Control Fault (7)
- Motor Cooling Control Fault (8)
- Soft Start Temperature Sensor Fault (9)
- Not Valid (10), (11), (12), (13), (14), (15)

Compressor 1-3 Alarms Word 2
- Not Valid (0), (1), (2), (3), (4), (5), (6)
- Inverter Cooling Control Alarm (7)
- Motor Cooling Control Alarm (8)
- Not Valid (10), (11), (12), (13), (14), (15)
SECTION 1: TOUCH SCREEN INTERFACE

Troubleshooting

Touch Screen Troubleshooting

Updating the Touch Screen

- First, delete the old “chiller.jar” file, located in the Chiller folder on your Touch Screen hard drive. Then, copy the new chiller.jar file in its place.

Communication Lost - No Comm

- Verify that the Main Controller is powered on and is firmly connected to the Touch Screen with the communications cable.
- Verify that the CommLink 5 is powered on and connected to your Touch Screen with the Ethernet cable.

Unit Run/Stop & Compressor Disable

There are 4 switches located below the Touch Screen that can be used to disable the compressors or force the unit to run. See Figure 23.

The switches labeled, Circuit A, B, & C allow for a direct disabling of each Compressor—1, 2 or 3. These switches might be used if someone thinks there may be a problem with a given compressor and they need to take that compressor out of operation.

The switch labeled, Unit Run/Stop Switch is a local Run switch. It is labeled as Run/Stop, but it does not necessarily “Stop” the unit. This is a local run switch which could be used to force the unit to run even though the Boiler controller (which is the master controller) is not commanding the unit to run. This might be used in a local test situation where an operator needs to force the chiller into operation for diagnostic reasons.

Figure 23: Chiller Rocker Switch Panel
Main Chiller Controller Operation

The chiller system consists of two primary systems:

1. Refrigeration Loop Control
   1.1. Compressor control (executed by Compressor Circuit Module)
   1.2. Condenser control (by Main Chiller Controller)
   1.3. Expansion/tank level control (by Main Chiller Controller)
   1.4. Economizer/sub-cooling control (executed by Economizer/sub-cooling Module)
2. Vestibule Fan-Coil Control (by Main Chiller Controller)

Refrigeration Loop Control

The Main Chiller Controller Refrigeration Loop Control sequence consists of (5) primary control sections and safeties:

1. Compressor Control
   1.1. Lead/Lag Control
2. Condenser Control
3. Expansion Valve Control
4. Economizer/Sub-cooling Control
5. Safeties Management (interspersed throughout)

Compressor Control

Compressor control is managed based on demands and utilizes the Compressor Circuit Modules.

Run-time Accumulation

The Main Chiller Controller should maintain a total accumulated run-time for each compressor to be used in Lead/Lag management. These run-times should be individually clearable in the event a compressor is replaced.

Lead/Lag Operation

Lead/Lag operation is embedded within the staging so that lead/lag operation can be managed within a system that never (or rarely) shuts down. The lead/lag philosophy is simple:

- When staging up, the compressor with the least run time stages up first.
- When staging down, the compressor with the most run-time stages down first.
- There are no provisions for enforcing a running compressor changeover to manage lead/lag.

Startup

1. The Controller will wait for one of (4) run commands:
   1.1. Remote Start/Stop activation Wet Contact on Binary Input #1 of the Main Controller
   1.2. Remote Start/Stop activation 5.0 VDC input on Chiller Expansion Module Input #3
   1.3. Command via WattComms
   1.4. Command via BACnet®

   The WattComms and BACnet® commands should affect the same internal variable such that an activation through either one will be seen as an activation by the other, and in turn, either command can deactivate, regardless of which initiated the activation. The Remote Start/Stop overrides the WattComms or BACnet® commands if enabled and its control cannot be defeated by an activation or deactivation command from either.

2. The Controller will then open the butterfly valve over a period of 5 minutes and wait for the valve to completely open before moving on.

3. The Controller will then wait for Proof of Water Flow. (NOTE: This is an overlap to the water flow safety in that compressors cannot be run without water flow).

Staging

Staging should be based on demands above or below the current modulation capacity of the running compressors. Staging specifics should refer to the Turbocor® compressor manual for setting and managing demand settings and timings during the stage action.

Stage Up

1. During Stage Up, the controller will verify the following conditions:
   - The Leaving Water Temperature is higher than the Leaving Water Temperature Setpoint.
   - No compressors are active or all running compressors are at maximum position.
   - There is an enabled compressor available to activate.
   - All running compressors have completed their startup cycle.
   - Stage Up and Minimum Off timers met.
   - No safeties are active which would stop compressor operation.
Main Chiller Controller Operation

SECTION 2: SEQUENCE OF OPERATIONS

1. No Turbocor® Faults are active for the designated compressor activating.

2. If this is not the first compressor to start, Wait at least 10 minutes for the Condenser Ratio to be 2.4 (adjustable) or lower.

   After 10 minutes, ignore the ratio if it hasn’t dropped low enough and start anyway.

3. Select next compressor to start based on whether lead/lag or sequential operation is selected:

   - **Lead/lag operation**: Based on current accumulated run-times for all available compressors, select the available compressor with the lowest run-time.
   
   - **Sequential operation**: Select the next available compressor in the straight sequence 1, 2, 3.

4. Establish the demand for all compressors based on the number of currently running compressors:

   - **No compressors currently running**: Demand = Start demand
   
   - **One compressor currently running**: Demand = 2 Compressor start demand
   
   - **Two compressors currently running**: Demand = 3 Compressor start demand

5. Set the desired demand for all running compressors and for the new compressor to be started (this will start the new compressor).

6. Wait for indication the new compressor is fully activated and begin/continue modulation.

**Stage Down**

1. During Stage Down, the controller will verify the following conditions:

   - **Leaving Water Temperature is lower than the Leaving Water Temperature Setpoint – Cooling Stage Window.**
   
   - At least one compressor is active and all running compressors are at stage up/down minimums based on the number of running compressors.
   
   - All running compressors have completed their startup cycle.
   
   - Stage Down and Minimum Run timers met.

2. Select the compressor to shutdown based on whether lead/lag or sequential operation is selected:

   - **Lead/lag operation**: Based on current accumulated run-times for all running compressors, select the compressor with the longest run-time and signal it to shutdown (do not wait for the shutdown to complete at this point).
   
   - **Sequential operation**: Select the numerically highest running compressor in the straight sequence 1, 2, 3 and signal that compressor to shutdown (do not wait for the shutdown to complete at this point).

3. If there are additional compressors still running:

   - Since the stage down demand has been set for the number of running compressors, it will resume modulating from this level when operations allow it to continue.
   
   - Wait for indication the compressor being shut down is fully deactivated and continue modulation from the current stage down level.

4. If no compressors are running, return to startup and wait for demand or shutdown.

**Modulation**

1. Modulation demand is based on the Leaving Water Temperature and a resettable setpoint.

2. The current setpoint is determined based on the reset input and the reset high and reset low settable set points.

3. All running compressors modulate together.

4. A PID loop is used to calculate a demand factor to apply to the compressors. This demand factor should be sent to all running Compressor Circuit Modules to drive compressor operation.

**Shutdown**

1. Verify conditions for shutdown:

   - (1) Emergency stop was activated.
   
   - (2) A phase brown-out condition occurred.
   
   - (3) A Refrigerant Leak has been detected.
   
   - (4) Remote start/stop was deactivated.
   
   - (5) No outstanding run command from WattComms or BACnet®.
2. Remove the run enable signal from all compressor modules and economizer modules. The compressors will run their auto-shutdown sequence and will ignore any minimum demand level sent from the main controller.

Compressor Faults
1. All running compressors are continuously monitored for operating Faults that cause the affected compressor to shutdown. If a fault is detected, the associated Economizer Module is de-activated until such time that the fault is corrected and normal operations resume.

2. If Lead/Lag is the control method, then a compressor removed from operation can resume operation automatically if the fault is corrected and all signals from the Turbocor® indicate normal operations can resume.

3. If Sequential Operation is the control method, the unit will not stage above the affected controller until the fault is corrected and the affected compressor resumes normal operation.

4. If three compressors are running and compressor 1 or 2 fault, the remaining compressors will continue normal operation if they have already staged on. On sequential systems, the remaining compressors will not be able to stage past the affected compressor.

Condenser Control
Condenser control will manage fan speed of all fans simultaneously based on the highest pressure ratio from all running compressors.

Startup
1. Startup begins with the activation of the selected Compressor Circuit Module after the IGV has opened and the RPM’s are detected.

2. Determine the condenser starting position based on a reset function with outside air temperature.

3. Apply the condenser start position to all condenser fan controllers and maintain it through the fan-bank startup sequence.

4. Activate the condenser fan-banks in a delayed startup stage based on a settable delay.

5. Maintain the condenser start position for an additional delay following all banks starting.

6. Continue with modulation.

Modulation
1. Obtain the pressure ratio from each running Compressor Circuit Module.

2. Using the highest pressure ratio, modulate the condenser fans to maintain the defined pressure ratio.

3. The modulation sequence does not change with compressor staging except that added or removed compressors can change the selection of highest pressure ratio.

Shutdown
1. When all compressors shutdown, turn off all fan banks simultaneously when the compressor state indicates they are finished with the shutdown procedure.

Expansion Valve Control
The expansion valve control is used to regulate the level of coolant in the tank.

Startup
1. At startup, all expansion valves are initially closed.

2. The starting position is set with the activation of the selected Compressor Circuit Module, after the IGV has opened and RPM’s are detected.

3. Hold the starting position for a programmable delay before entering modulation.

Modulation
Modulation is intended to control the level of refrigerant in the tank.

1. Modulation runs on a PID loop as the barrel level can go from 100% full to empty in 30 seconds.

2. The target tank level is based on a combination of the number of running compressors and the current demand level in a reset type function.

   • Based on the number of compressors running, a separate pair of settable minimum and maximum control positions will be used.
Vestibule Fan-Coil Control Sequence

The purpose of the fan-coil control is to manage the environmental conditions in the vestibule on the chiller.

1. If the vestibule temperature is above the Vestibule Cooling Setpoint:
   (1) Cooling Sequence - Stage Up—Activate Fan Coil Fan (VF-R3) and Vestibule Cool (VF-R1) (Vest Cool is the Vest Pump)
   (2) Cooling Sequence - Stage Down—Deactivate Fan Coil Fan (VF-R3) and Vestibule Cool (VF-R1) (Vest Cool is the Vest Pump)

2. If the vestibule temperature is below the Vestibule Heating Setpoint:
   (1) Heating Sequence - Stage Up—Activate Fan Coil Fan (VF-R3), wait 30 seconds, then activate Fan Coil Heat (VH-R1)
   (2) Heating Sequence - Stage Down—Deactivate Fan Coil Heat (VH-R1), wait 30 seconds, then deactivate Fan Coil Fan (VF-R3)

3. If the vestibule temperature is in between the Vestibule Cooling and Heating setpoints, all Outputs will be inactive.

4. If the refrigerant leak monitor detects refrigerant:
   (1) Disable the chiller if BIN 1 (Refrigerant Monitor Input) on Chiller Expansion Module is active.
   (2) Activate Relay 2 (VF-R2) to open the Outside Dampers and turn on the Vent Fans.

ShUTDOWN

1. When no compressors are active, close all expansion valves.

Economizer Subcool Module Management

There are (3) Economizer Subcool Modules associated 1 to 1 with the (3) Compressor Circuit Modules. The Economizer Subcool Modules are commanded from the Main Chiller Controller based on which compressor is being called to activate. If a compressor faults and stops running, the associated economizer module will also shutdown as long as the fault prevents the compressor from running.

Safeties

In the event of any shutdown safety activation, command all running compressors to the stop state. NOTE: This will cause a shutdown sequence to be followed; these compressors do not have a forced emergency.

1. Compressor demands are ignored at this point as the run enable signal is removed and the compressor module forces the Turbocor® to run its shutdown sequence.

2. Ignore minimum off times and minimum run times.

• From the current minimum and maximum levels, a reset function will be enacted based on the current demand.

(1) If the compressor demand signal is at minimum, the PID target level will be at the maximum.

(2) If the compressor demand signal is at maximum, the PID target level will be at the minimum.

(3) Between minimum and maximum compressor demand, the PID target will vary linearly between maximum and minimum target levels.

3. The Discharge Superheat can override the level calculation and drive it lower if the superheat drops too low. An adjustable level (default 6°) will be compared to the lowest of the 3 discharge superheat readings. The lowest reading will override the barrel level lower until the superheat rises above the setpoint by 1°. To disable this feature, enter a 0° minimum level.

Vestibule Fan-Coil Control Sequence

The purpose of the fan-coil control is to manage the environmental conditions in the vestibule on the chiller.

1. If the vestibule temperature is above the Vestibule Cooling Setpoint:
   (1) Cooling Sequence - Stage Up—Activate Fan Coil Fan (VF-R3) and Vestibule Cool (VF-R1) (Vest Cool is the Vest Pump)
   (2) Cooling Sequence - Stage Down—Deactivate Fan Coil Fan (VF-R3) and Vestibule Cool (VF-R1) (Vest Cool is the Vest Pump)

2. If the vestibule temperature is below the Vestibule Heating Setpoint:
   (1) Heating Sequence - Stage Up—Activate Fan Coil Fan (VF-R3), wait 30 seconds, then activate Fan Coil Heat (VH-R1)
   (2) Heating Sequence - Stage Down—Deactivate Fan Coil Heat (VH-R1), wait 30 seconds, then deactivate Fan Coil Fan (VF-R3)

3. If the vestibule temperature is in between the Vestibule Cooling and Heating setpoints, all Outputs will be inactive.

4. If the refrigerant leak monitor detects refrigerant:
   (1) Disable the chiller if BIN 1 (Refrigerant Monitor Input) on Chiller Expansion Module is active.
   (2) Activate Relay 2 (VF-R2) to open the Outside Dampers and turn on the Vent Fans.
Compressor Circuit Module Operation

SECTION 2: SEQUENCE OF OPERATIONS

Compressor Circuit Module

The Compressor Circuit Module performs the following functions:

- Controls the operation of the compressor via communications with the compressor control board.
- Manages the isolation valve.
- Manages the load balance/startup bypass valve.
- Communicates with and manages operation of the Economizer/sub-cooling module.
- Communicates with and controls its associated compressor via Modbus from the Modbus Master port.

Points of Information and Control

The Compressor Circuit Module provides the following critical points of information (beyond general status) to the Main Chiller Controller via E-BUS (Modbus):

Commands

Compressor-Run – This is a binary condition to run or stop the compressor operation. This condition can be overridden by the Disable Binary Input; if the input is active, the Compressor-Run is overridden to indicate a stop condition.

Compressor-Demand – This is a value provided to drive the demand of the compressor. This should be a 0-100% value, with 0% = compressor minimum capacity and 100% = compressor maximum capacity.

Status

Startup-Status – This is a binary indication that this board has completed all steps required for complete startup, including all valve positioning operations.

Running-Status – This value should indicate if the compressor is running at, beyond, or below the demand.

Fault-Status – This value should indicate any faults in the compressor or within this module, including indication that the Disable binary input is active.

Shutdown-Status – This is a binary indication that the board has completed all steps required for complete shutdown, including all valve positioning operations.

Sequence

The sequence consists of several sub-sequences:
- Load Balance/Startup Bypass Valve
- Isolation Valve
- Compressor Operation

Load Balance/Startup Valve Control

In the Off state, this valve shall be maintained closed.

Startup

1. When Compressor-Run is activated, wait a settable delay.
2. Open the valve fully at the maximum operating rate.
3. Wait for the compressor control startup sequence to complete.
4. Close this valve at a settable rate.
5. Startup is completed when the valve is fully closed.

Shutdown

1. Prior to Compressor-Run deactivation, open valve to 100% (6386 steps).
2. Wait 20 seconds before deactivating the compressor.
3. Once the Compressor is confirmed off, close the valve.

Isolation Valve Control

Startup

1. When Compressor-Run is activated, open this valve immediately.
2. Wait a settable delay before considering startup complete (default is 90 seconds).

Shutdown

1. When Compressor-Run is deactivated and the compressor control sequence has completed, close this valve.
2. Wait a settable delay as used in opening and consider shutdown complete.
Compressor Control

Compressor control is managed based on demands and utilizes the Compressor Circuit Modules. While this sequence is based on the Danfoss Turbocor® Compressor Controller Manual, that manual should be referred to in the actual code development to ensure all requirements for compressor operation are met.

Run-time Monitor

Compressor operation includes a run-time monitor which should track the total run hours for the compressor and be maintained in permanent storage. In order to reduce the wear on storage:

1. This value should be updated into flash storage for every accumulated hour of run-time, so that in the event of a power loss, no more than one hour of accumulation tracking is lost.
2. Power up will have to restart the accumulation from the value stored in flash.
3. This value should be resettable (including zeroing the storage) in the event a new compressor is installed.

Power Up

1. Initially show this board as disabled (as if the Disable input were activated) and hold that condition for the duration of the power up sequence.
2. During initial power application, the compressor control board has a no-communication status for a period of about 75 seconds. Wait this time before attempting to communicate with the compressor.
3. Check the compressor status and wait for indication that the compressor control has completed all initialization.
4. Update the fault status as may be pertinent to the current condition of the compressor.
5. Consider power up sequence completed and release the Disable hold.

Startup

1. When Compressor-Run is activated, wait for the Isolation valve startup to complete.
2. Wait an additional settable delay before beginning the actual compressor startup.
3. Set the demand value to the compressor and enable the compressor for operation.
4. Wait for the compressor to indicate full operation at the provided demand before considering compressor startup complete.

Modulation

1. The Compressor-Demand is forwarded to the compressor.

Shutdown

1. When Compressor-Run is deactivated, reduce the compressor demand to minimum and lock it there.
2. Issue the appropriate shutdown commands to the compressor controller.
3. Wait for the compressor to indicate it has stopped all operation before considering compressor shutdown complete.

Economizer Subcool Module Management

Startup

1. When the compressor is activated (Step 4 in Compressor Startup), wait a settable delay before commanding the Economizer Subcool Module to start. (This command will be transferred by the Main Chiller Controller).

Shutdown

1. At shutdown, command the Economizer Subcool Module to cease operation.
**SECTION 2: SEQUENCE OF OPERATIONS**

**Economizer Subcool Module & Main Faults**

**Economizer Subcool Module**

The Economizer Subcool Module manages the superheat of the sub-cooler to a settable limit. The Economizer Subcool Module will receive its run/stop from the Compressor Circuit Module.

**Points of Information and Control**

The Economizer Subcool Module provides the following critical points of information (beyond general status) to the Main Chiller Controller via E-BUS (Modbus):

**Commands**

- **Economizer-Run** – This is a binary condition to run or stop the economizer operation.

**Status’s**

- **Startup-Status** – This is a binary indication that this board has completed all steps required for complete startup, including all valve positioning operations.
- **Running-Status** – This value should indicate if the compressor is running at, beyond, or below the demand.
- **Fault-Status** – This value should indicate any faults in the compressor or within this module, including indication that the Disable binary input is active.
- **Shutdown-Status** – This is a binary indication that the board has completed all steps required for complete shutdown, including all valve positioning operations.
- **Run-time** – This value is an accumulation of running hours for the attached compressor.

**Sequence**

- **Startup**
  
  When Economizer-Run is activated, open the EXV to the initial starting position and hold for a settable time delay.

- **Modulation**
  
  Using a PID loop, modulate the EXV to obtain the set superheat value desired.

- **Shutdown**
  
  When Economizer-Run is deactivated, close the EXV.

**Fault Detection**

The Main Chiller Controller continuously performs self diagnostics during normal operation to determine if any operating failures have occurred.

These failures (faults) can be reported to the Panel PC with Touch Screen interface or to a computer running Prism 2 software.

The following are the available fault designations for the Main Chiller Controller:

- **No Flow**
  No Water Flow has been detected once the butterfly valve has been opened.

- **Exp Lost**
  One or more expansion boards aren’t communicating with the main controller.

- **CondFail**
  The condenser fault input has been lost so that indicates an alarm. This doesn’t affect control.

- **Shutdown**
  Either the Emergency Stop or the Phase Loss inputs on the Main Controller have set this condition or a Refrigerant Leak on the Chiller Expansion Module has occurred.

- **CompFail**
  This alarm indicates a compressor fault has been received on the EBUS from the Main Controller.

- **Disabled**
  This alarm indicates the Binary Input on the Compressor Module is not made.

- **Freeze**
  This alarm indicates the water temperature is below the Leaving Water Temperature Setpoint.

- **LostComm**
  This alarm should never occur, but just in case, it means there is no communication with the CommLink 5.

**No Flow Fault**

The rate of flow is monitored when the Butterfly Valve opens. If the Butterfly Valve is 100% open and the flow rate in Gallons Per Minute (GPM) is not at or above a proving level of 330 GPM (adjustable) it will not enable the Proof of Water Flow indicator, and cooling will be disabled.

If the Proof of Flow was enabled by adequate GPM’s and the flow rate drops below a lower limit of 290 GPM (adjustable) for at least 3 seconds, the Proof of Flow enable will be removed.

If the Proof of Flow is not enabled, the cooling will not be allowed to activate. If the cooling was currently running and the Proof of Flow was lost, the cooling will be de-activated until such time as the GPM rise above the proof level again.
**Main Faults**

### Exp Lost - Expansion Board Lost Fault
- Chiller Expansion Module Missing
- Compressor Module #1 Missing
- Compressor Module #2 Missing
- Compressor Module #3 Missing
- Economizer Module #1 Missing
- Economizer Module #2 Missing
- Economizer Module #3 Missing

If the controller is configured to have any of the above Expansion Boards (Modules), but the controller does not detect that board, then the applicable alarm will occur. If the board is properly detected after the unit has alarmed, the alarm will be cleared.

If the Chiller Expansion Module is missing, an alarm will occur and if the enable to run signal was being read from that board, the main controller will not enter the Run Mode and control the Leaving Water Temperature. If the Run mode was activated by Binary Input #1 or BACnet, the unit will run and provide cooling, but the Vestibule temperature will not be controlled.

If either an Economizer Module or a Compressor Module is missing, that particular compressor will not run, but the main controller will still attempt to use the remaining compressors that are not missing.

**NOTE:** If an Economizer Module is missing, then the associated Compressor Module will be de-activated. If the Compressor Module is missing, then the associated Economizer Module will be de-activated.

###CondFail - Condenser Failure Fault
This is simply an alert that there is a problem with one of the Condenser Fans. No operational changes are made, but the user is notified there is an issue that needs to be corrected in the condenser section.

### Shutdown Fault
A 24 VAC wet contact input is available to be used when an Emergency Stop or Phase Loss condition occurs. If one of these contacts opens, it will initiate shutdown of the Main Controller and will generate a fault condition. Also, if a Refrigerant Leak is detected on the Chiller Expansion Module, a shutdown and fault will occur.

### CompFail - Compressor Failure Fault
This indicates one of the Compressor faults has been detected. A Compressor fault will automatically shutdown the affected Compressor by the Turbocor®’s own internal control module. The Main Chiller Controller simply reads the fault conditions and reports them to the end user. If the Compressor has a fault before it has been enabled to run, that Compressor will never receive the enable to run request and control will move to the next available Compressor.

### Disabled - Compressor Disabled Fault
This fault is generated by removing the Binary Input Enable signal from the Compressor Module board. This is a manual method of locking out a Compressor for maintenance or other operational issues.

### Freeze - Freeze Protection Fault
If the Leaving Water Temperature drops below this value, the Compressors are disabled from running but the main water value remains open. If the Leaving Water Temperature rises 5° above this limit, the Compressors are enabled to run again, but no call for cooling will re-occur until the water temperature is above the Leaving Water Temperature Setpoint.
SECTION 3: WIRING

Main Chiller Controller & Expansion Module Input/Output Maps

**Input/Output Map**

See Table 1 for the Main Chiller Controller Inputs/Outputs and Table 2 for the Chiller Expansion Inputs/Outputs.

### MAIN CHILLER CONTROLLER

**Analog Inputs**

1. Leaving Water Temperature (AI1)
2. Entering Water Temperature (AI2)
3. Outside Air Temperature (AI3)
4. Not Used (AI4)
5. Refrigerant Level (0-5VDC) (AI5)
6. Reset Signal (0-10VDC) (AI6)

**Binary Inputs**

1. Remote Start/Stop (BIN1)
2. Water Flow Switch (BIN2)
3. Emergency Stop #1 & #2 (BIN3)
4. Condenser Fault (BIN4)
5. Phase Brownout (BIN5)

**Analog Outputs (0-10 VDC)**

1. MCS Expansion Valves #1 thru #5 (AO1)
2. Condenser Fan VFD #1 thru #5 (AO2)
3. Butterfly Valve Actuator (AO3)

**Binary Outputs (24 VAC)**

1. Condenser Fan 1 (RLY1)
2. Condenser Fan 2 (RLY2)
3. Condenser Fan 3 (RLY3)
4. Condenser Fan 4 (RLY4)
5. Condenser Fan 5 (RLY5)
6. Alarm Relay (RLY6)

Table 1: Main Chiller Controller Inputs & Outputs

### CHILLER EXPANSION MODULE

**Analog Inputs**

1. Vestibule Temperature Sensor (T1)
2. Liquid Line Temperature Sensor (T2)
3. Chiller Enable (0-5VDC) (T3)
4. Liquid Line Pressure (0-5VDC) (SIG 1 Input)

**Binary Inputs**

1. Refrigerant Leak Detector (BIN1)

**Analog Outputs (0-5 VDC)**

1. Chiller Active (5V = Active) (AOUT1)
2. Chiller Loaded (5V = Active) (AOUT2)

**Binary Outputs (24 VAC)**

1. Vestibule Cool Enable (VF-R1)
2. Vent Fans #1 - #4 - All Damper Actuators (VF-R2)
3. Fan Coil Fan Enable (VF-R3)
4. Fan Coil Heat Enable (VH-R4)

Table 2: Chiller Expansion Module Inputs & Outputs
SECTION 3: WIRING

Compressor Circuit & Economizer Subcool Module I/O Maps

Input/Output Map

See Table 3 for the Compressor Circuit Module Inputs/Outputs and Table 4 for the Economizer Subcool Module Inputs/Outputs.

### COMPRESSOR CIRCUIT MODULE

<table>
<thead>
<tr>
<th>Analog Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Suction Line Temperature Sensor (TEMP1)</td>
</tr>
<tr>
<td>2 Discharge Line Temperature Sensor (TEMP2)</td>
</tr>
<tr>
<td>3 Suction Line Pressure (0-5VDC) (SIG 1 Input)</td>
</tr>
<tr>
<td>4 Discharge Line Pressure (0-5VDC) (SIG 2 Input)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Compressor Disable (BIN1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Load Balance Expansion Valve (EXV-1)</td>
</tr>
<tr>
<td>2 Turbocor Control (MODBUS)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Outputs (24 VAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Isolation Valve (R1)</td>
</tr>
<tr>
<td>2 Compressor Enable (R2)</td>
</tr>
<tr>
<td>3 Load Balance Expansion Valve Active (R3)</td>
</tr>
</tbody>
</table>

Additionally, each Compressor Circuit Module will communicate with and control its associated Compressor via Modbus from the Modbus Master port.

### ECONOMIZER SUBCOOL MODULE

<table>
<thead>
<tr>
<th>Analog Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Economizer Suction Pressure (0-5V)</td>
</tr>
<tr>
<td>(SIG 1 Input)</td>
</tr>
<tr>
<td>2 Economizer Suction Temperature Sensor (TEMP1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MCS Economizer Expansion Valve (AOUT1)</td>
</tr>
</tbody>
</table>

Table 4: Economizer Subcool Module Inputs & Outputs
Main Chiller Controller Inputs

The G015540 Main Chiller Controller is only used with Turbocor® Compressors in Chiller Operation. The Controller is designed with 8 analog inputs, 4 analog outputs, 8 binary inputs, and 8 relay outputs.

The Main Chiller Controller has an on-board BACnet® port for connection to a BACnet® MS/TP BAS network.

The Main Chiller Controller provides Compressor demand management, Condenser control, and Expansion Valve control of the Turbocor® Compressor in Chiller operation.

See Figure 24, below, for input wiring.
Main Chiller Controller Outputs

The Main Chiller Controller has (2) E-BUS Expansion Ports which allow for the connection of the Chiller Expansion Module, (3) Compressor Circuit Modules, and (3) Economizer Subcool Modules via EBC E-BUS Cables.

The Main Chiller Controller must be connected to 18-30 VAC as shown in Figure 25, below. Please see Table 8, page 40 for correct VA requirements to use when sizing the transformer(s) used for powering the Controller.

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

Figure 25: Main Chiller Controller Output Wiring
The G015550 Chiller Expansion Module is used only with Turbocor® Compressors in Chiller operation. The Chiller Expansion Module connects to the Main Chiller Controller with an EBC E-BUS cable to provide additional inputs and outputs beyond those found on the Main Chiller Controller.

The Chiller Expansion Module adds an additional 5 Analog Inputs, 5 Analog Outputs, 3 Binary Inputs, and 5 Configurable Relay Outputs.

The Chiller Expansion Module provides the following features:
- Vestibule Temp Control
- Calculates Liquid Line Subcooling
- Refrigeration Leak Protection
- Signals to and from a Boiler

The Chiller Expansion Module must be connected to an 18-30 VAC power source. When wiring the Chiller Expansion Module, its relay outputs must be wired as wet contacts (connected to 24 VAC). See Figure 26, below for wiring.
Compressor Circuit Module Wiring

The G015560 Compressor Circuit Module is used only with Turbocor® Compressors in Chiller operation. The Compressor Circuit Module monitors and controls one refrigeration circuit of the Chiller. The module is designed for R134a refrigerant.

The Compressor Circuit Module connects to the Main Chiller Controller or another module using an EBC E-BUS cable. Up to 3 Compressor Circuit Modules can be connected, depending on the size of the system.

Each Compressor Circuit Module will communicate with and control its associated Compressor via Modbus from the Modbus Master port.

The Compressor Circuit Module must be connected to an 18-30 VAC power source. See Figure 27, below for wiring.

---

Figure 27: Compressor Circuit Module Wiring

The Compressor Circuit Module provides the following features:

- Controls the operation of the Compressor via communications with the compressor control board.
- Manages the isolation valve.
- Manages the load balance/startup bypass valve.
- Communicates with and manages operation of the Economizer Subcooling Module.
- Provides alarms and safeties for the Compressor operation.
- 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.

---

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. 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.
Economizer Subcool Module Wiring

The G015570 Economizer Subcool Module is used only with Turbocor® Compressors in Chiller operation. The Economizer Subcool Module monitors and controls the subcooling for one refrigeration circuit of the Chiller. The module is designed for R134a refrigerant.

The Economizer Subcool Module connects to the Main Chiller Controller or another module using an EBC E-BUS cable. Up to 3 Economizer Subcool Modules can be connected, depending on the size of the system.

The Economizer Subcool Module must be connected to an 18-30 VAC power source. See Figure 28, below for wiring.

The Economizer Subcool Module provides the following features:

- Modulates the MCS Economizer Expansion Valves to maintain the Superheat Setpoint of the Sub-Cooler.
- Receives its run/stop from the Compressor Circuit Module.
- Provides alarms and safeties for the Compressor operation.
- 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.

**Figure 28: Economizer Subcool Module 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.
Main Chiller Controller & Expansion Module LED Diagnostics

Main Chiller Controller LEDs

The Main Chiller Controller is equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. The Main Chiller Controller has 26 LEDs—10 used for operation & status, 8 used for relays, and 8 used for binary inputs. See Figure 30, 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:

**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.

**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 there is an override, the LED will blink 2 times every 10 seconds. And finally, if one of the outputs is in force mode, the LED will blink 3 times every 10 seconds.

**Communication LEDs**

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

**LOOP COMM** - This yellow LED will light up and blink continuously to indicate the Main Chiller Controller is communicating.

**BACNET** - This yellow LED will light up and blink continuously to indicate BACnet® communications.

**Relay LEDs**

**RLY1 - RLY6** - 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 is closed.

**BIN3** - This green LED will light up when Emergency Stop #1 or #2 switch is closed.

**BIN4** - This green LED will light up when the Condenser Fault switch is closed.

**BIN5** - This green LED will light up when the Phase Brownout contact is closed.

**Chiller Expansion Module LEDs**

The Chiller Expansion Module is equipped with 4 LEDs that can be used as very powerful troubleshooting tools. See Figure 31, page 35 for LED locations. The LEDs and their uses are as follows:

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

**ALARM** - 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.

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

**COMM** - Every time the module receives a valid E-BUS request from the Main Chiller Controller, this LED will blink on and then off, signifying that it received a valid request and responded.
SECTION 4: TROUBLESHOOTING

Main Chiller Controller & Expansion Module LED Diagnostics

Figure 30: Main Chiller Controller LED Locations

Figure 31: Chiller Expansion Module LED Locations
Using LEDs To Verify Operation

The Modules are equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. See Figure 32, below 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 Main Chiller 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.

**Binary Input LEDs**

**BIN1** - This green LED will light up when the Compressor Disable contact is closed.

**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.

**Stepper Motor Valve LEDs**

**EXV-1** - This green LED will light up when the Expansion Valve is modulating.

---

Figure 32: Compressor and Economizer Module LED Locations (Compressor Circuit Module Shown)
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.

Thermistor 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 tables. Please follow the notes and instructions that appear after the chart when checking sensors.

### Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor 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>
<td>45902</td>
<td>4.1</td>
</tr>
<tr>
<td>20</td>
<td>-6.66</td>
<td>40147</td>
<td>4.002</td>
</tr>
<tr>
<td>25</td>
<td>-3.88</td>
<td>35165</td>
<td>3.891</td>
</tr>
<tr>
<td>30</td>
<td>-1.11</td>
<td>30805</td>
<td>3.773</td>
</tr>
<tr>
<td>35</td>
<td>1.66</td>
<td>27140</td>
<td>3.651</td>
</tr>
<tr>
<td>40</td>
<td>4.44</td>
<td>23874</td>
<td>3.522</td>
</tr>
<tr>
<td>45</td>
<td>7.22</td>
<td>21094</td>
<td>3.39</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>18655</td>
<td>3.252</td>
</tr>
<tr>
<td>52</td>
<td>11.11</td>
<td>17799</td>
<td>3.199</td>
</tr>
<tr>
<td>54</td>
<td>12.22</td>
<td>16956</td>
<td>3.143</td>
</tr>
<tr>
<td>56</td>
<td>13.33</td>
<td>16164</td>
<td>3.087</td>
</tr>
<tr>
<td>58</td>
<td>14.44</td>
<td>15385</td>
<td>3.029</td>
</tr>
<tr>
<td>60</td>
<td>15.55</td>
<td>14681</td>
<td>2.972</td>
</tr>
<tr>
<td>62</td>
<td>16.66</td>
<td>14014</td>
<td>2.916</td>
</tr>
<tr>
<td>64</td>
<td>17.77</td>
<td>13382</td>
<td>2.861</td>
</tr>
<tr>
<td>66</td>
<td>18.88</td>
<td>12758</td>
<td>2.802</td>
</tr>
<tr>
<td>68</td>
<td>20</td>
<td>12191</td>
<td>2.746</td>
</tr>
<tr>
<td>69</td>
<td>20.55</td>
<td>11906</td>
<td>2.717</td>
</tr>
<tr>
<td>70</td>
<td>21.11</td>
<td>11652</td>
<td>2.691</td>
</tr>
<tr>
<td>71</td>
<td>21.66</td>
<td>11379</td>
<td>2.661</td>
</tr>
<tr>
<td>72</td>
<td>22.22</td>
<td>11136</td>
<td>2.635</td>
</tr>
<tr>
<td>73</td>
<td>22.77</td>
<td>10878</td>
<td>2.605</td>
</tr>
</tbody>
</table>

**Table 5**: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors
Suction Pressure Transducer Testing for R134a Refrigerant

The Evaporator Coil Temperature is calculated by converting the Suction Pressure to Temperature. The Suction Pressure is obtained by using the 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 Compressor Circuit Module(s) or Economizer Subcool Module(s). The Main Chiller Controller and the 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 SP terminal located on the Module(s) terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the SP 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 SP 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 Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R134a Refrigerant testing. The charts show a temperature range from 10°F to 130°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and pressures.
Discharge Pressure Transducer Testing 0-500 PSI

The Discharge Pressure is obtained by using the Discharge Pressure Transducer, which is connected into the Discharge Line of the Compressor.

Use the voltage column to check the Discharge Pressure Transducer while connected to the Compressor Circuit Module. The Module must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the DP input terminal located on the Module. Place the negative lead from the meter on the ground (COM) terminal located adjacent to the DP terminal on the Module. Use a refrigerant gauge set to measure the suction line pressure near where the Discharge Pressure Transducer is connected to the discharge line. Measure the Voltage at the terminals DP and COM terminals and compare it to the appropriate chart depending on the refrigerant you are using. If the pressure/voltage readings do not align closely with the chart, your Discharge Pressure Transducer is probably defective and will need to be replaced.

<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>10</td>
<td>12</td>
<td>0.596</td>
<td>90</td>
<td>104.3</td>
<td>1.335</td>
</tr>
<tr>
<td>15</td>
<td>15.1</td>
<td>0.621</td>
<td>95</td>
<td>113.9</td>
<td>1.411</td>
</tr>
<tr>
<td>20</td>
<td>18.4</td>
<td>0.647</td>
<td>100</td>
<td>124.1</td>
<td>1.493</td>
</tr>
<tr>
<td>25</td>
<td>22.1</td>
<td>0.677</td>
<td>105</td>
<td>134.9</td>
<td>1.579</td>
</tr>
<tr>
<td>30</td>
<td>26.1</td>
<td>0.709</td>
<td>110</td>
<td>146.3</td>
<td>1.671</td>
</tr>
<tr>
<td>35</td>
<td>30.4</td>
<td>0.743</td>
<td>115</td>
<td>158.4</td>
<td>1.767</td>
</tr>
<tr>
<td>40</td>
<td>35</td>
<td>0.78</td>
<td>120</td>
<td>171.1</td>
<td>1.869</td>
</tr>
<tr>
<td>45</td>
<td>40</td>
<td>0.82</td>
<td>125</td>
<td>184.5</td>
<td>1.976</td>
</tr>
<tr>
<td>50</td>
<td>45.4</td>
<td>0.863</td>
<td>130</td>
<td>198.7</td>
<td>2.09</td>
</tr>
<tr>
<td>55</td>
<td>51.2</td>
<td>0.91</td>
<td>135</td>
<td>213.5</td>
<td>2.208</td>
</tr>
<tr>
<td>60</td>
<td>57.4</td>
<td>0.959</td>
<td>140</td>
<td>229.2</td>
<td>2.334</td>
</tr>
<tr>
<td>65</td>
<td>64</td>
<td>1.012</td>
<td>145</td>
<td>245.6</td>
<td>2.465</td>
</tr>
<tr>
<td>70</td>
<td>71.1</td>
<td>1.069</td>
<td>150</td>
<td>262.8</td>
<td>2.603</td>
</tr>
<tr>
<td>75</td>
<td>78.6</td>
<td>1.129</td>
<td>155</td>
<td>281</td>
<td>2.748</td>
</tr>
<tr>
<td>80</td>
<td>86.7</td>
<td>1.194</td>
<td>160</td>
<td>299.9</td>
<td>2.899</td>
</tr>
<tr>
<td>85</td>
<td>95.2</td>
<td>1.262</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Temperature/Pressure/Voltage for Discharge Pressure Transducers
## Important Wiring Considerations

### General

Correct wiring of the Main Chiller Controller and its modules is the most important factor in the overall success of the controller installation process. The Main Chiller Controllers 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 Main Chiller 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 8, 9 & 10.

<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><strong>Main Chiller Controller</strong></td>
<td>24VAC (25%/−15%), Class 2</td>
<td>15</td>
<td>-30°F to 150°F</td>
<td>0-95% RH</td>
</tr>
<tr>
<td>Inputs</td>
<td>Resistive Inputs require 10KΩ Type 3 Thermistor</td>
<td>24VAC Inputs provide 4.7kΩ Load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outputs</td>
<td>Relay Outputs: 1 Amp maximum per output.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 8: Main Chiller 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><strong>Chiller Expansion Module</strong></td>
<td>24VAC (25%/−15%), Class 2</td>
<td>5</td>
<td>-30°F to 150°F</td>
<td>0-95% RH</td>
</tr>
<tr>
<td>Inputs</td>
<td>Resistive Inputs require 10KΩ Type 3 Thermistor</td>
<td>24VAC Inputs provide 4.7kΩ Load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outputs</td>
<td>Relay Outputs: 1 Amp maximum per output.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 9: Chiller Expansion 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><strong>Compressor Circuit Module &amp; Economizer Subcool Module</strong></td>
<td>24VAC (25%/−15%), Class 2</td>
<td>18</td>
<td>-30°F to 150°F</td>
<td>0-95% RH</td>
</tr>
<tr>
<td>Inputs</td>
<td>Resistive Inputs require 10KΩ Type 3 Thermistor</td>
<td>24VAC Inputs provide 4.7kΩ Load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outputs</td>
<td>Relay Outputs: 1 Amp maximum per output.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 10: Compressor Circuit Module & Economizer Subcool Module Electrical and Environmental Requirements**
***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 Main Chiller Controller and its associated modules.

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

1. All wiring is to be in accordance with local and national electrical codes and specifications.

2. All 24 VAC 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 VAC 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 VAC 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 Main Chiller 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 Main Chiller Controller and its associated modules, be sure to recheck all wiring connections and terminations thoroughly.
APPENDIX A - MAIN CHILLER CONTROLLER LCD SCREENS

Navigation Keys & Main Screens Map

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 33, below and refer to Table 11 for descriptions.

![Figure 33: LCD Display and Navigation Keys](image)

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

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

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

Press **✓** to go to the first Main Menu Screen.

Main Screens Map

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

### Table 11: Navigation Key Functions

<table>
<thead>
<tr>
<th>NAVIGATION KEY</th>
<th>KEY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MENU</strong></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><strong>UP</strong></td>
<td>Use this key to adjust setpoints and change configurations.</td>
</tr>
<tr>
<td><strong>DOWN</strong></td>
<td>Use this key to adjust setpoints and change configurations.</td>
</tr>
<tr>
<td><strong>ENTER</strong></td>
<td>Use the ENTER key to navigate through the Main Menu Screen categories.</td>
</tr>
</tbody>
</table>
Settings Screens

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

- **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.

- **MSTP Baud 38400**

- **EBUS Lo Speed or Hi Speed**

**UNIT ADDRESS**
Unit address. Valid range is 1-59. Default is 59.

**BAUD RATE SPEED**
485 baud rate speed. Valid range is Lo-Speed or Hi-Speed. Default is Hi-Speed.

**MAC Addr 0 TO 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.
Status Screens

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

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

- UNOCCUPY (Unoccupied)
- INITMODE
- RUN MODE

**LEAVING WATER TEMPERATURE**

**LEAVING WATER TEMPERATURE SETPOINT**

**ENTERING WATER TEMPERATURE**

**OUTDOOR AIR TEMPERATURE**

**WATER VALVE POSITION**

**REFRIGERANT LEVEL**

**DEMAND PERCENTAGE**
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. For alarm definitions and troubleshooting, see pages 24 & 25.

**Alarms**

The screen will display the alarms as follows:

- **No Alarms**: There are no alarms.
- **No Flow**: No Water Flow has been detected once the butterfly valve has been opened.
- **Exp Lost**: One or more expansion boards aren’t communicating with the Main Controller.
- **CondFail**: The Condenser fault input has been lost so that indicates an alarm. This doesn’t affect control.
- **Shutdown**: Either the Emergency Stop or the Phase Loss inputs on the Main Controller have set this condition or a Refrigerant Leak on the Chiller Expansion Module has occurred.
- **CompFail**: This alarm indicates a compressor fault has been received on the EBUS from the Main Controller.
- **Disabled**: This alarm indicates the Binary Input on the Compressor Module is not made.
- **Freeze**: This alarm indicates the water temperature is below the Leaving Water Temperature Setpoint.
- **LostComm**: This alarm should never occur, but just in case, it means there is no communication with the CommLink 5.
Main Screens Map
Refer to the following map when navigating through the LCD Main Screens. To scroll through the screens, press the <MENU> button.

Press ☑️ to scroll through TBCOR MODULE Screens.

Press ☑️ to go to SYSTEM STATUS Screen.

Press ☑️ to scroll through SYSTEM STATUS Screens.

Press ☑️ to go to SENSOR STATUS Screen.

Press ☑️ to scroll through SENSOR STATUS Screens.

Press ☑️ to go to TURBOCOR INFO Screen.

Press ☑️ to go to TURBOCOR INFO Screens.

Press ☑️ to go to ALARMS Screen.

Press ☑️ to scroll through ALARMS Screens.

Press ☑️ to scroll through ALARMS Screens.

Press ☑️ to return to the TBCOR Screen.

Module Screens
Refer to the following map when navigating through the Compressor Circuit Module Screens. From the TBCOR MODULE Screen, press <ENTER> to scroll through the screens.

Press ☑️ to scroll through E-BUS COMMUNICATION DIAGNOSTICS.

Press ☑️ to return to the TBCOR Screen.
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**
  - Possible choices are OFF, INIT, STARTUP, RUN, SHUTDOWN

- **TURBOCOR**
  - Possible choices are NO COMM, OFF, STARTUP, RUN, SHUTDOWN

- **DEMAND XX.X%**
  - DEMAND PERCENTAGE 0-100%

- **SPEED XXXXRPM**
  - SPEED RPM 4200 RPM

- **LB VALVE XXX%**
  - MODULATING PERCENTAGE 0-100%

- **ISO VLV**
  - ISOLATION VALVE OPEN or CLOSED
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

SUCTION XXX PSI

DISCHARGE XXX PSI

PSIRATIO X.XX

SUCTION TEMPERATURE

SUC TEMP XX.X F

SUC LINE XX.X F

SUCTION LINE TEMPERATURE 1 READING FROM TEMPERATURE SENSOR INPUT

DIS TEMP XX.X F

DISCHARGE TEMPERATURE

DIS LINE XX.X F

DISCHARGE LINE TEMPERATURE 1 READING FROM TEMPERATURE SENSOR INPUT
Turbocor Info Screens

Refer to the following map when navigating through the Turbo Info Screens. From the TURBCOR INFO Screen, press <ENTER> to scroll through the screens.

**TURBCOR INFO**

**BMC STATE**

BMC Operation Mode:
- 0 = Standby
- 1 = Levitate
- 2 = Drive
- 3 = Calibrate

**COMPSTAT BITO - 15=#**

**MIN SPD XXXX RPM**

Minimum Compressor Speed Feedback

RPMs from Turbocor

**MAX SPD XXXX RPM**

Maximum Compressor Speed Feedback

RPMs from Turbocor

**3PH AMP 0**

3-Phase Amperage

Three Phase Current Feedback reading from the Turbocor compressor.

**COMM T/O #**

Comm Timeout Timer

0 - 30 (if 30, Alarm & Fault)

**IGV % XXX**

IGV Percentage

0-100%

**Turbocor Info Screen**
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.

**MB MASTR COMM T/O:** This alarm indicates that communication has been lost between the Module and the Turbocor® compressor for at least 30 seconds. This can be the result of a bad cable or a missing cable.

**COMP BIN DISABLED:** This indicates the compressor enable signal binary input is no longer active. This input is connected to the specific compressor circuit enable/disable switch on the front panel access door.

**TURBOCOR FAULT:** This alarm will occur if the Turbocor® compressor communicates through ModBus that it has shutdown due to a fault condition. The compressor module will attempt to reset the fault after 5 minutes if the Turbocor® compressor sends the signal that it is okay to reset the fault.

**EBUS COMM TIMEOUT:** This alarm indicates that communication has been lost between the Module and the Main controller. This can be the result of a bad cable or a missing cable.
APPENDIX A - ECONOMIZER SUBCOOL MODULE LCD SCREENS

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

- Press <✓> to scroll through ECONOMIZER MODULE 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 ALARMS Screens.
- Press <M> to return to the ECONOMIZER Screen.

Module Screens
Refer to the following map when navigating through the RSMV Screens. From the TBCOR MODULE Screen, press <ENTER> to scroll through the screens.

- Press <✓> to return to the ECONOMIZER Screen.
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**
- **STATUS ON/OFF**
- **POSITION XXX%**
- **SUC PRES XXX PSI**
- **SUPRHEAT XX.X F**
- **CURRENT SUPERHEAT CALCULATION**
- **COILTEMP XX.X F**
- **COIL TEMPERATURE READING FROM TEMPERATURE SENSOR INPUT**
- **SUC TEMP XX.X F**
- **SUCTION TEMPERATURE**
- **SETPOINT XX.X F**
- **SUCTION TEMPERATURE SETPOINT**
- **EXVA PID -1 0 0**
- **EXV VALVE PID**
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.

**EBUS COMM TIMEOUT:** This alarm indicates that communication has been lost between the Module and the Turbocor® compressor for at least 30 seconds. This can be the result of a bad cable or a missing cable.
Figure 34: BACnet® Connection to MS/TP Network

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.
<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Software Version</td>
<td>AI:1</td>
<td>Current version of the software in the unit</td>
<td></td>
</tr>
<tr>
<td>Operating Mode</td>
<td>AI:2</td>
<td>Current Occupied/Startup Status</td>
<td>Off Mode (0) Initial Start Delay (1) Run Mode (2)</td>
</tr>
<tr>
<td>Leaving Water Temperature</td>
<td>AI:3</td>
<td>Leaving Water Temperature</td>
<td></td>
</tr>
<tr>
<td>Leaving Water Setpoint</td>
<td>AI:4</td>
<td>Current Leaving Water Temperature Setpoint</td>
<td></td>
</tr>
<tr>
<td>Entering Water Temperature</td>
<td>AI:5</td>
<td>Entering Water Temperature</td>
<td></td>
</tr>
<tr>
<td>Outdoor Air Temperature</td>
<td>AI:6</td>
<td>Outdoor Air Temperature</td>
<td></td>
</tr>
<tr>
<td>Vestibule Temperature</td>
<td>AI:7</td>
<td>Vestibule Temperature</td>
<td></td>
</tr>
<tr>
<td>Barrel Refrigerant Level</td>
<td>AI:8</td>
<td>Refrigerant Level in the Barrel</td>
<td></td>
</tr>
<tr>
<td>Barrel Level Setpoint</td>
<td>AI:9</td>
<td>Current Barrel Refrigerant Level Operating Setpoint</td>
<td></td>
</tr>
<tr>
<td>Water Temperature Reset Voltage</td>
<td>AI:10</td>
<td>Leaving Water Setpoint Reset Voltage Signal</td>
<td></td>
</tr>
<tr>
<td>Compressor Demand Percent Signal</td>
<td>AI:11</td>
<td>Demand Signal to all Active Compressors</td>
<td></td>
</tr>
<tr>
<td>Liquid Line Temperature</td>
<td>AI:12</td>
<td>Liquid Line Temperature</td>
<td></td>
</tr>
<tr>
<td>Liquid Line Pressure</td>
<td>AI:13</td>
<td>Liquid Line Pressure</td>
<td></td>
</tr>
<tr>
<td>Liquid Line Saturation Temperature</td>
<td>AI:14</td>
<td>Liquid Line Saturation Temperature</td>
<td></td>
</tr>
<tr>
<td>Liquid Line Sub-cooling</td>
<td>AI:15</td>
<td>Liquid Line Sub-cooling Temperature</td>
<td></td>
</tr>
<tr>
<td>Evap Expansion Valve Position</td>
<td>AI:16</td>
<td>Expansion Valve Position for Barrel Level</td>
<td></td>
</tr>
<tr>
<td>Condenser Fan Speed</td>
<td>AI:17</td>
<td>Condenser Fan VFD Speed</td>
<td></td>
</tr>
<tr>
<td>Water Valve Position</td>
<td>AI:18</td>
<td>Water Valve Position</td>
<td></td>
</tr>
<tr>
<td>Economizer #1 Expansion Valve</td>
<td>AI:19</td>
<td>Economizer #1 Expansion Valve Position</td>
<td></td>
</tr>
<tr>
<td>Economizer #1 Suction Pressure</td>
<td>AI:20</td>
<td>Economizer #1 Suction Pressure</td>
<td></td>
</tr>
<tr>
<td>Economizer #1 Saturation Temperature</td>
<td>AI:21</td>
<td>Economizer #1 Saturation Temperature</td>
<td></td>
</tr>
<tr>
<td>Economizer #1 Suction Line Temperature</td>
<td>AI:22</td>
<td>Economizer #1 Suction Line Temperature</td>
<td></td>
</tr>
<tr>
<td>BACnet® Point Name</td>
<td>Object</td>
<td>BACnet® Description</td>
<td>Limits</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------</td>
<td>--------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Economizer #1 Superheat</td>
<td>A1:23</td>
<td>Economizer #1 Superheat</td>
<td></td>
</tr>
<tr>
<td>Economizer #2 Expansion Valve</td>
<td>A1:24</td>
<td>Economizer #2 Expansion Valve Position</td>
<td></td>
</tr>
<tr>
<td>Economizer #2 Suction Pressure</td>
<td>A1:25</td>
<td>Economizer #2 Suction Pressure</td>
<td></td>
</tr>
<tr>
<td>Economizer #2 Saturation Temperature</td>
<td>A1:26</td>
<td>Economizer #2 Saturation Temperature</td>
<td></td>
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<tr>
<td>Economizer #2 Suction Line Temperature</td>
<td>A1:27</td>
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</tr>
<tr>
<td>Economizer #2 Superheat</td>
<td>A1:28</td>
<td>Economizer #2 Superheat</td>
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</tr>
<tr>
<td>Economizer #3 Expansion Valve</td>
<td>A1:29</td>
<td>Economizer #3 Expansion Valve Position</td>
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<tr>
<td>Economizer #3 Suction Pressure</td>
<td>A1:30</td>
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<tr>
<td>Economizer #3 Saturation Temperature</td>
<td>A1:31</td>
<td>Economizer #3 Saturation Temperature</td>
<td></td>
</tr>
<tr>
<td>Economizer #3 Suction Line Temperature</td>
<td>A1:32</td>
<td>Economizer #3 Suction Line Temperature</td>
<td></td>
</tr>
<tr>
<td>Economizer #3 Superheat</td>
<td>A1:33</td>
<td>Economizer #3 Superheat</td>
<td></td>
</tr>
<tr>
<td>Comp #1 IGV Position</td>
<td>A1:34</td>
<td>Compressor #1 Load Balance Valve Position</td>
<td></td>
</tr>
<tr>
<td>Comp #1 Actual Speed in RPM</td>
<td>A1:35</td>
<td>Compressor #1 Actual Speed in RPM</td>
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<tr>
<td>Comp #1 Load Balance Valve</td>
<td>A1:36</td>
<td>Compressor #1 Load Balance Valve</td>
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<tr>
<td>Comp #1 Compressor RPM</td>
<td>A1:37</td>
<td>Compressor #1 Compressor RPM</td>
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<tr>
<td>Comp #1 Suction Pressure</td>
<td>A1:38</td>
<td>Compressor #1 Suction Pressure</td>
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<tr>
<td>Comp #1 Saturation Temperature</td>
<td>A1:39</td>
<td>Compressor #1 Saturation Temperature</td>
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<td>Comp #1 Suction Line Temperature</td>
<td>A1:40</td>
<td>Compressor #1 Suction Line Temperature</td>
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<tr>
<td>Comp #1 Discharge Pressure</td>
<td>A1:41</td>
<td>Compressor #1 Discharge Pressure</td>
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<tr>
<td>Comp #1 Saturated Discharge Temp</td>
<td>A1:42</td>
<td>Compressor #1 Saturated Discharge Temperature</td>
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</tr>
<tr>
<td>Comp #1 Discharge Line Temp</td>
<td>A1:43</td>
<td>Compressor #1 Discharge Line Temperature</td>
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</tr>
<tr>
<td>Comp #1 Discharge Superheat</td>
<td>A1:44</td>
<td>Compressor #1 Superheat</td>
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</tr>
</tbody>
</table>
## APPENDIX B - BACnet®

### BACnet® Parameters

#### ANALOG INPUTS

<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp #1 Condenser Ratio</td>
<td>AI:45</td>
<td>Compressor #1 Condenser Ratio</td>
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</tr>
<tr>
<td>Comp #1 Motor Current</td>
<td>AI:46</td>
<td>Compressor #1 Motor Current</td>
<td></td>
</tr>
<tr>
<td>Comp #1 Faults</td>
<td>AI:47</td>
<td>Compressor #1 Faults</td>
<td>See Fault Bits on page 58.</td>
</tr>
<tr>
<td>Comp #1 Alarms</td>
<td>AI:48</td>
<td>Compressor #1 Alarms</td>
<td>See Alarm Bits on page 58.</td>
</tr>
<tr>
<td>Comp #2 IGV Position</td>
<td>AI:49</td>
<td>Compressor #2 Load Balance Valve Position</td>
<td></td>
</tr>
<tr>
<td>Comp #2 Actual Speed in RPM</td>
<td>AI:50</td>
<td>Compressor #2 Actual Speed in RPM</td>
<td></td>
</tr>
<tr>
<td>Comp #2 Load Balance Valve</td>
<td>AI:51</td>
<td>Compressor #2 Load Balance Valve</td>
<td></td>
</tr>
<tr>
<td>Comp #2 Compressor RPM</td>
<td>AI:52</td>
<td>Compressor #2 Compressor RPM</td>
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</tr>
<tr>
<td>Comp #2 Suction Pressure</td>
<td>AI:53</td>
<td>Compressor #2 Suction Pressure</td>
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<td>Comp #2 Saturation Temp</td>
<td>AI:54</td>
<td>Compressor #2 Saturation Temperature</td>
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<tr>
<td>Comp #2 Suction Line Temp</td>
<td>AI:55</td>
<td>Compressor #2 Suction Line Temperature</td>
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<tr>
<td>Comp #2 Discharge Pressure</td>
<td>AI:56</td>
<td>Compressor #2 Discharge Pressure</td>
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</tr>
<tr>
<td>Comp #2 Saturated Discharge Temp</td>
<td>AI:57</td>
<td>Compressor #2 Saturated Discharge Temperature</td>
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</tr>
<tr>
<td>Comp #2 Discharge Line Temp</td>
<td>AI:58</td>
<td>Compressor #2 Discharge Line Temperature</td>
<td></td>
</tr>
<tr>
<td>Comp #2 Discharge Superheat</td>
<td>AI:59</td>
<td>Compressor #2 Superheat</td>
<td></td>
</tr>
<tr>
<td>Comp #2 Condenser Ratio</td>
<td>AI:60</td>
<td>Compressor #2 Condenser Ratio</td>
<td></td>
</tr>
<tr>
<td>Comp #2 Motor Current</td>
<td>AI:61</td>
<td>Compressor #2 Motor Current</td>
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</tr>
<tr>
<td>Comp #2 Faults</td>
<td>AI:62</td>
<td>Compressor #2 Faults</td>
<td>See Fault Bits on page 58.</td>
</tr>
<tr>
<td>Comp #2 Alarms</td>
<td>AI:63</td>
<td>Compressor #2 Alarms</td>
<td>See Alarm Bits on page 58.</td>
</tr>
<tr>
<td>Comp #3 IGV Position</td>
<td>AI:64</td>
<td>Compressor #3 Load Balance Valve Position</td>
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<tr>
<td>Comp #3 Actual Speed in RPM</td>
<td>AI:65</td>
<td>Compressor #3 Actual Speed in RPM</td>
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<tr>
<td>Comp #3 Load Balance Valve</td>
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<td>Comp #3 Compressor RPM</td>
<td>AI:67</td>
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<tr>
<td>Comp #3 Suction Pressure</td>
<td>AI:68</td>
<td>Compressor #3 Suction Pressure</td>
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</tr>
<tr>
<td>Comp #3 Saturation Temp</td>
<td>AI:69</td>
<td>Compressor #3 Saturation Temperature</td>
<td></td>
</tr>
</tbody>
</table>
## Analog Inputs

<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp #3 Suction Line Temperature</td>
<td>AI:70</td>
<td>Compressor #3 Suction Line Temperature</td>
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</tr>
<tr>
<td>Comp #3 Discharge Pressure</td>
<td>AI:71</td>
<td>Compressor #3 Discharge Pressure</td>
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<tr>
<td>Comp #3 Saturated Discharge Temp</td>
<td>AI:72</td>
<td>Compressor #3 Saturated Discharge Temperature</td>
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</tr>
<tr>
<td>Comp #3 Discharge Line Temp</td>
<td>AI:73</td>
<td>Compressor #3 Discharge Line Temperature</td>
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<tr>
<td>Comp #3 Discharge Superheat</td>
<td>AI:74</td>
<td>Compressor #3 Superheat</td>
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<tr>
<td>Comp #3 Condenser Ratio</td>
<td>AI:75</td>
<td>Compressor #3 Condenser Ratio</td>
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<tr>
<td>Comp #3 Motor Current</td>
<td>AI:76</td>
<td>Compressor #3 Motor Current</td>
<td></td>
</tr>
<tr>
<td>Comp #3 Faults</td>
<td>AI:77</td>
<td>Compressor #3 Faults</td>
<td>See Fault Bits below.</td>
</tr>
<tr>
<td>Comp #3 Alarms</td>
<td>AI:78</td>
<td>Compressor #3 Alarms</td>
<td>See Alarm Bits below.</td>
</tr>
</tbody>
</table>

**CompressorFaultBits**: := BIT STRING {
  Inverter Temperature Fault (0),
  Discharge Temperature Fault (1),
  Suction Pressure Fault (2),
  Discharge Pressure Fault (3),
  3-Phase Overcurrent Fault (4),
  Cavity Temperature Fault (5),
  Invalid Fault (6),
  Pressure Ratio Fault (7),
  Bearing/Motor Controller Fault (8),
  Sensor Fault (9),
  SCR Temperature Fault (10),
  Lock Out Fault (11),
  Motor Winding Temperature Fault (12),
  High Suction Superheat Fault (13),
  Earth Leakage Fault (14),
  Soft Start Temperature Fault (15),
}

**CompressorAlarmBits**: := BIT STRING {
  Inverter Temperature Alarm (0),
  Suction Pressure Alarm (2),
  Discharge Pressure Alarm (3),
  3-Phase Overcurrent Alarm (4),
  Cavity Temperature Alarm (5),
  Invalid Alarm (6),
  Pressure Ratio Alarm (7),
  SCR Temperature Alarm (10),
}
## BINARY INPUTS

<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Start/Stop Wet Contact</td>
<td>BI:1</td>
<td>Wet Contact to Activate Run Mode</td>
</tr>
<tr>
<td>Water Flow Proving Wet Contact</td>
<td>BI:2</td>
<td>Wet Contact to Indicate Water Flowing in the Loop</td>
</tr>
<tr>
<td>Emergency Stop Wet Contact</td>
<td>BI:3</td>
<td>Wet Contact to Indicate Emergency Stop Button Pressed</td>
</tr>
<tr>
<td>Condenser Fault Wet Contact</td>
<td>BI:4</td>
<td>Wet Contact to Indicate a Condenser Fault Occurred</td>
</tr>
<tr>
<td>Phase Brownout Wet Contact</td>
<td>BI:5</td>
<td>Wet Contact to Indicate a Phase Brownout has Occurred</td>
</tr>
<tr>
<td>Start/Stop From Boiler</td>
<td>BI:6</td>
<td>5 VDC Signal from Boiler to Request Run Mode</td>
</tr>
<tr>
<td>Compressor #1 Run Request</td>
<td>BI:7</td>
<td>Compressor #1 is being Requested to Run</td>
</tr>
<tr>
<td>Compressor #2 Run Request</td>
<td>BI:8</td>
<td>Compressor #2 is being Requested to Run</td>
</tr>
<tr>
<td>Compressor #3 Run Request</td>
<td>BI:9</td>
<td>Compressor #3 is being Requested to Run</td>
</tr>
<tr>
<td>Isolation Valve #1 Status</td>
<td>BI:10</td>
<td>Isolation Valve #1 Open/Close Status</td>
</tr>
<tr>
<td>Isolation Valve #2 Status</td>
<td>BI:11</td>
<td>Isolation Valve #2 Open/Close Status</td>
</tr>
<tr>
<td>Isolation Valve #3 Status</td>
<td>BI:12</td>
<td>Isolation Valve #3 Open/Close Status</td>
</tr>
<tr>
<td>Proof of Water Flow Fault</td>
<td>BI:13</td>
<td>Water Flow Alarm Detected</td>
</tr>
<tr>
<td>Expansion Boards Missing</td>
<td>BI:14</td>
<td>One or more Expansion Boards is bad or missing.</td>
</tr>
<tr>
<td>Condenser Fault</td>
<td>BI:15</td>
<td>Condenser Fan has set a Fault Condition</td>
</tr>
<tr>
<td>Emergency or Phase Shutdown</td>
<td>BI:16</td>
<td>Emergency Stop, Phase Brownout, Refrigerant Leak</td>
</tr>
<tr>
<td>Compressor Module Fault</td>
<td>BI:17</td>
<td>Compressor Fault Status from Turbocor</td>
</tr>
<tr>
<td>Compressor Disabled Fault</td>
<td>BI:18</td>
<td>Compressor Disabled</td>
</tr>
<tr>
<td>Freeze Limit Fault</td>
<td>BI:19</td>
<td>Freeze Limit Fault</td>
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<tr>
<td>Condenser Fan Bank #1</td>
<td>BI:20</td>
<td>Current Status of Main Fan Relay #1 on Main Board</td>
</tr>
<tr>
<td>Condenser Fan Bank #2</td>
<td>BI:21</td>
<td>Current Status of Configurable Relay #2 on Main Board</td>
</tr>
<tr>
<td>Condenser Fan Bank #3</td>
<td>BI:22</td>
<td>Current Status of Configurable Relay #3 on Main Board</td>
</tr>
<tr>
<td>Condenser Fan Bank #4</td>
<td>BI:23</td>
<td>Current Status of Configurable Relay #4 on Main Board</td>
</tr>
</tbody>
</table>
### BINARY INPUTS

<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condenser Fan Bank #5</td>
<td>BI:24</td>
<td>Current Status of Configurable Relay #5 on Main Board</td>
</tr>
<tr>
<td>Alarm Indicator</td>
<td>BI:25</td>
<td>Current Status of Configurable Relay #6 on Main Board</td>
</tr>
<tr>
<td>On Board Relay 7</td>
<td>BI:26</td>
<td>Not Used</td>
</tr>
<tr>
<td>On Board Relay 8</td>
<td>BI:27</td>
<td>Not Used</td>
</tr>
<tr>
<td>Expansion Module Relay 1</td>
<td>BI:28</td>
<td>Current Status of Configurable Relay #1 on Chiller Expansion Module</td>
</tr>
<tr>
<td>Expansion Module Relay 2</td>
<td>BI:29</td>
<td>Current Status of Configurable Relay #2 on Chiller Expansion Module</td>
</tr>
<tr>
<td>Expansion Module Relay 3</td>
<td>BI:30</td>
<td>Current Status of Configurable Relay #3 on Chiller Expansion Module</td>
</tr>
<tr>
<td>Expansion Module Relay 4</td>
<td>BI:31</td>
<td>Current Status of Configurable Relay #4 on Chiller Expansion Module</td>
</tr>
<tr>
<td>Expansion Module Relay 5</td>
<td>BI:32</td>
<td>Current Status of Configurable Relay #5 on Chiller Expansion Module</td>
</tr>
</tbody>
</table>

### ANALOG VALUES

<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
<th>Limit Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaving Water Freeze Cutoff Limit</td>
<td>AV:1</td>
<td>If the Leaving Water Temperature drops below this value the compressors will be locked out.</td>
<td>0-40</td>
</tr>
<tr>
<td>Leaving Water Setpoint Stage Down</td>
<td>AV:2</td>
<td>If the Leaving Water drops this much below the Water Setpoint, the compressors will stage off.</td>
<td>1-10</td>
</tr>
<tr>
<td>Maximum Leaving Water Reset Limit</td>
<td>AV:3</td>
<td>The Leaving Water Setpoint resets between this maximum value and the minimum reset limit as the Reset Input Voltage Signal varies from min to max.</td>
<td>1-110</td>
</tr>
<tr>
<td>Minimum Leaving Water Reset Limit</td>
<td>AV:4</td>
<td>See above note: This is the minimum reset limit for the Leaving Water Temperature Setpoint</td>
<td></td>
</tr>
<tr>
<td>Max OAT to Reset Starting Condenser</td>
<td>AV:5</td>
<td>The initial Condenser Fan Speed is calculated based on the Outdoor Air Temperature. This is the outdoor temperature that sets 100% Condenser VFD Speed.</td>
<td>60-120</td>
</tr>
<tr>
<td>Min OAT to Reset Starting Condenser</td>
<td>AV:6</td>
<td>See above note: This is the minimum Outdoor Air Temperature that sets 0% Condenser VFD Speed.</td>
<td>0-60</td>
</tr>
<tr>
<td>Lowest Superheat to Override Barrel</td>
<td>AV:7</td>
<td>If the lowest superheat temperature from all operating compressors is below this value, the Expansion Valves will begin to close down to change the Refrigerant Level in the Barrel.</td>
<td>3-10</td>
</tr>
<tr>
<td>Vestibule Cooling Setpoint</td>
<td>AV:8</td>
<td>If the Vestibule Temperature rises above this setpoint the cooling mode will activate on the Fan Coil.</td>
<td>50-90</td>
</tr>
</tbody>
</table>
## BACnet® Parameters

### ANALOG VALUES

<table>
<thead>
<tr>
<th>BACnet® Point Name</th>
<th>Object</th>
<th>BACnet® Description</th>
<th>Limit Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vestibule Heating Setpoint</td>
<td>AV.9</td>
<td>If the Vestibule Temperature drops below this setpoint the heating mode will activate on the Fan Coil.</td>
<td>50-90</td>
</tr>
<tr>
<td>Vestibule Heat/ Cool Setpoint Deadband</td>
<td>AV.10</td>
<td>The Vestibule temperature has to be above or below the setpoint by this amount to initiate heat or cool modes.</td>
<td>0.1-10</td>
</tr>
<tr>
<td>Vestibule Temp Sensor Calibration Offset</td>
<td>AV.11</td>
<td>If the Vestibule Temperature Sensor is reading incorrectly you can use this option to enter an offset temperature to adjust the Sensor’s Temperature.</td>
<td>-100-100</td>
</tr>
<tr>
<td>Leaving Water Sensor Calibration Offset</td>
<td>AV.12</td>
<td>If the Leaving Water Sensor is reading incorrectly you can use this option to enter an offset temperature to adjust the Sensor’s Temperature.</td>
<td>-100-100</td>
</tr>
<tr>
<td>Entering Water Sensor Calibration Offset</td>
<td>AV.13</td>
<td>If the Entering Water Sensor is reading incorrectly you can use this option to enter an offset temperature to adjust the Sensor’s Temperature.</td>
<td>-100-100</td>
</tr>
<tr>
<td>Outdoor Air Sensor Calibration Offset</td>
<td>AV.14</td>
<td>If the Outdoor Air Sensor is reading incorrectly you can use this option to enter an offset temperature to adjust the Sensor’s Temperature.</td>
<td>-100-100</td>
</tr>
<tr>
<td>Comp Ratio Setpoint for Condenser Speed</td>
<td>AV.15</td>
<td>The Condenser Fan Speed is controlled by the highest Pressure Ratio from the active compressors.</td>
<td>0.5-3</td>
</tr>
<tr>
<td>Comp Ratio Startup for Compressors</td>
<td>AV.16</td>
<td>During Compressor Startup, the Pressure Ratio must be below this setpoint.</td>
<td>0.5-3</td>
</tr>
<tr>
<td>Override Start/ Stop On</td>
<td>AV.17</td>
<td>Mechanical Cooling will be locked out if the Outdoor Air Temperature is below this setpoint.</td>
<td>0-1</td>
</tr>
<tr>
<td>Override Outdoor Air Temperature</td>
<td>AV.18</td>
<td>Mechanical Heating will be locked out if the Outdoor Air Temperature is above this setpoint.</td>
<td>-100-150 -100 = No Override</td>
</tr>
</tbody>
</table>