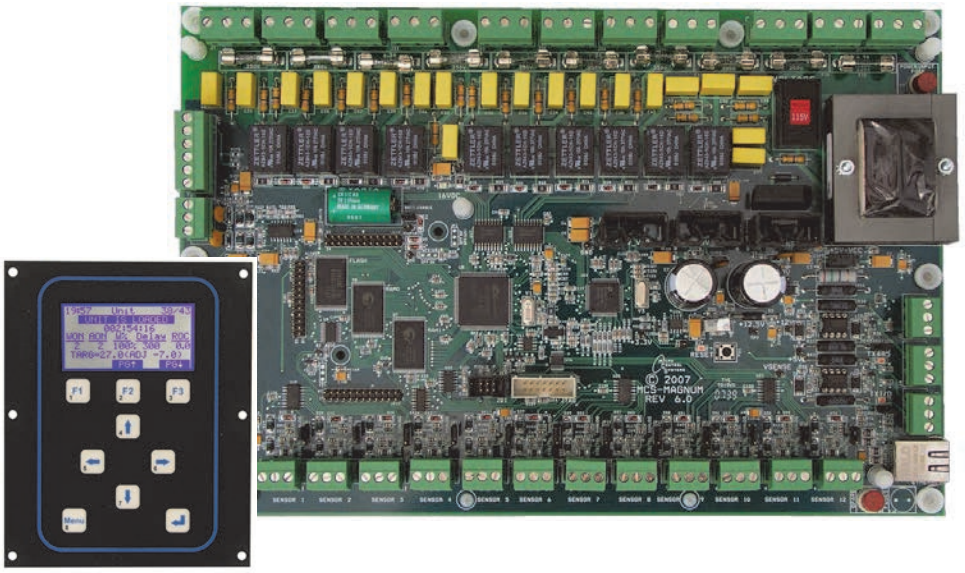
Installation, Operation, and Maintenance

Unit Controller Version 17 Manual Rev. 3.0 for Cold Generator™ Chillers

HVAC V17 Software



⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

April 2020 **CG-SVX030C-EN**

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

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Revision History

Updated to include application for CGWR/CCAR units.

Table of Contents

General Information

About this Manual

This manual documents the function of the Unit Controller V17 software. Controller use for individual units is presented, including Quick Reference and Specification sheets, followed by information on application in chiller array installations. The Table of Contents should be used as a guide. However, to fully understand the capabilities of the unit controller and system, the entire manual should be read.

About the Unit Controller

The Unit Controller is a rugged microprocessor controller designed for the harsh environment of the HVAC/R industry. It is designed to provide primary control without needing mechanical controls. It will interface locally with a null modem serial cable, remotely through an Ethernet connection, and also through building management systems. The Unit Controller offers a great deal of flexibility with adjustable setpoints and is designed to safeguard the system being controlled.

PC Support Software for Unit Controller

MCS-Connect provides both local and remote communications to the Unit Controller independent of software type. Local communications can be either via an RS485 or Ethernet connection. This program displays the status of the controller, and changes can be made to the system with proper authorization. Configuration files can be transmitted to or received from a Unit Controller unit. The Unit Controller automatically performs history logging and this program allows the data to be presented in a useful graph form.

RS 485 Network

Access to this network can be local via RS 232 or Ethernet connection.

Each Unit Controller in the network must be assigned a unique address in the configuration file at the factory. This address will be the key in establishing communications with the appropriate Unit Controller system.

Notes:

- *RS 232 transmissions should not exceed 50' in length.*
- *RS 485 transmissions should not exceed 1 mile without a repeater.*

Ethernet Port

When connecting directly through the 100 MBPS Ethernet port on the Unit Controller from a PC it is necessary to use a crossover Ethernet cable.

RS 485 Communications

Figure 1. RS 485 network with local RS232 communications

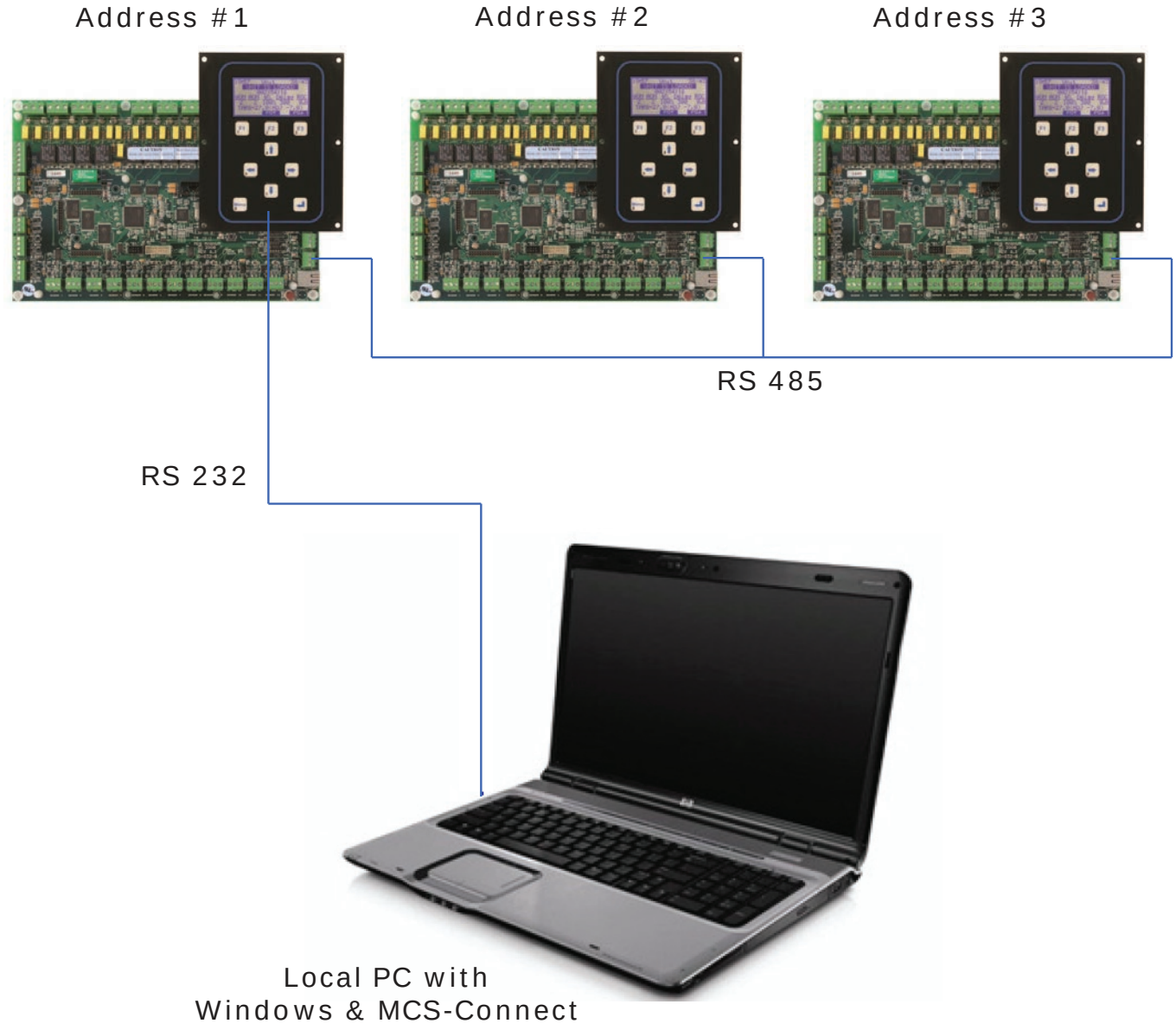
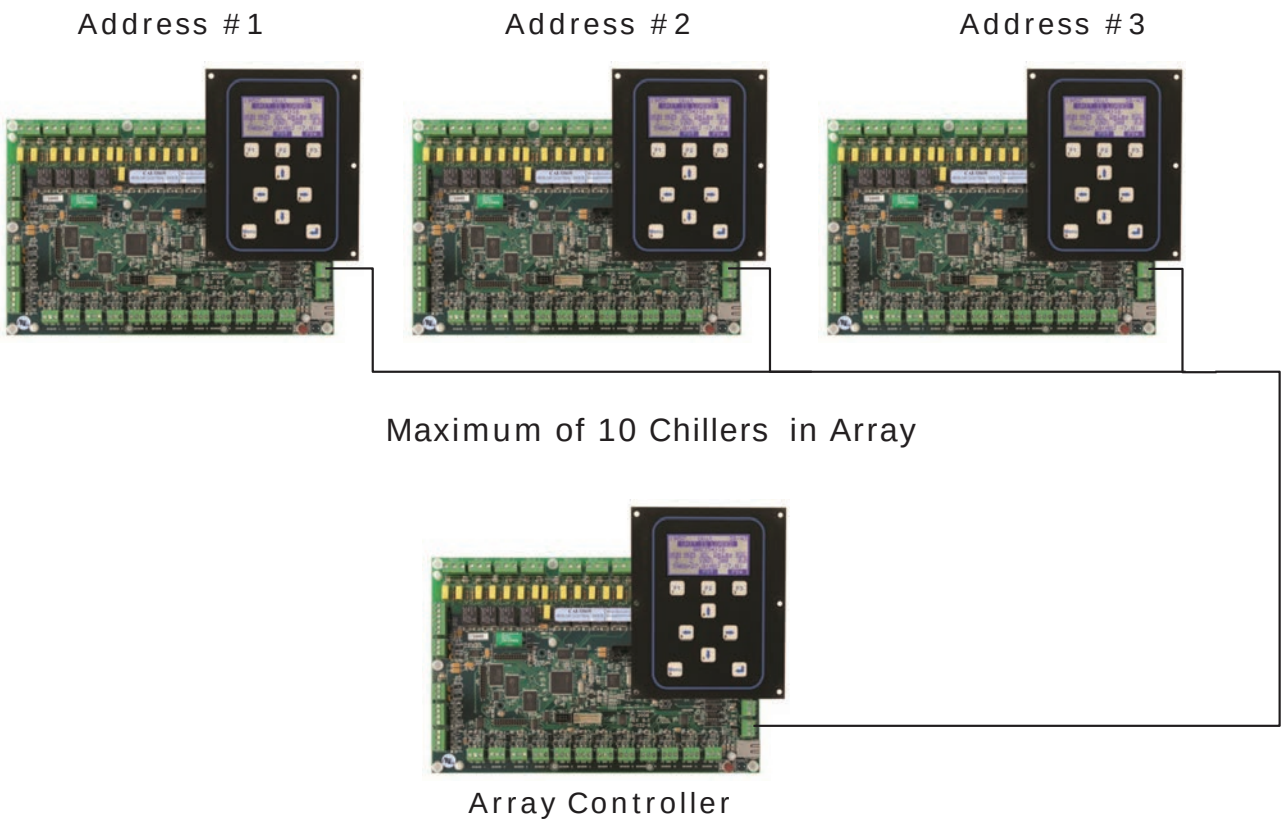


Figure 2. RS 485 I/O network with array controller



Requirements for PC Software

To install and run the program we suggest the following system requirements:

Minimum System Required to Run Program:

- Windows® 2000 or higher
- Pentium processor
- 20 Gigabyte Available Hard Disk space
- Super VGA Display capable of displaying 256 colors
- 512 Megabytes RAM

Unit Controller Control Zone Logic

The control strategy is designed to modulate the compressor(s) capacity to maintain the control sensor reading within the specified control zone. To accomplish this, the system will constantly monitor the control value, its rate of change, and position in relationship to the control zone and make adjustments accordingly.

Common Definitions

Target

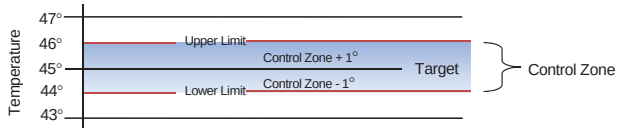
The control target is specified in setpoint #1 "CW OUT TRGT". This will be the base of developing the control zone.

Control Zone

The control zone is developed by utilizing two more setpoints to calculate the upper and lower limits. Setpoint #2 "Ctrl Zone +" is added to the target to determine the deadband to the upper limit, and setpoint #3 is subtracted from the target to determine the deadband to the lower limit.

Example:

- Setpoint #1 Target = 45
- Setpoint #2 Upper Deadband = 1
- Setpoint #3 Lower Deadband = 1



Control Sensor

This sensor has been specified in the unit controller or array controller configuration as providing the control value reading. It will normally be the leaving water temperature. The setpoints must be adjusted according to the type of control measurement selected.

Control Input Rate of Change

The Rate of Change is how rapidly the control value changes over a set period of time. If the control value is increasing, the rate will be positive; if it is decreasing, the rate will be a negative value. How quickly the input is changing, its direction, and its distance from the control zone will all be used to determine how the system will respond.

Step Delay and Sensitivity

The system will not attempt to take action until the Step Delay counts down to zero. Setpoint #26 “STEP DELAY” contains the initial value. The speed that the counter will decrement by is based on the control input rate of change and the sensitivity that has been specified in setpoint #25 “STEP SENSTIY”. The purpose of the sensitivity value is to limit how quickly the system reacts to changes indicated by the control sensor. The lower the value of this setpoint, the faster the system will react to changes of the control sensor.

Chiller Control Zone Logic Example

The system will attempt to keep the control value within the control zone that has been developed by calculating the required system capacity. The system capacity will be based upon the number of compressors that are wanted on.

If chiller has been enabled to run and flow has been established, the controller will compare leaving water temperature to target set point #1 “CW OUT TRGT”. If the leaving water temperature is above set point #1 “CW OUT TRGT” but within the control zone, the controller will look to the Max Positive Rate Of Change set point #28 “MAX ROC +”. If ROC is below this set point the chiller will not start a compressor until temperature reaches the top of the zone (set point #2 “Ctrl Zone +”). If ROC is above set point #28 “MAX ROC +” then the Step Delay timer will be activated (set point #26 “STEP DELAY”). Upon reaching zero, a compressor will be turned on.

The controller will wait 30 seconds before taking further action. At the end of this delay, the controller will now look to the Maximum Negative Rate of Change set point # 27 “MAX ROC -”. If actual ROC is exceeding the set point no additional compressors will be turned on. If actual ROC falls below this point then controller will again activate delay timer and turn another compressor on. When temperature falls to the Target set point, step timer will activate and turn a compressor off if the Negative ROC is above set point #27 “MAX ROC -”. Otherwise it will hold until reaching the bottom of the control zone (set point #3 “Ctrl Zone -”).

Unless auto rotation is enabled, compressors will stage up in numerical order and stage down in reverse order. (See “Compressor Auto Rotation,” p. 21.)

Unit Controller Display Summary

The following is an examination of some of the information screens that can be accessed through both the Unit Controller keypad and MCS-Connect program.

Unit Controller Keypad and Display

Menu Screen

The main menu is accessed by pressing the “Menu” key.

ACTUAL DISPLAY

```
09:55     Main Menu
-Status          -Setpoints
-Outputs        -Serv Tools
-Inputs          -Lckout RST
-Alarms          -Lckout ALM
-Graphs          -Passwords
 Help
```

DESCRIPTION

```
HH:MM                  Main Menu
-Control Status Display          -Setpoint Display
-Relay and Analog Output Display-Service Tools Display
-Sensor Input Display            -Lockout Reset Display
-Alarm Display                   -Lockout Alarms Display
-Graph Display                   -Password Display
```

Introduction to Status Screens

The current status of the unit and compressors is displayed by selecting the “Status” option from the “Menu” screen. This following screen will be displayed.

By pressing the PG↑ or PG↓ function keys you will get additional information on each compressor.

Unit Status

ACTUAL DISPLAY

```
09:55      Unit     45/54
       UNIT IS UNLOADED
            025:42:33
WTD  ACT  WTD%  DLY   ROC
 0    0    ---  180   0.0
    TARGET=45.0 (ADJ +0.0)
             PG↑        PG↓
```

DESCRIPTION

```
HH:MM              CHILLER UNIT          LEV/ENT
                CURRENT CONTROL STATE
                TIME IN CURRENT STATE
WANTED    ACTUAL     WANTED%    DELAY      SLOPE
#STEPS    #STEPS     ACTUAL%   NEXT CHG   DIRECTION
          TARGET SETPOINT + TARGET RESET
                      PAGE UP                PAGE DN
```

Compressor Status

ACTUAL DISPLAY

```
09:56      CMP #1      45/54
        CMP OFF/READY
          000:00;30
SUCT    DISC     OPD    MOTOR
 66P    190P     124P     0%
 55F    177F     ----     OK
              PG↑         PG↓
```

DESCRIPTION

```
HH:MM                COMPRESSOR          LEV/ENT TMP
                CURRENT CONTROL STATE
                TIME IN CURRENT STATE
  SUCTION     DISCHARGE    DIFFERENTIAL    MOTOR
 Pressure     Pressure       Pressure        Amp %
Temperature  Temperature       ----          Status
                     PAGE UP                 PAGE DN
```

ACTUAL DISPLAY

```
09:55      CMP #1      45/54
        CMP OFF/READY
          000:00:42
SST     SSH      SCT      DSH
 38    16.9      97      79.2

              PG↑         PG↓
```

DESCRIPTION

```
HH:MM                COMPRESSOR          LEV/ENT TMP
                CURRENT CONTROL STATE
                TIME IN CURRENT STATE
SAT.SUCTION  SUCT SHEAT     SAT.COND.    DISC S.HEAT
Temperature  Temperature    Temperature  Temperature

                     PAGE UP                 PAGE DN
```

EXV Status

ACTUAL DISPLAY

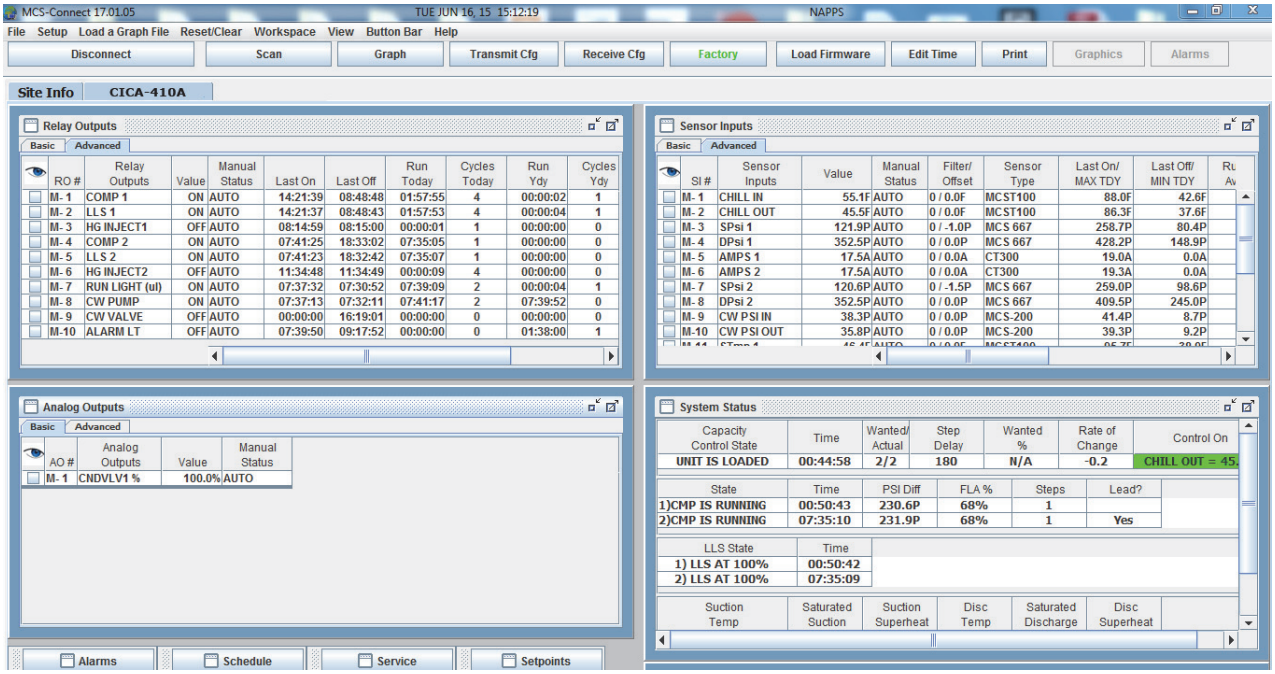
```
09:55      EXV #1      45/54
          IS HOLDING
           000:36:42
VLV%    DELAY    SPHT     ROC
 27      40      12.2     0.0

             PG↑         PG↓
```

DESCRIPTION

```
HH:MM          ELECTRONIC EXP VLV          LEV/ENT TMP
                CURRENT CONTROL STATE
                TIME IN CURRENT STATE
VLV OPEN%    TIME DELAY     SUCT SHEAT     ROC
Percent      Delay To       Temperature    Rate Of
             Next Change                   Change
                     PAGE UP                 PAGE DN
```

HVAC STATUS Display (MCS-Connect)

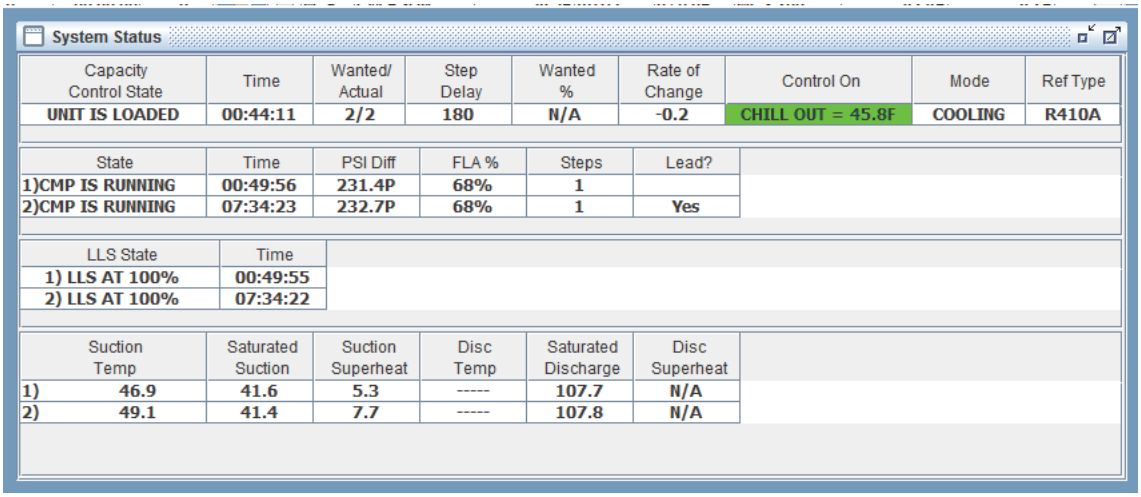


The screen shot above shows the following features:

- The top row of buttons provides function selection within MCS-Connect.
- The authorization level button is located in this row, it will automatically update to display the current authorization level. The example above is at a factory level authorization.
- Just below the top row of buttons, there is a row of tabs. The first is the Site Info screen which will show you details of all the Unit Controllers available to establish a connection, the remaining tabs allow you to access to each one respectively.
- There are four quadrants of information displayed for each Unit Controller, namely: Relay Outputs, Analog Outputs, Sensor Inputs, and Unit Status (with six sub-menus of Status, Alarms, SetPoints, Reset/Clear, Schedule, and Service).

Note: *These screens may not always be displayed in the same position, MCS-Connect will automatically adjust the screen arrangement for optimum display information.*

The status of the Capacity Control States, Compressor Control States and EXV Control States can be viewed from MCS-Connect by clicking the “Status” tab in the Unit Status quadrant. The following screen will be displayed:



Unit Controller Display Summary

System (unit) information is shown in the top section:

- **Capacity Control State** – State of chiller.
- **Time** – Time spent in current state. If the state is UNIT IN POWER UP time will count down to zero.
- **Wanted / Actual** – Number of capacity steps Wanted On versus Actual On.
- **Step Delay** – Value that is counted down. The sensitivity and difference between the control sensor and control zone will determine the speed of the countdown. When this value reaches zero, the controller will determine if a change in the system capacity is required.
- **Rate Of Change** – Rate of Change of control sensor.
- **Control On** – The control sensor value. The name and the reading will be displayed, with color to indicate its relationship to the target setpoint.
- **Mode** – The mode can be either COOLING or HEATING.

Compressor information (all active compressors will be displayed):

- **State** – Compressor number and state.
- **Time** – Time spent in current state. If the state is CMP ANTICYCLE time will count down to zero.
- **Oil Diff** – Oil differential pressure. It is calculated as follows:
  - **Scroll Compressors** – Discharge-Suction PSI (there is no oil pressure measurement).
  - **FLA%** – Full Load Amps based on the compressor's respective setpoint.
  - **Steps** – Indicates number of steps associated with this compressor that are turned on.
  - **Lead?** – YES will be displayed for the lead compressor.

Compressor Superheat information:

- **Suction Temp** – Compressor number and Suction Temperature, if available.
- **Saturated Suction** – Calculated Suction Saturated Temperature.
- **Suction Superheat** – Calculated Suction Superheat, only available if both the Suction Temperature and the Suction Pressure are used. Suction Superheat = Suction Temperature - Suction Saturated Temperature.
- **Disc Temp** – Discharge Temperature, if available. (Factory installed option.)
- **Saturated Discharge** – Calculated Discharge Saturated Temperature.
- **Disc Superheat** – Discharge Superheat is available only if both the Discharge Temperature and the Discharge Pressure are used. Discharge Superheat = Discharge Temperature - Discharge Saturated Temperature.
- **Ref Type** – Refrigerant type used.

Unit Controller Control States

Both the CAPACITY CONTROL STATES and COMPRESSOR CONTROL STATES are displayed on the STATUS option on the graphic's LCD. To view the state of the chiller, select the STATUS option from the MENU on the keypad. You can then view the entire status by using the page up / down function keys. The information can also be accessed via the MCS-Connect program under status screen by clicking on the CONTROL STATUS button.

Unit Control States

Unit In Power Up

This state is entered when the Unit Controller is powered up or the system has been reset. The system will remain in this state for the time specified in setpoint #23 "POWER DELAY" or for 60 seconds if not active. In this state all Relay Outputs are turned off. This time delay is to insure the microprocessor has stable power before starting the algorithm.

No Run- I/O Lost

This state will be entered whenever the Unit Controller loses communications with any of the I/O boards that are connected via the MCS I/O network. When this state is entered the system will generate an MCS I/O offline alarm, which identifies which I/O is offline and a lost I/O shutdown alarm which locks out the unit. Once locked out, if there are ten consecutive successful I/O reads the system will reset and attempt to run. When this occurs a "LOST I/O RESTART" will be generated. Or, the lockout-reset key can be pressed to reset the system, after the lost I/O has been corrected. This will generate a "LOCKOUT RESET." In this state all ROs except ALARM and OIL HEATER are turned OFF.

Unit In Lockout

This state is entered whenever a critical situation is encountered that could cause harm to the chiller package. Items such as freeze protect and emergency stop will force the system into this state. Lockouts can be reset without authorization from the keypad or MCS-Connect program; however if the lockout condition has not been corrected, the system will again be forced into the LOCKOUT state. In this state, all ROs except ALARM and OIL HEATER (for screws with an oil pump) are turned OFF and placed in the "LOCKOUT" state.

Note: *If the Lockout Reset is pressed more than 6 times in one day the unit cannot be reset without the SERVICE password. See* *"Authorization Function," p. 19**.*

Unit Is Off

This state is entered when the system has finished a STARTUP, DISABLE, LOCKOUT, or NO RUN- I/O LOST state. The chiller is now ready to move into an active state to meet the capacity required.

Unit Is Holding

This state is entered when one of three conditions exists:

1. The control sensor reading is being maintained within the control zone.
2. Control sensor reading is above the control zone but the Rate of Change is less than the value in the (MAX ROC-, #27) setpoint. This indicates that the temperature is decreasing toward the target at an acceptable speed rate. Therefore, no additional cooling is needed at this time.
3. The temperature is below the control zone but the Rate of Change is greater than the (MAX ROC+, #28) setpoint. This indicates that the temperature is increasing toward the target. Therefore, no reduction in cooling is needed at this time. This state indicates that there is no need to adjust the capacity of the chiller package. This state will end when more or less capacity is required.

Unit Unloading

This state is entered when less capacity is required. Every second an adjustment is made to the step delay. When the delay reaches zero, the counter "steps wanted" on is decreased by 1.

Unit Is Loading

This state is entered when more capacity is required. Every second an adjustment is made to the step delay. When the delay reaches zero, the counter "steps wanted on" is increased by 1.

Off-Smoke Alarm

This state is entered when a smoke alarm has been detected. In the Configuration file the Smoke Alarm Indicator must be selected in the General Info section under the MAG HVAC V17 screen. When this sensor trips, an error message "OFF-SMOKE ALARM" is generated and the unit state is changed. In this state all ROs except ALARM are turned OFF. (Factory option)

Run/Stop Sw Off

This state is entered when the run stop switch is off, in the stop position. When the chiller is in this state, the individual compressor states if active are moved to the CMP IS OFF state through the normal states. One capacity STEP will be moved per second. (CIC*/CCA*/CGW* chillers have factory installed circuit enable switches. A field installed RUN/STOP switch can be added.)

Scheduled Off

This state is entered when the schedule is calling for the package to be off. When the chiller is in this state, the individual compressor states if active are moved to the CMP IS OFF state through the normal states. One capacity STEP will be moved per second.

Off- No Flow

This state is entered when the evaporator flow switch is off. When the chiller is in this state, the individual compressor states if active are moved to the CMP IS OFF state through the normal states. One capacity STEP will be moved per second. If the NO FLOW setpoint is active and set to Lockout the chiller will lockout on no flow.

Ambient Off

This state is entered when the ambient temperature falls below setpoint #22 "LOW AMBIENT". The system will remain in this state until the ambient temperature if low rises 5.0°F (2.5°C) above the #22 "LOW AMBIENT" setpoint value. When the chiller is in this state, the individual compressor states if active are moved to the CMP IS OFF state through the normal staging function. One capacity STEP will be moved per second. (Factory option)

Unit Is Unloaded

This state is entered when all of the systems available capacity steps are off. The package is providing no cooling capacity, as none is required. The system is ready to react to cooling needs.

Unit Is Loaded

This state is entered when all of the system's available capacity steps are on and the package is providing the maximum amount of cooling capacity.

Off Tmp-Ice Made

This state is entered when target temperature has been satisfied.

Unit Off Unlding

This state is entered when the unit has been disabled. It will force a quick unload of the system.

Unit Dmd Unlding

This state is only entered when the demand limiting input has been selected. The demand limit sensor must be selected in the General Information section under the MAG HVAC V17 screen and its type must be "BmsDmndLmt." This input will indicate the maximum number of steps that the unit can run. If this value is less than the number of steps that are currently on, the unit will unload to meet this value. (Factory option)

Compressor Control States

The action of the compressor control states may result in an increase or decrease in capacity. The Unit Control States may affect or change the Compressor Control States or supersede them altogether.

Lost I/O Locked

This state is entered when the Capacity Control State is NO RUN- I/O LOST. Resetting the lockout will move the compressor to the CMP OFF/READY state.

Cmp Locked Out

This state is entered when the Capacity Control State is in UNIT IN LOCKOUT or a safety trip has occurred for this compressor (Examples of safety setpoints include #77 "LOW SUCTION" and #81 "HI DISC PSI"). Lockouts can be reset without authorization from the keypad or MCS-Connect program, however if the condition causing the lockout has not been corrected, the compressor will again be forced into the LOCKOUT State.

Switched Off

This state is entered when the compressor is off due to the circuit enable switch being off. In this state the compressor and all related points, including the liquid line solenoid are off. The compressor will not leave this state unless the enable switch is turned on. If the enable switch is turned on, the compressor state will be changed to the CMP OFF/READY state.

Cmp Anti-Cycle

This state is entered when the UNLD and PMPDWN state has been completed. The compressor will stay in this state with all compressor points off for the period of time contained in setpoint #59 "ACYC OFF-> ON" or setpoint #63 "ACYC ON -> ON", whichever is longer. The compressor will then move to the OFF state. NOTE: "ACYC ON -> ON" can be used to set the maximum number of compressor starts per hour.

Cmp Off/Ready

This state is entered when no capacity is required from this compressor, or the last state was CMP ANTICYCE, LOST I/O LOCKED, or SWITCHED OFF. In this state the compressor is ready to provide capacity if needed. The compressor will remain in this state for a minimum of 60 seconds.

Cmp Is Running

This state occurs when the compressor is fully loaded. In this state, the compressor is providing the maximum amount of cooling capacity.

Safety Tripped

This state is entered when a safety trip occurs but a lockout is not generated. An alarm is generated but the system will automatically restart after the delay specified in the corresponding setpoint. If a second trip occurs within the time specified in the setpoint, the compressor will be placed in the CMP LOCKED OUT state.

Setpoint Definitions

Setpoint Types

There are three different types of setpoints. The Unit Controller software determines if a setpoint contains a target value or is a safety. If it is a safety then its type determines what action the system will take when the safety occurs (either locking out the unit or generating an alarm only).

Setpoint

This type of setpoint contains a target or provides information for some action. The time element in this type can be used for an additional counter if specified. This time is displayed and can be changed through MCS-Connect, or from the keypad display.

Lockout

This type of setpoint contains a safety value and the time that the safety must be violated before the safety will trip. When a safety trips, the circuit will be in a SAFETYTRIPPED state. The circuit will remain in this state for 10 minutes and then move to the CMP ANTICYCLE or CMP IS OFF state where the compressor will be allowed to run again if required.

If the same safety trip occurs again within 2 hours of the first trip, the circuit will be set to CMP LOCKED OUT state, which requires a manual reset to restart the compressor. Some safeties will generate a lockout condition on the first trip.

Some but not all lockout safeties have this feature.

With each safety trip, the system will generate an alarm; see"Unit Controller Alarms and Safeties," p. 29.

Alarm

This type of setpoint has two uses:

1. When it is used as a safety, it will be similar to the LOCKOUT setpoint except it will never cause a lock out. The system will continue to try returning to normal operation after waiting the safety down time of 10 minutes. An ALARM setpoint type will never require manual intervention to reset the system.

When the setpoint is being used as a second timer it will be available to change in a live unit. If the type is not changed to ALARM then the time field cannot be viewed or changed from a live unit.

Authorization Function

The authorization code is a special four-character code that enables access to the Unit Controller.

The code may consist of any valid alpha/numeric characters if the system is being accessed through MCS-Connect, however, the code must be numeric with values between 1 and 8 if it is to be entered through the Keypad/Display. The authorization code and the associated level cannot be viewed or changed through the Keypad/Display or MCS-Connect. The service level code is 2112. Higher level requires NAPPS factory authorization.

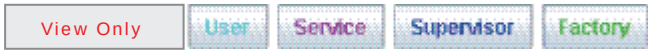
To get authorized through the Keypad/Display do the following:

1. Press 'Menu'.
2. Using ↑, ↓, →, or ← keys, move cursor to 'Passwords'.
3. Press ↵ key.
4. Enter 4 digit password and press ↵
5. The authorization will be displayed.
6. Press 'Menu' to make next selection.

To get authorized through MCS-Connect do the following:

1. Highlight desired Unit Controller in the Site Info tab.
2. Click View Only button.
3. Enter the 4 digit code into the pop-up box and click ok (or press the enter key).

Depending on the authorization level, the button will change to one of the following displays, indicating if the code was accepted or not.



Standard Control Options

The following options are specified and setup at the factory when building the configuration. These options are used to customize the system to meet the individual control requirements.

General Options

- Control method can be based upon the control zone or a voltage input indicating the number of stages to be on.
- The control temperature sensor can be either the returning or leaving sensor.
- Chilled water reset from the Building Management System (BMS).
- Condenser control maintaining sufficient discharge superheat for good oil separation.
- Evaporator pump control.
- Anti-cycle timers (OFF to ON and ON to ON).
- Alarm RO (turned on whenever an alarm is generated).
- Optional auto rotation for compressors.
- Low ambient temperature shut down.

Hot Gas Injection Solenoid/ Hot Gas Bypass

Hot Gas Injection Solenoid Operation

All CIC*/CCA*/CGW* chillers have the hot gas injection solenoid feature. The chiller's unit controller energizes the hot gas injection solenoid on a fall in suction pressure at approximately 101 psig and de-energizes the solenoid on a rise in pressure at approximately 105 psig. Operation in this pressure control range is very stable and effective in minimizing low suction pressure safety nuisance trips, provided the unit is being operated within its operating range.

Important: *This feature is not effective in minimizing nuisance low suction pressure safety trips under some conditions when operated outside the operating envelope or when the unit is not installed or operated in accordance with installation and operating instructions.*

Hot Gas Bypass Operation as a Minimum Capacity Step

This feature requires field selection. When selected in the field, this feature can be used as a minimum step of capacity on CIC*/CCA*/CGW* with factory installed Water Regulating Valves only. When selected, the Hot Gas Bypass valve is energized when the leaving water temperature is 1°F below the target set-point provided only one compressor on a circuit is operating. It is de-energized when the leaving water temperature is up to 2°F above the target set-point. As with the Suction Pressure Actuated Hot Gas Bypass feature, its abatement capacity is in the range of 65,000 BTUH when SDT is in the range of 90°F and SST is in the range of 35°F. This feature is very effective in providing a reduced minimum capacity step while stabilizing the leaving chilled water temperature.

Analog Chilled Water Reset

Chilled Water Reset (CWR) is a 0 to 5 volts dc sensor input (Display Type is TRGTRST) to the unit controller microprocessor. The CWR follows these rules using setpoint #21, MAX CW Reset:

1. If the input is 2.5 volts dc the CWR is zero.
2. At 0 vdc the CWR is a negative value equal to the setpoint value.
3. At 5 vdc the CWR is a positive value equal to the value in the setpoint.
4. For values in between 0 – 2.5 and 2.5 – 5.0 the CWR is a plus or minus value which is proportional to the sensor input voltage.

On/Off Switches

The following digital inputs can affect the entire package or individual circuits:

- **Flow Switch** – If OFF the system has no flow. The system will Lock Out (if setpoint #105 is active), or shut down (if setpoint #105 is inactive). This is for all stand alone CIC*/CCA*/CGW* Chillers.
- **Run/Stop** – If OFF the system will not run. If the system is running, the system turns all compressors off in normal steps (If a RUN/STOP and a Network RUN/ STOP are both available they operate in series). CIC*/ CCA*/CGW* chillers have factory installed circuit enable switches. A field installed RUN/STOP switch can be added.)
- **Network Run/Stop** – If OFF the system will not run. This input is provided by another system on the network. It functions in the same matter as the Run/ Stop switch.

Note: *CIC*/CCA*/CGW* chillers with BMS option are shipped with this indicator set to MANUAL ON. Enter password 2112 from keypad then select NET_R/S (CIC*/CCA*/CGW*) or NET RnStop (array controller) and set to AUTO to allow network control.*

Chilled Water Pump Control

The system will support a chilled water pump plus a backup with rotation. These must be set up at the factory. (This is a factory option.)

Setpoint #105 and Setpoint #106 are used with this control logic.

If setpoint #105 "CW LOW FLOW" is active and flow is lost for the period of time contained in the value and only one pump is present the system will move to a LOCK OUT state. If the system has two pumps and flow is lost the backup pump will start and the lead pump will be locked out. A lock out reset will be required to restart the system or to reactivate a locked out pump.

If this setpoint is inactive and the flow is lost, the system will move to the OFF- NO EVAP FLOW state. When flow is returned the system will automatically restart, no reset is required.

Setpoint #106 "LEAD PUMP" indicates whether the rotation option is active or which pump is the lead pump.

If the setpoint #106's value is zero, then rotation of the pumps will occur whenever the lead pump is turned off. If no rotation has occurred during the current day, a forced rotation at midnight will occur. This forces at least one rotation per day.

If the setpoint #106's value is non-zero, then rotation of the pumps is inactive and the value will specify the lead pump. This setpoint can be changed in a live unit and the appropriate action will be taken.

Low Ambient Shutdown

The system supports a low ambient shut down. This option requires an ambient temperature sensor and #22 "LOW AMBIENT" setpoint. The AMBIENT OFF state is entered when the ambient temperature falls below the #22 "LOW AMBIENT" setpoint. The system will remain in this state until the ambient temperature rises 5.0°F (or 2.5°C) above the #22 "LOW AMBIENT" setpoint value. When the chiller is in this state, the individual compressor states if active are moved to the CMP IS OFF state through the normal staging function. One capacity STEP will be moved per second. (Factory option.)

Compressor Auto Rotation

The auto rotation option is selected by setting the value in setpoint #103 "LEAD COMP" to zero. If this value is not zero, it will contain the number of the lead compressor and auto rotation is disabled. Note this setpoint can be manually changed to force a different compressor as the lead compressor or to enable auto rotation. (Setting this to 0 will start the compressor that's been off the longest to start next and the compressor that's been running longest to stop next.)

When this option is enabled, the system will rotate the compressors based upon the value in setpoint # 104 "CMP ROTATION".

If setpoint # 104 value is zero, rotation will occur with every complete capacity cycle and the next compressor will be selected as the lead compressor. (As described above.)

Else, the value is the number of days between rotations. At midnight the system will check if it is time to rotate compressors. If yes, the system will check the run hours on each compressor and select the one with the least amount of run hours to be the lead compressor.

Compressor Anti-Cycle Logic

When a compressor is to be turned off, the system will make a calculation to determine the amount of time that the compressor shall be in an anti-cycle state. This calculation is based upon how long the compressor has been on and setpoints #59 (ACYC OFF->ON) and #63 (ACYC ON->ON).

If the value of setpoint #63 minus the amount of time that the compressor has been on is greater than the value in setpoint #59, the compressor will remain in the anti-cycle state for the period of time specified in setpoint #63. Else the anti-cycle time will be set to the value in setpoint #59.

Example:

- A compressor has been running for 180 seconds:
  - #59 (ANTI-CYC OFF) = 300 seconds
  - #63 (ANTI-CYC ON) = 600 seconds
  - 600 – 180 = 420 is greater than setpoint #59

Therefore, anti-cycle timer will be set to 600 seconds, the value of setpoint #63.

- If the compressor had been running for 12 minutes (720 seconds):
  - 600 – 720 = -120 this is less than setpoint #59

Therefore, the anti-cycle timer will be set to 300 seconds, the value of setpoint #59.

If the controller loses power, the length of time that the system was down will be taken into consideration when determining whether the compressor should be in an anti-cycle state and for how long.

Alarm Relay Outputs

Alarm Relay Output will be turned on whenever the system generates an alarm type of message. This indicates that a safety or lockout condition has occurred.

Operating Schedules

Two operating schedules per each day of the week and 8 holidays are supported. Each schedule contains a start and end time, if the time and day of the system is within these limits the schedule is true and the system will be allowed to run. If not, the system will be off due to schedule.

Compressor Lead and Rotation

Refer to Setpoints #103 and #104.

Condenser Control Logic

The type of condenser plus the number of relay outputs needed are specified in MCS-Config.

CGW*/CCA* chillers are factory programmed as follows:

- **1 circuit air-cooled chillers** have up to 3 dry contact relays for controlling fans. The controller has one 0 to 10VDC analog output to control a VFD or fan damper actuator.
- **2 circuit air-cooled chillers** have up to 8 dry contact relays (4 per circuit) for controlling fans plus 2-0 to 10VDC analog outputs.
- **1 circuit water-cooled chillers** have one dry contact relay to start a condenser pump. These chillers also have one 0 to 10VDC analog output to control a head pressure control valve.
- **2 circuit water-cooled chillers** have one dry contact relay to start a condenser pump. These chillers have two 0 to 10 VDC analog outputs (one for each circuit) to control head pressure control valves.

CIC* chillers are factory programmed as follows:

- **1 circuit water-cooled chillers** have two dry contact relays to start a condenser pump. These chillers also have one 0 to 10VDC analog output to control a head pressure control valve.
- **2 circuit water-cooled chillers** have two dry contact relays to start a condenser pump. These chillers have two 0 to 10 VDC analog outputs (one for each circuit) to control head pressure control valves.

Condenser Related Setpoints

See Table 10, p. 54 and p.55 for the following condenser related setpoints.

#48 "CND VLV DLAY"	Water Cooled
#49 "CND VLV START"	Water Cooled
#50 "CND VLV TARG"	Water Cooled
#51 "CND VLV DIV"	Water Cooled
#52 "CND VLV MIN"	Water Cooled
#53 "CND VLV ROC-"	Water Cooled
#55 "CND MIN ADJ"	Water Cooled

RO Step Condenser Cut In – Out Logic

The Cut In and Cut Out Logic setpoints are as follows:

Setpoint #45 "CND STG1 ON"- Condenser stage 1 Cut In (ON).

Setpoint #46 "CND STG1 OFF"- Condenser stage 1 Cut Out (OFF).

Setpoint #47 "CND DIFF ON"- Cut In differential for additional condenser stages for (ON).

Setpoint #48 "CND DIFF OFF"- Cut Out differential for additional condenser stages (OFF).

Setpoint #49 "CND MIN RUN"- Minimum run time for a condenser stage

Condenser relay outputs will be turned on based upon the value in setpoint #45 "CND STG1 ON". When discharge pressure reaches this value, the first condenser relay output is turned on. If additional condenser outputs exist, they will be turned on when the pressure exceeds the cut in value plus the value contained in setpoint #47 "CND DIFF ON". When discharge pressure falls, the condenser outputs will be turned off based upon the setpoint #46 "CND STG1 OFF" plus the value contained in setpoint #48 "CND DIFF OFF". The first step will be turned off when discharge pressure falls below setpoint #46 "CND STG1 OFF".

Example:

Setpoint #45 "CND STG1 ON" = 320 psi

Setpoint #46 "CND STG1 OFF"= 250 psi

Setpoint #47 "CND DIFF ON" = 50 psi

Setpoint #48 "CND DIFF OFF"= 20 psi

Setpoint #51 "CND VFD START = 100%

COND FAN 1 ON at 320 psi (Discharge)

COND FAN 1 OFF at 250 psi

COND FAN 2 ON at 370 psi (320 + 50)

COND FAN 2 OFF at 270 psi (250 + 20)

Note: *Setting the VFD START% to 30% would start the fan and/or damper at about 259 psi to allow damper time to open prior to needlessly starting another fan.*

RO Step Condenser with Variable Speed Fan or Damper

The setpoints for variable speed fan control are as follows:

Setpoint #54 "CND MIN SPD"- Minimum variable speed allowed.

Setpoint #55 "CND MAX SPD"- Maximum variable speed allowed.

The purpose of the variable speed fan is to reduce the cycling of the fans by adjusting the speed of the variable fan point. This control works in conjunction with the Cut In and Cut Out logic of each circuit. When a fan is turned on, the speed of the variable point for that compressor is set to maximum allowed percentage. As the discharge pressure falls, the fan speed is adjusted proportionally. When the minimum is reached the fan will turn off.

Condenser Related Setpoints

See Table 10, p. 54 and p.55 for the following condenser related setpoints:

#45"CND STG1 ON"..... Air Cooled
#46"CND STG1 OFF" ..... Air Cooled
#47"CND DIFF ON"..... Air Cooled
#48"CND DIFF OFF"..... Air Cooled
#48"CND VLV DELAY" ..... Water Cooled
#49"CND MIN RUN"..... Air Cooled
#49"CND VLV START"..... Water Cooled
#50"CND VLV TARG"..... Water Cooled
#51"CND VLV DIV"..... Water Cooled
#51"CND VFD MIN"..... Air Cooled
#52"CND VLV MIN"..... Water Cooled
#53"CND VLV ROC-"..... Water Cooled
#54"CND MIN SPD" ..... Air Cooled
#55"CND MAX SPD"..... Air Cooled
#55"CND MIN ADJ"..... Water Cooled

Fan or Damper Analog Output (AO) Control (same for all types of air condenser control)

Two more setpoints than the previous example are needed to control the speed of the fan:

Setpoint#	Name	Value
54	CND MIN SPD	20.0%
55	CND MAX SPD	100.0%

CND STG1 ON will be turned on when the control pressure is equal to or greater than 320.0, same as in previous example. At this point the Fan AO speed will be set to its maximum value, setpoint #55. If the pressure changes between 250.0 and 320.0 the fan speed will also be modulated proportionally between its maximum and minimum settings. If the pressure is at 285.0 the fan speed will be set to 60.0%. If the pressure is at 300.0 the fan will increase to 77.0%. This will provide precision control in maintaining optimum discharge pressure.

If the pressure increases to 370.0 the condenser's second stage will be turned on and the fan speed will also be at 100.0%. If the pressure changes between 270.0 and 370.0 the fan speed will also be modulated proportionally between its maximum and minimum settings.

EXV Control Options

Note: *Only CICA chillers have an EXV. CCA*/CGW* single circuit units have one TXV and CICB/CCA*/CGW* dual circuit units have two TXVs.*

Most of the EXV logic set points are factory use only and cannot be field adjusted. Some settings are field adjustable with proper authorization.

NOTICE:

Equipment Damage!

Do not make changes without factory support. Incorrect settings could case serious equipment damage.

Figure 3, p. 26 and Figure 4, p. 27 show the control logic for the EXVs with superheat control option.

EXV Logic

Figure 3. EXV logic — chart 1

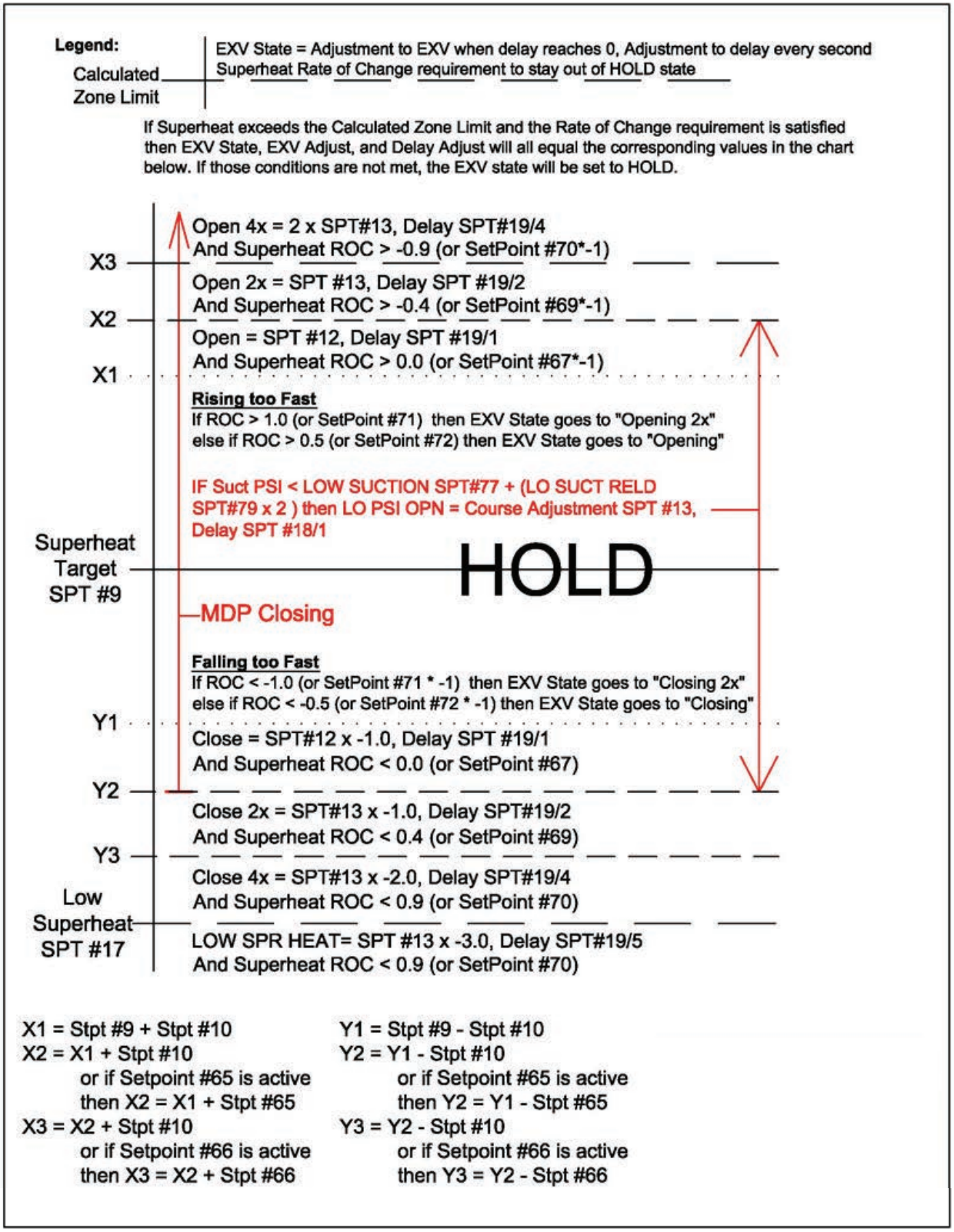
EXV LOGIC

EXV Setpoints

#9 SUPERHT TARG = Target temperature setting for Superheat (time field is used for ROC interval)
#10 SPRHT ZONE+- = Used for zones around superheat target.
#11 EXV LOAD ADJ = EXV adjustment in response to Slide adjustment.
#12 EXV FINE ADJ = Small Adjustment for the Valve (See Chart).
#13 EXV COURSE = Large Adjustment for the Valve (See Chart).
#14 EXV LOAD DIV = Divider for EXV adjustment based on FLA Changed
#15 EXV MIN% = Minimum Valve % allowed.
#16 EXV MAX% = Maximum Valve % allowed.
#17 LO SUPERHEAT = Temperature setting for Low Superheat.
#18 LOSUCTPSIDLY = Delay (sec) when in Lo Suct PSI Opening
#19 EXV DELAY = Delay (sec) between valve adjusments.
#20 EXV STRT TME = Delay (sec) to remain in EXV IN STARTUP.
#65 EXV ZONE1 DB = Is an offset added to and subtracted from setpoint #10 "Superheat Target" to develop the upper and lower limits for "EXV is Opening" and "EXV is Closing" zones.
#66 EXV ZONE2 DB = Is an offset added to and subtracted from setpoint #10 "Superheat Target" to develop the upper and lower limit for "EXV Opening 2x" and "EXV Closing 2x" zones.
#67 EXV ROC ZN1 = This setpoint value is entered as a positive number and for "EXV is Opening" zone multiplied by -1.
#68 NOT USED.
#69 EXV ROC ZN2 = Is the superheat's Rate Of Change (ROC) holding limit for the "EXV Opening 2x" and "EXV Closing 2x" zone. The setpoint value is entered as a positive number and for "EXV Opening 2x" zone multiplied by -1.
#70 EXV ROC ZN3 = Is the superheat's Rate Of Change (ROC) holding limit for the "EXV Opening 4x" and "EXV Closing 4x" zone. The setpoint value is entered as a positive number and for "EXV Opening 4x" zone multiplied by -1.
#71 EXV ROC HD2x = Is the superheat ROC Opening 2x/Closing 2x limit for the "EXV is HOLDING" zone. The setpoint value is entered as a positive number and for "EXV Opening 2x" tested multiplied by -1.
#72 EXV ROC HD1x = Is the superheat ROC Opening/Closing limit for the "EXV is HOLDING" zone. The setpoint value is entered as a positive number and for "EXV Opening" zone multiplied by -1.
#77 LOW SUCTION = Low suction PSI safety (EXV LO PSI Opening).
#78 LO SUCT UNLD = Time value is used to delay the comp from going into safety unloading state to allow EXV time to open.
#79 LO SUCT RELD = Low suction reloading (EXV LO PSI Opening)
#199 EXV MOP SUCT = Is the Maximum Operation Suction pressure (MOP). If this setpoint is active and the suction pressure is above this value plus setpoint #200 the EXV is not allowed to open and is forced to close. The EXV state is set to "EXV IS MOP CLS".
#200 EXV MOP DB = If the suction pressure is greater than setpoint #199 minus this setpoint value and the EXV wants to open, the EXV is force into "EXV IS MOP HLD".
#201 EXV MOP ADJ = This setpoint's value is used as the amount to adjust the EXV closed when in "EXV IS MOP CLS". This setpoint's "Time in sec" column is used as the delay between EXV adjustments when in the "EXV IS MOP CLS" state.
#205 EXV MDP = Is the Min Oil Differential pressure limit - when oil diff is below this value the EXV state will go to "EXV is MDP CLS". The setpoint's time column is offset pressure to allow the EXV back to normal control(assumed 1 decimal). The Sec. To Ignore Safety column is the time delay after the comp starts to allow the MDP logic to function. The Lockout Delay Hrs. column is the adjust amount the EXV will be closed each time the delay reaches zero.

EXV STARTING % is stored in RO Grid in Compressor row

Figure 4. EXV logic — chart 2



EXV Related Setpoints

For more information, see "Setpoints for Unit Controller HVAC V17 Software," p. 54.

Setpoints 9 through 20 and 65 were added to provide fine-tuning to the testing of the movement of the superheat temperature. See EXV control logic charts in previous section.

EXV Control States

The EXV Control States are designed to show the status of the compressor's expansion valve. If the compressor has an EXV it will be displayed under the Status entry. The state will be preceded by EXV.

On the Magnum LCD Status screen, navigate to the EXV in the header line for the valve information.

Figure 5. EXV status screen

UNIT IS LOADING	00:00:36	1/0	180	50.0	0.0	CHILL OUT = 45.0F	COOLING

State	Time	Oil Diff	FLA %	Steps	Lead?
1)CMP OFF/READY	00:00:36	206.0P	83	0	Yes
2)CMP OFF/READY	00:00:36	206.0P	65	0	

	Suction Temp	Saturated Suction	Suction Superheat	Disc Temp	Saturated Discharge	Disc Superheat	Ref Type
1)	50.0	20.8	29.2	155.0	101.3	53.7	R-410A
2)	51.0	20.8	30.2	155.0	108.5	46.5	R-410A

Valve State	Time	Valve %	SuperHeat	SuperHeat ROC	ADJ Delay
1) EXV IS CLOSED	00:00:37	0.0	29.2	0.0	0
2) EXV IS CLOSED	00:00:37	0.0	30.2	0.0	0

States:

- LOCKED OUT
  The compressor is in a lock out state.
- IS CLOSED
  The associated compressor is off and the valve is closed.
- IN STARTUP
  At startup the valve will remain in this state for the time in setpoint #20. At that time the state will be changed to holding, at this point the valve control logic will position the valve.
- AT 100%
  This state will be entered when the valve opening reaches 100%.

For the following states, see EXV Logic Charts in figures above.

- IS HOLDING
  Superheat is in control zone and ROC is acceptable.
- IS OPENING
  Superheat is in control zone but rising too fast, ROC less than 1.0.
- IS CLOSING
  Superheat is in the control zone and the rate of change is acceptable, ROC greater than –0.5.
- LOW SPRHT
  Force a course valve adjustment.
- OPENING 4x
  Superheat is above control zone.
- OPENING 2x
  Superheat is in control zone but rising too fast, ROC greater than 1.0.
- LO PSI OPN
  Indicates a low suction pressure condition exists. The suction pressure is less than setpoint #77 (LOW SUCTION) and the superheat is greater than setpoint #9 (SPRHT TARGET) plus twice the value of setpoint #10 (SPRHTZONE+).
- CLOSING 2x
  Superheat is in the control zone and the rate of change is acceptable, ROC less than –0.5 and greater than –1.0.
- CLOSING 4x
  Superheat is in control zone but falling too fast, ROC less than –1.0.

Unit Controller Alarms and Safeties

There are three types of alarms that are generated by the Unit Controller control logic:

- Information only alarms
- Unit Controller system alarms
- Chiller setpoint safety alarms

All alarms have the same format. The alarm is identified and is date/time stamped. Alarms can be viewed from the Unit Controller keypad by selecting the 'Alarms' from the main menu, or through MCS-Connect.

Information Only Alarms

System Generated Alarms

The following alarms are generated to provide information; they will not cause a change in the control algorithm such as a lock out condition or a relay output being forced off.

- **POWER FAILED** – Generated when power to the Unit Controller was lost.
- **POWER RETURNED** – Generated when power to the Unit Controller returned.
- **HW DATE INVALID** – The date contained/read from the hardware real time clock chip is not valid. Check battery voltage, it should be > 2.0 vdc.
- **HW TIME INVALID** – The time contained/read from the hardware real time clock chip is not valid. Check battery voltage, it should be > 2.0 vdc.
- **SW DATE INVALID** – The date contained/read from the software clock is not valid.
- **SW TIME INVALID** – The time contained/read from the software clock is not valid.
- **RAM INTEGRITY** – the data contained in the battery-backed up RAM memory may be corrupted. This does not stop the Unit Controller from running. It means the historical data may be incorrect (run times, cycles, min/max values, and trend/graph data).
- **WATCHDOG RESET** – The Unit Controller has reset itself because of improper operator of the Unit Controller board. Please consult the manufacturer if this alarm has occurred.
- **LOST A/D CONVTR** – The Unit Controller microprocessor has lost communications to the Analog to Digital converter chip (chip that converts sensor voltages to a digital number). Check for a shorted sensor that may be the cause.
- **LOST DISPLAY** – Generated when communication to the Keypad/Display is lost.
- **CF INIT ERROR** – The Compact Flash card that was installed cannot be initialized and therefore cannot be used. Replace the Compact Flash card with one that works.
- **BATTERY FAILED** – Generated when Unit Controller is not getting power from the Battery.

User Initiated Alarms

The following alarms indicate that an individual took action: (Most require proper authorization)

- **LOCKOUT RESET** – Generated when a user resets a compressor or a unit from a locked condition.
- **COMPUTER RESET** – Generated when the manual reset button on the Unit Controller is pressed.
- **ALARMS CLEARED** – Generated when a user clears the alarm history.
- **STPT CHANGED** – Generated when a user makes a change to a setpoint; the number of the setpoint will also be displayed with the alarm.
- **RO TO (Selected Condition)** – Generated when a user manually changes the condition of a Relay Output (either AUTO, MANON, or MANOFF).
- **AO TO (Selected Condition)** – Generated when a user changes the condition of an Analog Output (either AUTO or MANUAL. If MANUAL, then a dialog box will appear to input the number value).
- **SI TO (Selected Condition)** – Generated when a user changes the condition of a Sensor Input (If a digital input, then either AUTO, MANON, or MANOFF. If an analog input, then either AUTO or MANUAL. If MANUAL, then a dialog box will appear to input the number value).
- **POINT INFO CLEAR** – Generated when a user clears all point information (run times, cycles, min/max values, etc).
- **CLOCK SET** – Generated when a user makes a change to the Unit Controller real time clock.
- **CFG DOWNLOADED** – Generated when a user uploads a new configuration file into the Unit Controller.
- **ETHERNET CHANGE** – Generated when a user makes a change to the Ethernet settings through the Keypad/Display.
- **RS485 CHANGED** – Generated when a user makes changes to the RS485 address through the Keypad/Display.
- **CF CARD INSERTED** – Generated when a user inserts a Compact Flash memory card into the Unit Controller.
- **CF CARD REMOVED** – Generated when a user removes a Compact Flash memory card from the Unit Controller.

Automatic Alarms

The following alarms indicate an action that the Unit Controller made automatically:

- **ROTATED LEAD** – Generated when the Unit Controller automatically rotates the Lead Compressor.
- **DAYLIGHT SAVINGS** – Generated when the Unit Controller automatically changes the real time clock to adjust for Daylight Savings Time.

Unit Controller System Alarms

Configuration Alarms

These alarms indicate a problem with the configuration file in the system. The system is not operational and a new configuration must be transmitted to the unit through MCS-Connect.

- **INVALID CONFIG** – Check sums are incorrect.
- **INVALID CFG VER** – The version number of the configuration is invalid.
- **INVALID CFG TYPE** – The configuration type does not match the software type.

Local Network Alarms

These alarms indicate problems with the unit controller local network:

- **LOST SI COMM #_ / LOST RO COMM #_** – Generated when communications to a Sensor Input or Relay Output board is lost. The number of the board will be displayed with the alarm. The system can be accessed but will be in a NO RUN- I/O LOST state.
- **MCS-STAT OFFLINE** – The Unit Controller has lost communications to the MCS-STAT.
- **LOST IO SHUTDOWN** – Generated when Unit Controller is running and there are no communications to one or more of the I/O boards. The system can be accessed but will be in a NO RUN- I/O LOST state.
- **LOST I/O RESTART** – Generated when the Unit Controller does an automatic reset once I/O communications are restored.

Key Sensors Alarms

These alarms indicate a problem with a key sensor, it is either shorted or open. The alarm will contain ALARM followed by the 10-character name of the sensor.

The following sensors related to the entire system are tested:

- Leaving temperature: If failed, then Lock Out the system.
- Returning temperature: If failed, then alarm only no Lock Out.
- Ambient temperature: If failed, then alarm only no Lock Out.

The following compressor sensors are tested. If they fail, then that compressor only is locked out:

- Suction pressure and temperature (affects both compressors that share a circuit)
- Discharge pressure and temperature (affects both compressors that share a circuit)
- Motor Fault Module

Setpoint Safety Alarms

The Unit Controller algorithm incorporates a number of safety checks, based on setpoints, preventing unsafe conditions that could potentially cause damage to the system.

When a safety trips the circuit will be in a SAFETYTRIPPED state. The circuit will remain in this state for 10 minutes and then move to the CMP ANTICYCLE or CMP IS OFF state where the compressor will be allowed to run again if required.

If the same safety trip occurs again within 2 hours of the first trip, the circuit will be set to CMP LOCKED OUT state, which requires a manual reset to restart the compressor. Some safeties will generate a lockout condition on the first trip.

Sensor Inputs Used With Unit Controller Setpoint Safeties:

- Suction Pressure
- Discharge Pressure
- Motor Amps
- Motor Fault
- Flow Switch (Digital Only)

Setpoint Safeties

For a safety trip to occur, both the sensor input and the associated setpoint must be active. If a safety trips, the alarm name will consist of the setpoint name plus additional identification such as point number, compressor number, or 120 second history leading up to the trip if applicable.

Note: *Most safeties are checked only if the compressor is running, however if the safety is always checked it will be noted.*

The following is a list of safeties that are incorporated in the standard chiller algorithm control. These safeties are checked every second. For a system with multiple circuits, each one is tested individually. If a safety trip occurs, only that respective compressor will be affected, the others will continue to function normally.

Freeze Protection (Safety Is Always Checked)

If the leaving temperature drops below the setpoint value then the entire system will Lock Out and a FREEZE alarm will be generated.

No Flow Protection

If a flow switch is used, then the entire system will be Locked Out if setpoint #105 is active. If the setpoint is

inactive, the system will determine if there is a second pump, if so it will be started. Else, the system will shut down and automatically restart when the flow switch is on, indicating flow has returned.

Phase Loss Protection

Phase loss, as indicated by the optional phase loss monitor, will result in the entire system being Locked Off and a phase loss alarm will be generated. If setpoint #166 is inactive the system will wait for 2 seconds before the Lock Out occurs. The alarm will be PHASE LOSS and no restart will be attempted. If setpoint #166 is active, the name of the setpoint will be in the message. See Table 10, p. 56, setpoint #166.

Low Suction Pressure

If the suction pressure drops below the value of the setpoint or the digital input turns ON for the time specified in the 'Time (sec)' field, the compressor will be locked out and a LOW SUCTION alarm generated. This safety is bypassed when the compressor is in a Pump Down state. When this safety trip occurs, all compressors in the same suction group will react the same. SeeTable 10, p. 55, setpoint #77.

Note: *Low suction alarms are most commonly caused by low water flow through the evaporator (low load) or low refrigerant charge on CICA/CICB chillers. Check flow first. Also, refrigerant sight glasses must remain absolutely clear for proper TXV and EXV operation.*

Unsafe Suction Pressure

This safety is similar to the low suction pressure safety, except it is often set up with a lower value and a shorter safety time. If the suction pressure drops below the value of the setpoint or the digital input turns ON for the time specified in the 'Time (sec)' field of that setpoint, then the circuit will be Locked Out and a UNSAFE SUCTION alarm generated. This safety will always cause a Lock Out on the first trip, requiring a manual reset. This safety is bypassed when the compressor is in a Pump Down state. When this safety trip occurs, all compressors in the same suction group will react the same. See Table 10, p. 55, setpoint #80.

High Discharge Pressure (Safety Is Always Checked)

If the discharge pressure rises above the value of the setpoint or the digital input turns ON for the time specified in the 'Time (sec)' field of that setpoint, then the circuit will be locked out and a HIGH DISCHARGE alarm generated. See Table 10, p. 55, setpoint #81.

Low Discharge Pressure

If the discharge pressure drops below the value of the setpoint for the time specified in the 'Time (sec)' field, the compressor will be Locked Out and a LOW DISCHARGE alarm generated. See Table 10, p. 55, setpoint #85.

High Motor Temperature Or Motor Fault (Safety Is Always Checked)

If the high motor temperature input rises above the value of the setpoint or the digital input turns ON for the time specified in the 'Time (sec)' field, the circuit will be Locked Out and a HIGH MOTOR TEMPERATURE or MOTOR FAULT alarm generated. Table 10, p. 55, setpoint #95.

High Motor Amperage

If the amperage analog input rises above the value of the compressor's respective FLA setpoint #171 – 190 times the value of setpoint #75 or the digital input turns ON for the time specified in the Time (sec)' field, then the circuit will be Locked Out and a HIGH MOTOR AMP alarm generated. Table 10, p. 56, setpoint #171.

PSI/No Amps

If the amperage analog input drops below the value of the compressor's respective FLA setpoint #171 – 190 times the value of setpoint #76 or the digital input turns ON for the time specified in the Time (sec)' field, then the circuit will be Locked Out and a LOW MOTOR AMP alarm will be generated. See Table 10, p. 55, setpoint #76.

Each refrigerant circuit is equipped with high and low pressure transducers and high and low pressure switches. Tripping the pressure switches is the most likely cause of this alarm because they interrupt control power to the affected contactors directly. The controller expects to read amp draw and it doesn't. Less likely cause could be bad contactor coil bad, CT, loose sensor wiring etc.

Unit Controller Unit Control States Quick Reference

The Unit Control States indicate the unit status; this information is critical. From the Unit Controller keypad / display, press the menu key and select STATUS>. The unit control status will be displayed.

Unit State (#)	**Brief Description**
Unit In Power (0)	System Reset or Power Returned (delay of 30 seconds or setpoint value)
No Run-I/O Lost (2)	Lost communication Chiller locked out
Unit In Lockout (3)	Chiller locked out, all points except alarm point are OFF
Unit is Off (4)	System ready to run but no cooling capacity required
Unit is Holding (5)	No change in capacity
Unit Unloading (6)	Reduce capacity
Unit Loading (7)	Increase capacity
No Run-Safety (8)	Unit disabled: due to unit safety condition
Run/Stop SW Off (9)	Unit disabled: remote run/stop switch is off
Scheduled Off (10)	Unit disabled: operating schedule is false
Off-No Flow(s) (11)	Unit disabled: no evaporator or condenser flow
Ambient Off (13)	Unit disabled: low ambient temperature
Unit is Unloaded (15)	Unit is unloaded, No cooling capacity is being provided
Unit is Loaded (16)	Unit is loaded, maximum cooling capacity is being provided
Off TMP-ICE Made (17)	This state is entered when target temperature has been satisfied
Unit DMD Unlding (22)	Demand limiting function: force unit to unload

Unit Controller Compressor Control States Quick Reference

Compressor Control States tell the user the compressor status; this information is critical. From the Unit Controller keypad/display, press the menu key and select STATUS>. Then press the F2 or F3 buttons to navigate through the compressor status information.

Unit State (#)	**Brief Description**
Lost IO Locked (0)	Lost communication with I/O boards, compressor locked out
CMP Locked Out (1)	Compressor locked off due to safety
Switched Off (2)	Enable switch off or system state is DISABLE
Unld and Pmpdwn (3)	Compressor is unloaded and being pump down
CMP Anticycle (4)	Compressor off, not ready until anti cycle time reached
CMP Off/Ready (5)	Compressor ready but not required or has not been in this state for 60 seconds
CMP Unloaded (8)	Compressor ON, hot gas bypass ON.
CMP is Holding (11)	Control temperature with in target control band
CMP is Running (14)	Compressor is fully loaded, Hot gas bypass is OFF
Safety Tripped (20)	Compressors off until to safety, check alarms

OEM Factory Checkout Procedure

Visual Check

- Control power wiring correct and 115 / 240 selector switch set correctly. Always set to 115.
- Jumper settings
  - Sensor input
  - MCS I/O communication termination
  - MCS communication termination
  - EEPROM write protection
  - Sensor Wiring
  - MCS-IO Communication Wiring
  - LCD Connector (dot to mark on the board)
  - Keypad Connector (dot to mark on the board)
  - RO Wiring

Ensure that the EMG stop is on (closed position) or run/stop input off so that the unit will not run after power applied to micro.

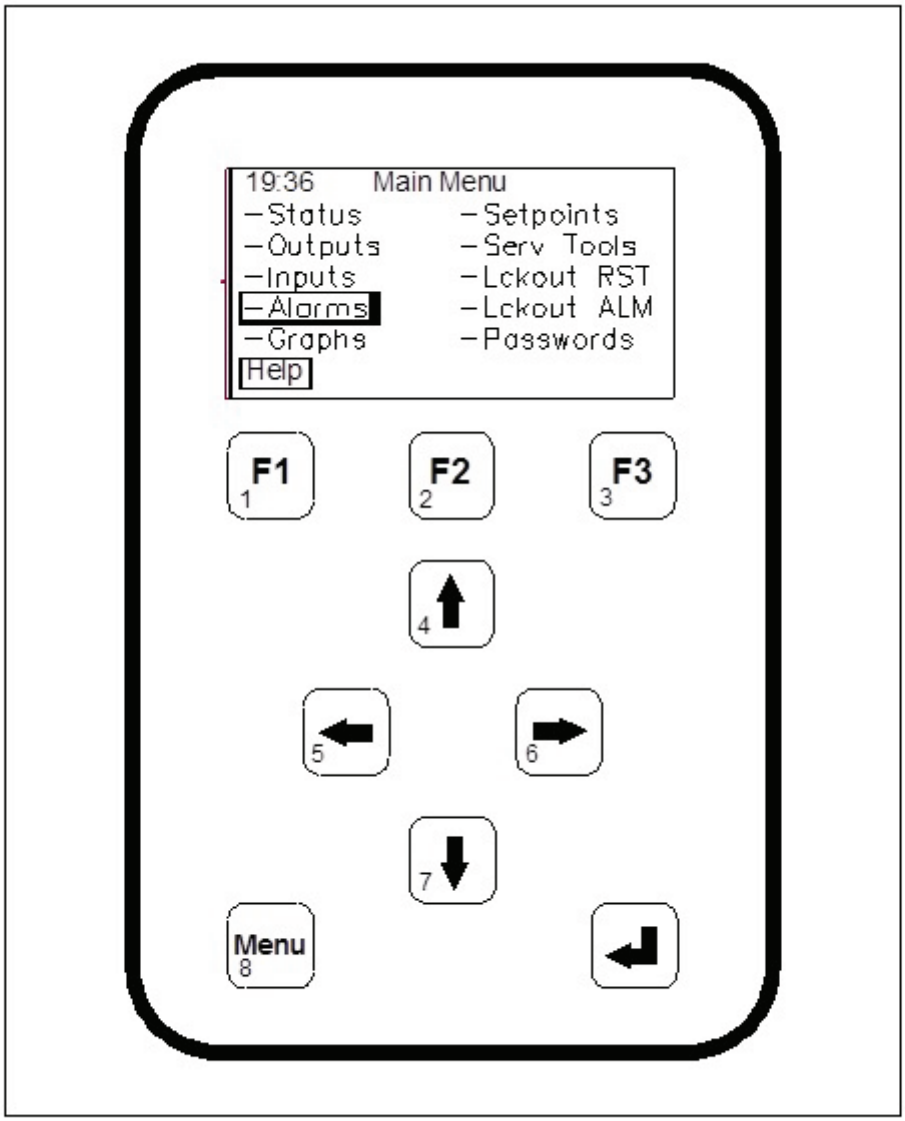
MCS Power On (Compressor Power off)

- MCS System on
- LCD on and valid display TRANE logo then Main Menu screen
- Communications light blinking if I/O units
- Get AUTHORIZED

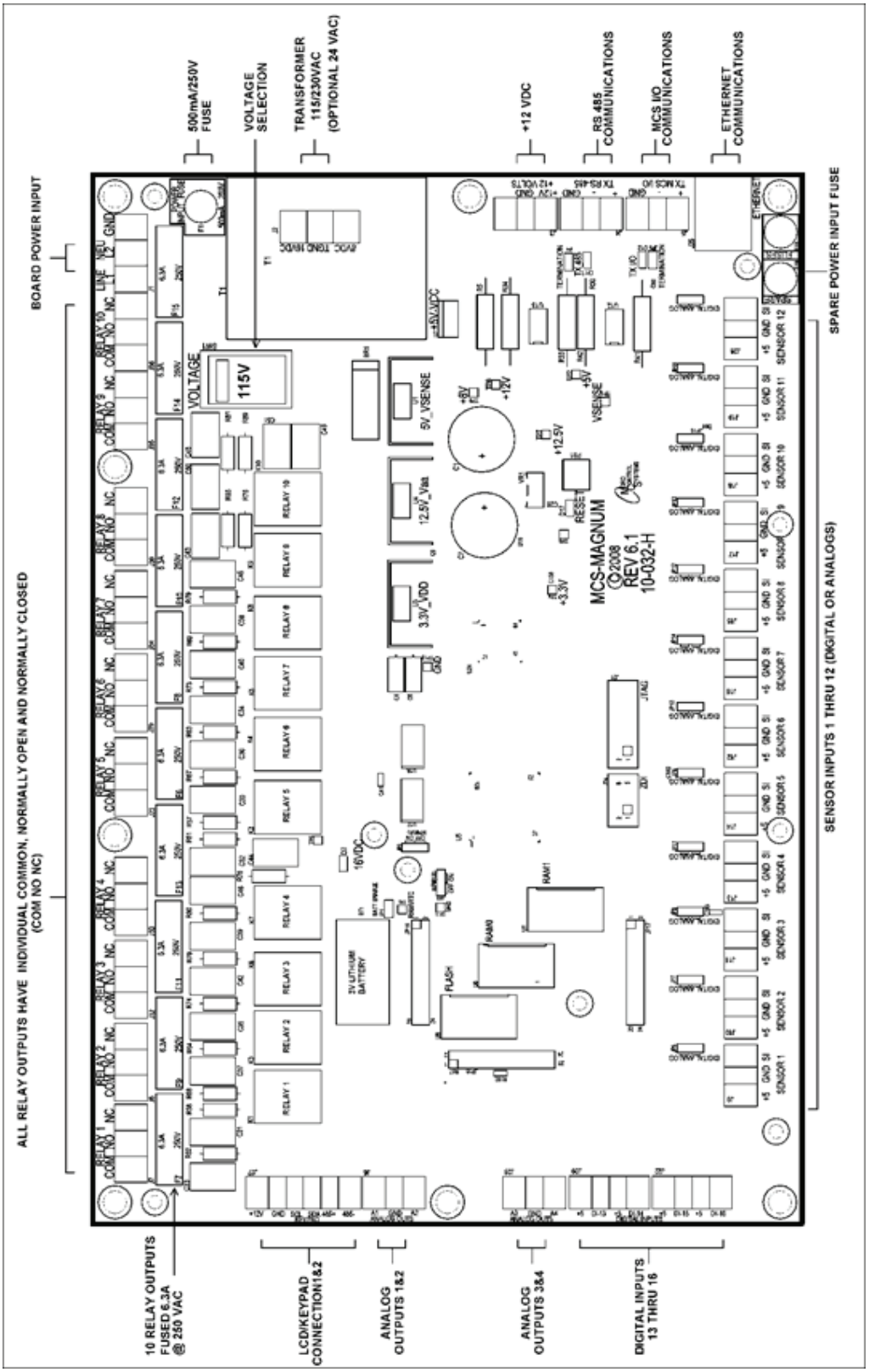
Check sensor readings

Unit Controller Keypad Display Quick Reference

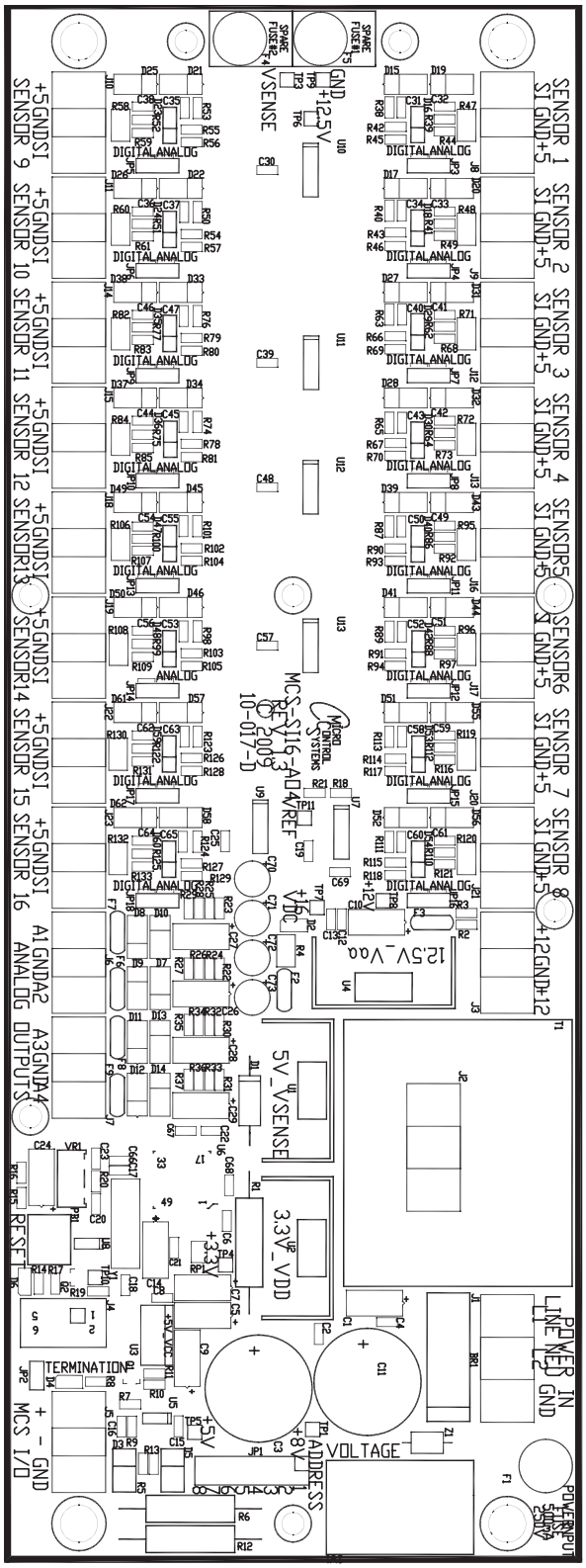
- No authorization is required to display information.
- Pressing the 'MENU' key will display the information below.
- Using the ←, ↑, →, ↓ position the curser on the item you want.
- Press the ↵ (ENTER) key to display item.
- The bottom line of the display defines the functions of F1 –F3.
- For Passwords use the numbers on the keys. (1 thru 8).
- The RS 232 connector is located on the back of the keypad inside the control panel.
- To use MCS-Connect you need to use a null modem cable.



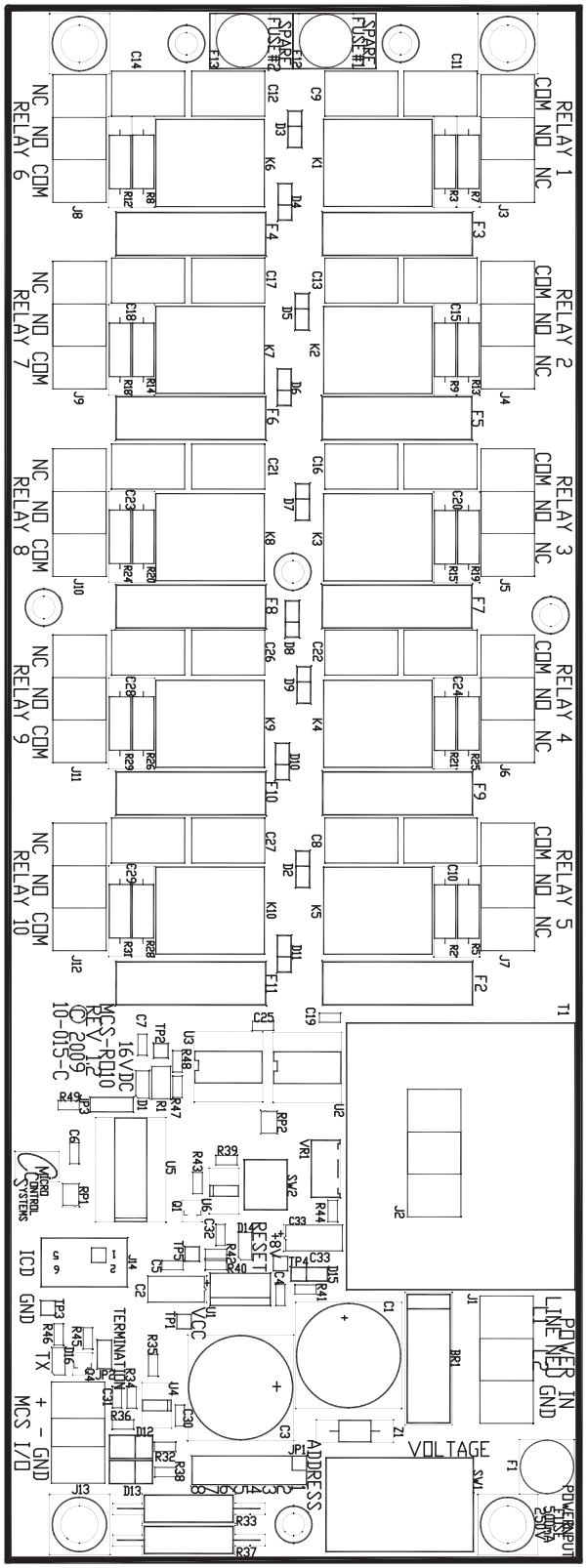
Unit Controller Hardware Rev 6
Quick Reference Sheet



Unit Controller Hardware SI16/AO4 Quick Reference



Unit Controller Hardware RO10 Quick Reference

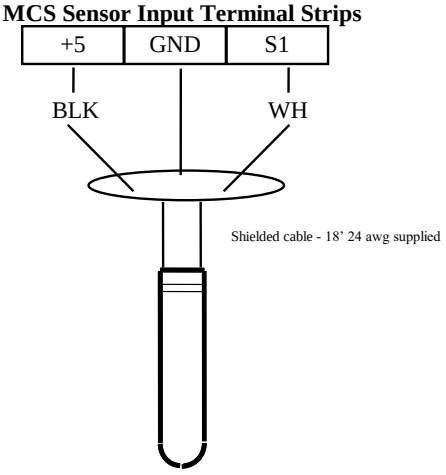


Unit Controller Quick Reference Sheet (Temp and Humidity)

MCS-T100 (SI #1 through 12 on Unit Controller or SI 16)

1. Connects to 1 of MCS Sensor Inputs 1 thru 12 or SI 16
2. Shielded cable GND drain must be connected to SI 'GND'
3. Temp Unit Controller SI (inputs 1-12) jumper setting is ANALOG'

MCS Sensor Input Terminal Strips

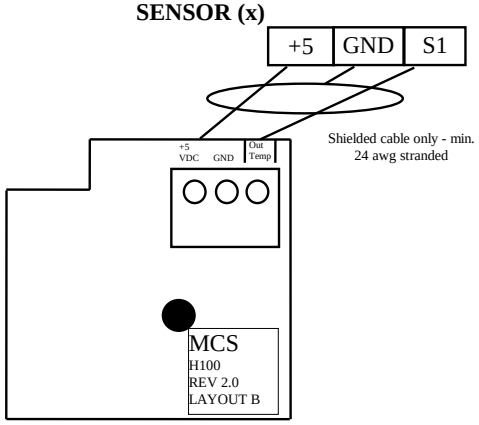


MCS-T100

MCS-ZONE (SI #1 through 12 on Unit Controller or SI 16)

1. Connects to 1 of MCS Sensor Inputs 1 thru 12 or SI 16
2. Shielded cable GND drain must be connected to SI 'GND'
3. Temp Unit Controller SI (inputs 1-12) jumper setting is 'ANALOG'

MCS Sensor Input Terminal Strips
SENSOR (x)

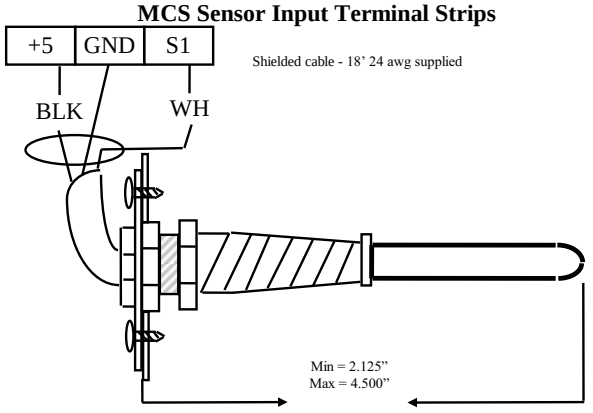


MCS-ZONE

MCS-SAIR (SI #1 through 12 on Unit Controller or SI 16)

1. Connects to 1 of Unit Controller Sensor Inputs 1-12 or SI 16
2. Shielded cable GND drain must be connected to SI GND
3. Temp on Unit Controller SI (input 1-12) or SI 16 jumpers setting to analog
4. Minimum extension inside duct 2.25"
5. Normal extension, as shown, 4.00".

MCS Sensor Input Terminal Strips

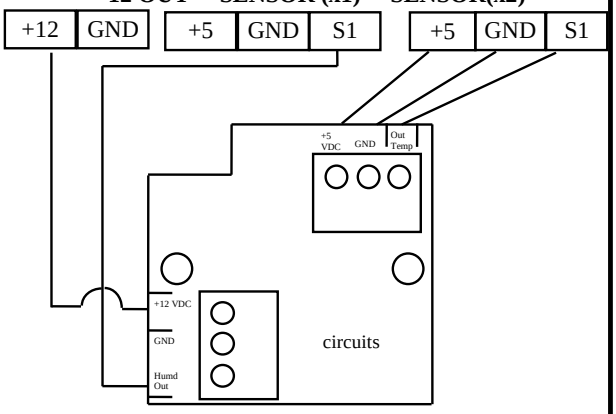


MCS-SAIR

MCS-HUMD (SI #1 through 12 on Unit Controller or SI 16)

1. Connects to 2 of Unit Controller Sensor Inputs 1 -12 or SI 16
2. Humidity Unit Controller SI (input 1-8) jumper setting to analog
3. +5 vdc & GND are common (only one connection required)
4. Temp. on Unit Controller SI (input 1-12) or SI 16 jumper setting is analog
5. Shielded cable GND drain must be connected to SI 'GND'

MCS Sensor Input Terminal Strips
+12 OUT SENSOR (x1) SENSOR(x2)



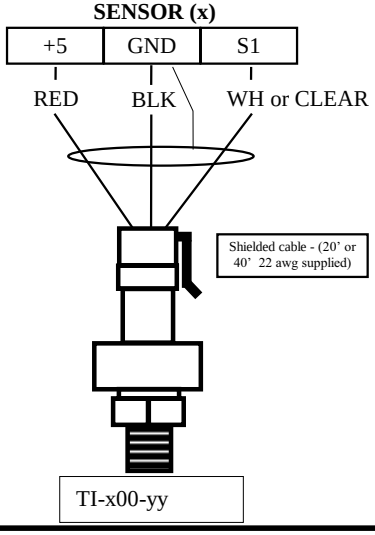
MCS-H100

Unit Controller Quick Reference Sheet (PSI, CT and Digital)

TI-xxx-xx (SI #1 thru 12 on Unit Controller or SI 16)

1. Pressure transducer (3 wire 0-5 vdc)
2. Wiring for 3 wire to SI# 1 through 12 or on SI 16
3. Jumper settings for SI is 'ANALOG'
4. Types: 150-A, 200, 500 or 667 indicate pressure ranges.

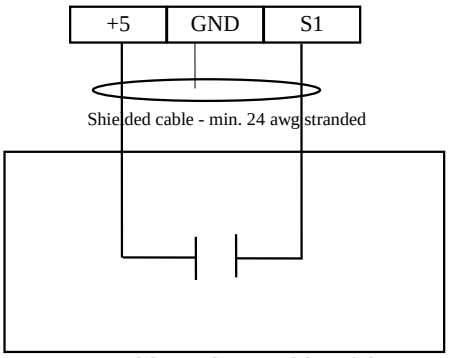
MCS Sensor Input Terminal Strips
SENSOR (x)



Dry Contact's on Unit Controller

1. Digital inputs for use on sensor inputs (SI 1-16)
2. Dry Contact Unit Controller SI (inputs 1-12) jumper setting is 'DIGITAL'
3. Dry Contact Unit Controller SI (inputs 13-16)Digital only
4. Verify on 'INPUTS Display on keypad
5. Shielded cable GND drain must be connected to SI GND"

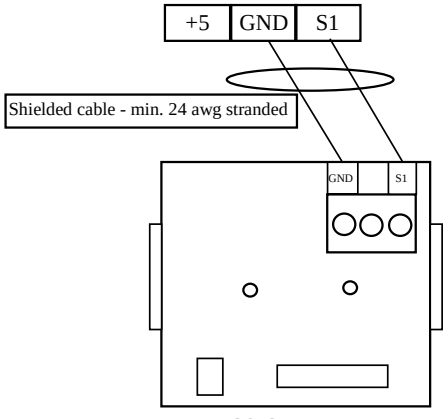
MCS Sensor Input Terminal Strips
Sensor (x)



MCS-CT-xxx (SI #1 through 12 on Unit Controller or SI 16)

1. Connect to Unit Controller sensor inputs 1 thru 12 or SI 16
2. The current transformer may be 100:0.5, 250:0.5, 500:0.5
3. AMPS jumper setting is 'ANALOG'
4. For wiring only remove terminal block from CT.
5. DO NOT REMOVE PRINTED CIRCUIT BOARD.
6. DO NOT WIRE +5 FROM UNIT CONTROLLER OR SI

MCS Sensor Input Terminal Strip Sensor (x)



Notes:

1. Sensor inputs should be shielded cable with shield tied to ground on Unit Controller sensor input ground terminal.
2. The four digital inputs, on the Unit Controller printed compressor board, do not require shielded cable.
3. All I/O boards with 24/120/240 vac must have grounds wired from terminal directly to ground. (Do not jumper grounds).

Unit Controller Troubleshooting Quick Reference Sheet

Problem	Potential Solution
No Sensor + 5 vdc or sensor +5 vdc less than 4.90 vdc.	• Indicates a possible shorted input sensor • Remove all sensor terminal blocks. • Wait about 30 to 60 seconds. If + 5 vdc returns, replace one sensor wire at a time until the + 5 vdc is lost again. This will be the shorted sensor.
A sensor input reads -99.9	This indicates an open sensor input signal or 5 VDC problem. • Check sensor wiring for missing wire or poor connection. • Check sensor for bad sensor. • Check + 5 vdc on sensor input to ground. If less than 5 VDC is on the sensor 5 VDC terminal block, the problem is with probably a shorted sensor. (A poly fuse protects the board) • Remove all sensor input terminals. • Wait about 1 min. or until 5 VDC restored at sensor input. • Connect terminals 1 at time until short reappears and fix bad sensor.
A sensor input reads +999.9	This indicates a shorted sensor input signal. • Check sensor wiring for +5VDC shorted to signal etc. • Check sensor for bad sensor.
A pressure sensor is reading more than 1 psi off (The temperature and humidity sensors do not require calibration.)	This indicates the transducer sensor input needs to be calibrated via the offset capability in the software. (Transducers by design need to be calibrated based on construction and altitude.) • You need to have a valid Auth code to change sensor offsets • You must use the Windows based software package 'MCS-Connect' • See MCS-Connect' Interactive section for instructions. ('Change SI Status, Manual Value and / or offset.)
Invalid reading on one sensor input.	This indicates an input problem with 1 sensor. • Verify jumper settings correct for that SI.
Lost I/O	Indicates communications problem. • Verify RS485 LED blinking. • Verify termination jumper J6 only on at Unit Controller and last I/O. • Verify Unit Controller and I/O address's set correctly. • Verify wiring from Unit Controller to each I/O correct. • Check fuses/120 VAC on I/O units
MCS-Connect– cannot make changes	This indicates you are not at a proper authorization level. Follow steps below for proper authorization • From either the SYSTEM INFO or STATUS screen, under MCS-Connect, click on the 'AUTH' button on the lower right of your LCD display. • Follow prompts and enter a valid 4-digit authorization number. • The authorization level is displayed at the top of the display and is reflected via the color of the AUTH button. 1. RED = view only 2. YELLOW = service level Service password is 2112 3. BLUE = Supervisor level 4. Green = Factory level
Invalid authorization	This indicates an invalid auth number. Follow steps below for proper authorization • Press SERVICE DIAGNOSTICS key until the authorization option appears • Press the ENTER key • From the "Display Status" press keys corresponding to your authorization number. • Press ENTER
SI from AMPS board 10 A low	This indicates a problem with this SI only • Jumper setting on this SI in wrong position • Incorrect sensor type used
Invalid Config Ver	Indicates layout of CFG wrong • CFG layout for different version than software
Invalid Config Type	Indicates CFG incompatible with software
Invalid Config Checksum	Indicates Checksum invalid • Reload a valid CFG

Unit Controller Troubleshooting Quick Reference Sheet

Problem	Potential Solution
Sensor input believed invalid (Under Sensor Diagnostic Sub Menu)	• Verify Berg jumpers using Quick Reference Sheets • Check board version number • Check wiring of sensor
Communications to RS-485-GATEWAY from MCS-Connect not working	• Verify red LED on the gate way is blinking. This indicates that the MCS-Connect program is talking to the gateway. • Verify that the two wire shielded cable is properly wired from the RS-485 connector to the gateway. • Verify red LED (Located just to the left of the RS-485 connector on the Unit Controller board is blinking. This indicates that the Unit Controller is responding to the gateway. • If both of these LED are blinking, check the address of the Unit Controller and any other Unit Controllers that are on the network. Each must have a unique address. This address can be changed from the Unit Controller. Proper authorization is required. Enter the UNIT INFORMATION screen by depressing the SERVICE DIAGNOSTIC key and scrolling to this item. Depress the ENTER key and scroll to the NETWORK ADDRESS screen. Change address if needed. • Verify + 12 vdc to RS-485-GATEWAY
Invalid Config	Indicates Checksum invalid • Either set to factory defaults on reset settings

BMS Communication Protocols

When the Trane® Cold Generator™ CIC*/CCA*/CGW* chiller or Array Controller is used in conjunction with a building management system (BMS) such as Tracer®, the chiller or Array Controller can be monitored and given input from a remote location. The chiller can be set up to fit into the overall building control strategy by using remote run/stop input, remote demand limit reset and/or remote chilled water reset functions.

As standard, the unit controller Ethernet port is always ready to talk BACnet® IP and Modbus™ TCP/ IP (Modbus RTU uses the RS485 network port. Supported baud rates for Modbus RTU are 4800 bps, 9600 bps, 38,400 bps, and 57,600 bps.). BACnet MS/TP, Johnson N2 and LonTalk® are optional protocols that can be factory-installed. The unit controller can facilitate the following BMS communications:

- Remote Off/Auto signal (input from BMS)
- Demand Limit Reset signal (input from BMS)
- Chilled Water Temperature Reset signal (input from BMS)
- Customer Alarm relay (view only)
- Chiller Run Indication (view only)
- Entering Chilled Water Temperature (view only)
- Leaving Chilled Water Temperature (view only)
- Chilled Water Flow Switch input (view only)
- Condenser Pump relay (view only)
- Chilled Water Pump relay (view only)

Note: *This is a partial BMS point list for the* CIC*/CCA*/CGW* *and Array Controller. A full BMS points list from the installed units' cfg. file can be provided.*

Table 1. CGW* 20 to 30 ton unit

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net_R/S	AV:246	Net_R/S	40201	Net_R/S	AV:246	NETRN_ST	AV:246	NETRN_ST	AV:246	iNETRN_ST
Demand Limit Reset signal (input from BMS)	4	Net_Demand_Steps	AV:249	Net_Demand_Steps	40205	Net_Demand_Steps	AV:249	NETDMD_STPS	AV:249	NETDMD_STPS	AV:249	iNETDMD_STPS
Chilled Water Temperature Reset signal (input from BMS)	2	Net_Tar/Res	AV:247	Net_Tar/Res	40202	Net_Tar/Res	AV:247	NETRGT_RST	AV:247	NETRGT_RST	AV:247	iNETRGT_RST
Customer Alarm relay (view only)	M-10	ALARM	BO:10	ALARM	10	ALARM	DO:10	M7_ALARM	DO:10	M7_ALARM	DO:10	M7_ALARMro
Chiller Run Indication (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Entering Chilled Water Temperature (view only)	M-1	CHILL IN	AI:1	CHILL IN	30001	CHILL IN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILL OUT	AI:2	CHILL OUT	30002	CHILL OUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUTsi
Chilled Water Flow Switch input (view only)	M-15	EVAP FLOW	AI:15	EVAP FLOW	30015	EVAP FLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOWsi
Condenser Pump relay (view only)	M-8	COND PUMP	BO:8	COND PUMP	8	COND PUMP	DO:8	M_8_CONDPUMP	DO:8	M_8_CONDPUMP	DO:8	M_8_CONDPUMPro
Chilled Water Pump relay (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2. CGW* 40 to 70 ton unit

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net_R/S	AV:246	Net_R/S	40201	Net_R/S	AV:246	NETRN_ST	AV:246	NETRN_ST	AV:246	iNETRN_ST
Demand Limit Reset signal (input from BMS)	4	Net_Demand_Steps	AV:249	Net_Demand_Steps	40205	Net_Demand_Steps	AV:249	NETDMD_STPS	AV:249	NETDMD_STPS	AV:249	iNETDMD_STPS
Chilled Water Temperature Reset signal (input from BMS)	2	Net_Tar/Res	AV:247	Net_Tar/Res	40202	Net_Tar/Res	AV:247	NETRGT_RST	AV:247	NETRGT_RST	AV:247	iNETRGT_RST
Customer Alarm relay (view only)	M-10	ALARM	BO:10	ALARM	10	ALARM	DO:10	M7_ALARM	DO:10	M7_ALARM	DO:10	M7_ALARMro
Chiller Run Indication (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Entering Chilled Water Temperature (view only)	M-1	CHILL IN	AI:1	CHILL IN	30001	CHILL IN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILL OUT	AI:2	CHILL OUT	30002	CHILL OUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUTsi
Chilled Water Flow Switch input (view only)	M-15	EVAP FLOW	AI:15	EVAP FLOW	30015	EVAP FLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOWsi
Condenser Pump relay (view only)	M-9	COND PUMP	BO:9	COND PUMP	9	COND PUMP	DO:9	M_8_CONDPUMP	DO:9	M_8_CONDPUMP	DO:9	M_8_CONDPUMPro
Chilled Water Pump relay (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3. CCA* 20 to 30 ton unit

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net_R/S	AV:246	Net_R/S	40201	Net_R/S	AV:246	NETRN_ST	AV:246	NETRN_ST	AV:246	iNETRN_ST
Demand Limit Reset signal (input from BMS)	4	Net_Demand_Steps	AV:249	Net_Demand_Steps	40205	Net_Demand_Steps	AV:249	NETDMD_STPS	AV:249	NETDMD_STPS	AV:249	iNETDMD_STPS
Chilled Water Temperature Reset signal (input from BMS)	2	Net_Tar/Res	AV:247	Net_Tar/Res	40202	Net_Tar/Res	AV:247	NETRGT_RST	AV:247	NETRGT_RST	AV:247	iNETRGT_RST
Customer Alarm relay (view only)	M-10	ALARM	BO:10	ALARM	10	ALARM	DO:10	M7_ALARM	DO:10	M7_ALARM	DO:10	M7_ALARMro
Chiller Run Indication (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Entering Chilled Water Temperature (view only)	M-1	CHILL IN	AI:1	CHILL IN	30001	CHILL IN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILL OUT	AI:2	CHILL OUT	30002	CHILL OUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUTsi
Chilled Water Flow Switch input (view only)	M-15	EVAP FLOW	AI:15	EVAP FLOW	30015	EVAP FLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOWsi
Condenser Pump relay (view only)	M-8	COND PUMP	BO:8	COND PUMP	8	COND PUMP	DO:8	M_8_CONDPUMP	DO:8	M_8_CONDPUMP	DO:8	M_8_CONDPUMPro
Chilled Water Pump relay (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4. CCA* 40 to 70 ton unit

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net_R/S	AV:246	Net_R/S	40201	Net_R/S	AV:246	NETRN_ST	AV:246	NETRN_ST	AV:246	iNETRN_ST
Demand Limit Reset signal (input from BMS)	4	Net_Demand_Steps	AV:249	Net_Demand_Steps	40205	Net_Demand_Steps	AV:249	NETDMD_STPS	AV:249	NETDMD_STPS	AV:249	iNETDMD_STPS
Chilled Water Temperature Reset signal (input from BMS)	2	Net_Tar/Res	AV:247	Net_Tar/Res	40202	Net_Tar/Res	AV:247	NETRGT_RST	AV:247	NETRGT_RST	AV:247	iNETRGT_RST
Customer Alarm relay (view only)	M-10	ALARM	BO:10	ALARM	10	ALARM	DO:10	M7_ALARM	DO:10	M7_ALARM	DO:10	M7_ALARMro
Chiller Run Indication (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Entering Chilled Water Temperature (view only)	M-1	CHILL IN	AI:1	CHILL IN	30001	CHILL IN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILL OUT	AI:2	CHILL OUT	30002	CHILL OUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUTsi
Chilled Water Flow Switch input (view only)	M-15	EVAP FLOW	AI:15	EVAP FLOW	30015	EVAP FLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOW	AI:15	M_15_EVAPFLOWsi
Condenser Pump relay (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chilled Water Pump relay (view only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5. CICA standalone unit

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net_R/S	AV:246	Net_R/S	40201	Net_R/S	AV:246	NETRN_ST	AV:246	NETRN_ST	AV:246	iNETRN_ST
Demand Limit Reset signal (input from BMS)	4	Net_Demand_Steps	AV:249	Net_Demand_Steps	40205	Net_Demand_Steps	AV:249	NETDMD_STPS	AV:249	NETDMD_STPS	AV:249	iNETDMD_STPS
Chilled Water Temperature Reset signal (input from BMS)	2	Net_Tar/Res	AV:247	Net_Tar/Res	40202	Net_Tar/Res	AV:247	NETRGT_RST	AV:247	NETRGT_RST	AV:247	iNETRGT_RST

Table 5. CICA standalone unit (continued)

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Customer Alarm relay (view only)	M-7	ALARM	BO:7	ALARM	00007	ALARM	DO:7	M7_ALARM	DO:7	M7_ALARM	DO:7	M7_ALARMro
Chiller Run Indication (view only)	M-3	RUN LIGHT	BO:3	RUN LIGHT	00003	RUN LIGHT	DO:3	M_3_RUN LIGHT	DO:3	M_3_RUN LIGHT	DO:3	M_3_RUN LIGHTro
Entering Chilled Water Temperature (view only)	M-1	CHILLWtrIN	AI:1	CHILLWtrIN	30001	CHILLWtrIN	AI:1	M_1_CHILLWtrIN	AI:1	M_1_CHILLWtrIN	AI:1	M_1_CHILLWtrINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILLWtrOUT	AI:2	CHILLWtrOUT	30002	CHILLWtrOUT	AI:2	M_2_CHILLWtrOUT	AI:2	M_2_CHILLWtrOUT	AI:2	M_2_CHILLWtrOUTsi
Chilled Water Flow Switch input (view only)	M-15	EXT FLOWSW	AI:15	EXT FLOWSW	30015	EXT FLOWSW	AI:15	M_15_EXT FLOWSW	AI:15	M_15_EXT FLOWSW	AI:15	M_15_EXT FLOWSWsi
Condenser Pump relay (view only)	M-8	COND PUMP	BO:8	COND PUMP	00008	COND PUMP	DO:8	M_8_CONDPUMP	DO:8	M_8_CONDPUMP	DO:8	M_8_CONDPUMPro
Chilled Water Pump relay (view only)	M-9	ChlWtrPump	BO:9	ChlWtrPump	00009	ChlWtrPump	DO:9	M_9_ChlWtrPump	DO:9	M_9_ChlWtrPump	DO:9	M_9_ChlWtrPumro

Table 6. CICA unit in an array

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Demand Limit Reset signal (input from BMS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chilled Water Temperature Reset signal (input from BMS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Customer Alarm relay (view only)	M-7	ALARM	BO:7	ALARM LT	00007	ALARM	DO:7	M7_ALARM	DO:7	M7_ALARM	DO:7	M7_ALARMro
Chiller Run Indication (view only)	M-3	RUN LIGHT	BO:3	RUN LIGHT	00003	RUN LIGHT	DO:3	M_3_RUN LIGHT	DO:3	M_3_RUN LIGHT	DO:3	M_3_RUN LIGHTro
Entering Chilled Water Temperature (view only)	M-1	CHILLWtrIN	AI:1	CHILLWtrIN	30001	CHILLWtrIN	AI:1	M_1_CHILLWtrIN	AI:1	M_1_CHILLWtrIN	AI:1	M_1_CHILLWtrINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILLWtrOUT	AI:2	CHILLWtrOUT	30002	CHILLWtrOUT	AI:2	M_2_CHILLWtrOUT	AI:2	M_2_CHILLWtrOUT	AI:2	M_2_CHILLWtrOUTsi

Table 6. CICA unit in an array (continued)

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Chilled Water Flow Switch input (view only)	M-15	EXT FLOWSW	AI:15	EXT FLOWSW	30015	EXT FLOWSW	AI:15	M_15_EXT FLOWSW	AI:15	M_15_EXT FLOWSW	AI:15	M_15_EXT FLOWSWsi
Condenser Pump relay (view only)	M-8	COND PUMP	BO:8	COND PUMP	00008	COND PUMP	DO:8	M_8_ COND PUMP	DO:8	M_8_ COND PUMP	DO:8	M_8_ COND PUMPro
Chilled Water Pump relay (view only)	M-9	ChlWtrPump	BO:9	ChlWtrPump	00009	ChlWtrPump	DO:9	M_9_ ChlWtrPu mp	DO:9	M_9_ ChlWtrPu mp	DO:9	M_9_ ChlWtrPu mro

Table 7. CICB standalone unit

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net_R/S	AV:246	Net_R/S	40201	Net_R/S	AV:246	NETRN_ST	AV:246	NETRN_ST	AV:246	iNETRN_ST
Demand Limit Reset signal (input from BMS)	4	Net_Demand_Steps	AV:249	Net_Demand_Steps	40205	Net_Demand_Steps	AV:249	NETDMD_STPS	AV:249	NETDMD_STPS	AV:249	iNETDMD_STPS
Chilled Water Temperature Reset signal (input from BMS)	2	Net_Tar/Res	AV:247	Net_Tar/Res	40202	Net_Tar/Res	AV:247	NETRGT_RST	AV:247	NETRGT_RST	AV:247	iNETRGT_RST
Customer Alarm relay (view only)	M10	ALARM LT	BO:10	ALARM LT	00010	ALARM LT	DO:10	M10_ALARMLT	DO:10	M10_ALARMLT	DO:10	M10_ALARMLTro
Chiller Run Indication (view only)	M-7	RUN LIGHT	BO:7	RUN LIGHT	00007	RUN LIGHT	DO:7	M_7_RUN LIGHT	DO:7	M_7_RUN LIGHT	DO:7	M_7_RUN LIGHTro
Entering Chilled Water Temperature (view only)	M-1	CHILL IN	AI:1	CHILL IN	30001	CHILL IN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLIN	AI:1	M_1_CHILLINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILL OUT	AI:2	CHILL OUT	30002	CHILL OUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUT	AI:2	M_2_CHILLOUTsi
Chilled Water Flow Switch input (view only)	M-15	EXT FLOWSW	AI:15	EXT FLOWSW	30015	EXT FLOWSW	AI:15	M_15_EXTFLOWSW	AI:15	M_15_EXTFLOWSW	AI:15	M_15_EXTFLOWSWsi
Condenser Pump relay (view only)	M-7	COND PUMP (Idec)	BO:7	COND PUMP (Idec)	00007	COND PUMP (Idec)	DO:7	M_7_COND PUMP	DO:7	M_7_COND PUMP	DO:7	M_7_COND PUMPro
Chilled Water Pump relay (view only)	M-8	CW PUMP	BO:8	CW PUMP	00008	CW PUMP	DO:8	M_8_CWPUMP	DO:8	M_8_CWPUMP	DO:8	M_8_CWPUMPro

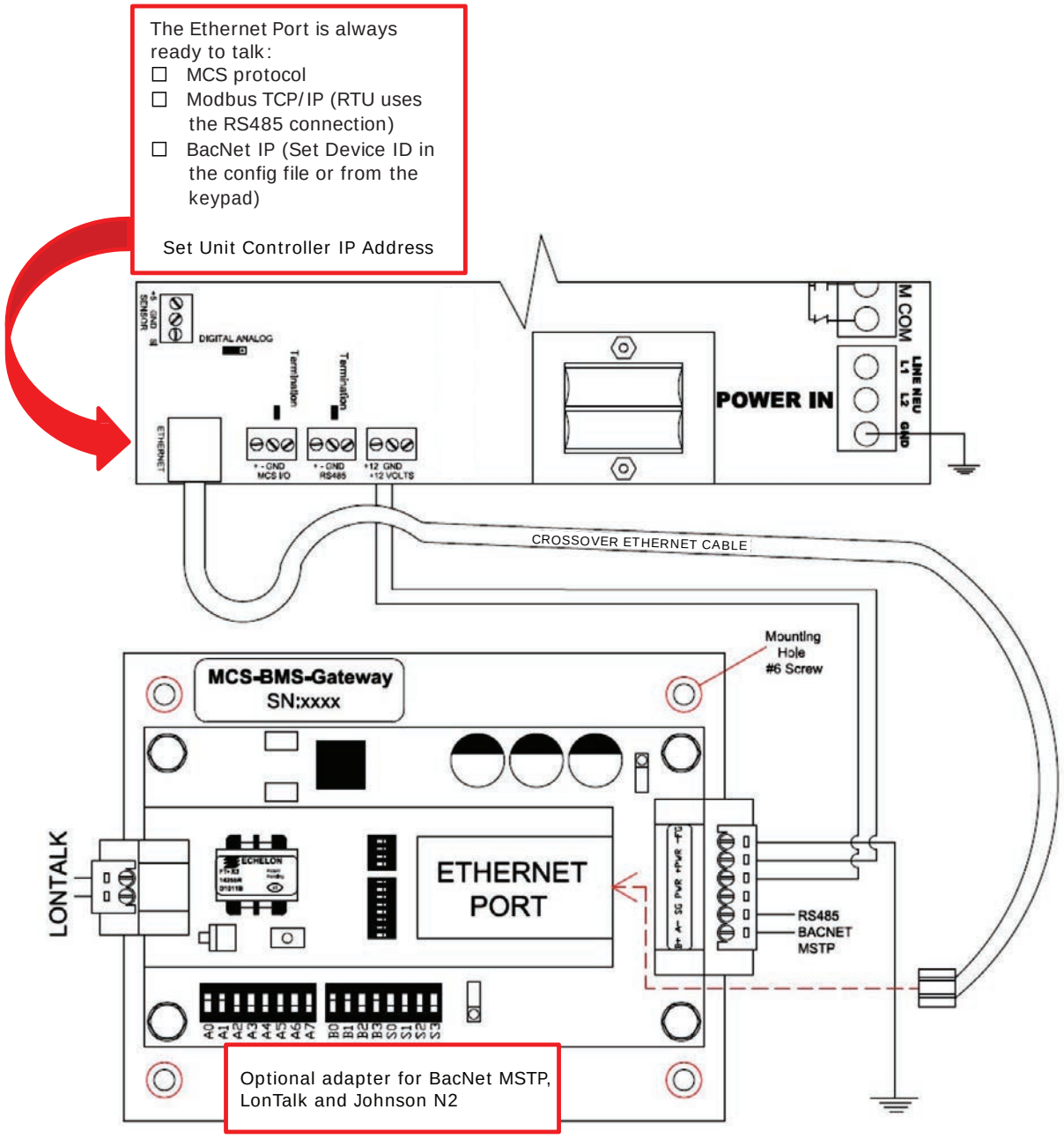
Table 8. CICB unit in an array

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Demand Limit Reset signal (input from BMS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chilled Water Temperature Reset signal (input from BMS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Customer Alarm relay (view only)	M10	ALARM	BO:10	ALARM	00010	ALARM	DO:10	M10_ALARM	DO:10	M10_ALARM	DO:10	M10_ALARMro
Chiller Run Indication (view only)	M-7	RUN LIGHT	BO:7	RUN LIGHT	00007	RUN LIGHT	DO:7	M_7_RUN LIGHT	DO:7	M_7_RUN LIGHT	DO:7	M_7_RUN LIGHTro
Entering Chilled Water Temperature (view only)	M-1	CHILL IN	AI:1	CHILL IN	30001	CHILL IN	AI:1	M_1_CHIL LIN	AI:1	M_1_CHIL LIN	AI:1	M_1_CHIL LINsi
Leaving Chilled Water Temperature (view only)	M-2	CHILL OUT	AI:2	CHILL OUT	30002	CHILL OUT	AI:2	M_2_CHIL LOUT	AI:2	M_2_CHIL LOUT	AI:2	M_2_CHIL LOUTsi
Chilled Water Flow Switch input (view only)	M-15	EXT FLOWSW	AI:15	EXT FLOWSW	30015	EXT FLOWSW	AI:15	M_15_EXT FLOWSW	AI:15	M_15_EXT FLOWSW	AI:15	M_15_EXT FLOWSWsi
Condenser Pump relay (view only)	M-7	COND PUMP (Idec)	BO:7	COND PUMP (Idec)	00007	COND PUMP (Idec)	DO:7	M_7_ COND PUMP	DO:7	M_7_ COND PUMP	DO:7	M_7_ COND PUMPro
Chilled Water Pump relay (view only)	M-8	CW PUMP	BO:8	CW PUMP	00008	CW PUMP	DO:8	M_8_CWP UMP	DO:8	M_8_CWP UMP	DO:8	M_8_CWP UMPro

Table 9. Array controller

	Unit Standard Point Mapping						Unit Point Mapping with Optional BMS Gateway Card					
	MCS - MAGNUM		BACnet® IP		Modbus™ IP & RTU		BACnet® MSTP		JOHNSON N2		LonTalk®	
	PT#	Name	Object ID	Name	Register	Name	ID	Name	ID	Name	ID	Name
Remote Off/ Auto signal (input from BMS)	1	Net RnStop	AV:246	Net RnStop	40201	Net RnStop	AV:246	NetRnStop	AV:246	NetRnStop	AV:246	iNetRnStop
Demand Limit Reset signal (input from BMS)	3	Net DmdLmt	AV:249	Net DmdLmt	40205	Net DmdLmt	AV:249	NetDmdLmt	AV:249	NetDmdLmt	AV:249	iNetDmdLmt
Chilled Water Temperature Reset signal (input from BMS)	2	Net TrgRst	AV:247	Net TrgRst	40202	Net TrgRst	AV:247	NetTrgRst	AV:247	NetTrgRst	AV:247	iNetTrgRst
Customer Alarm relay (view only)	M-1	ALARM	BO:1	ALARM	00001	ALARM	DO:1	M_1_ALARM	DO:1	M_1_ALARM	DO:1	M_1_ALARMro
Chiller Run Indication (view only)	M-9	RUN LT	BO:9	RUN LT	00009	RUN LT	DO:9	M_9_RUN LT	DO:9	M_9_RUN LT	DO:9	M_9_RUNLTro
Entering Chilled Water Temperature (view only)	M-1	CW IN TMP	AI:1	CW IN TMP	30001	CW IN TMP	AI:1	M_1_ CWINTMP	AI:1	M_1_ CWINTMP	AI:1	M_1_ CWINTMPsi
Leaving Chilled Water Temperature (view only)	M-2	CW OUT TMP	AI:2	CW OUT TMP	30002	CW OUT TMP	AI:2	M_2_ CWOUTTMP	AI:2	M_2_ CWOUTTMP	AI:2	M_2_ CWOUTTMPsi
Chilled Water Flow Switch input (view only)	M-15	CW FLOW	AI:15	CW FLOW	30015	CW FLOW	AI:15	M15_CWFLOW	AI:15	M15_CWFLOW	AI:15	M15_CWFLOWsi
Condenser Pump #1 relay (view only)	M-4	COND PUMP#1	BO:4	COND PUMP#1	00004	COND PUMP#1	DO:4	M4_ CONDPUMP#1	DO:4	M4_ CONDPUMP#1	DO:4	M4_ CONDPMP#1ro
Condenser Pump #2 relay (view only)	M-5	COND PUMP#2	BO:5	COND PUMP#2	00005	COND PUMP#2	DO:5	M5_ CONDPUMP#2	DO:5	M5_ CONDPUMP#2	DO:5	M5_ CONDPMP#2ro
Chilled Water Pump #1 relay (view only)	M-2	CW PUMP#1	BO:2	CW PUMP#1	00002	CW PUMP#1	DO:2	M_2_CWPUMP_1	DO:2	M_2_CWPUMP_1	DO:2	M_2_CWPUMP_1ro
Chilled Water Pump #2 relay (view only)	M-3	CW PUMP#2	BO:3	CW PUMP#2	00003	CW PUMP#2	DO:3	M_3_CWPUMP_2	DO:3	M_3_CWPUMP_2	DO:3	M_3_CWPUMP_2ro

Unit Controller BMS Connections



Unit Controller BMS Protocols Settings

Bacnet Over IP:

The BACNET DEVICE ID is a five-digit number. The first three digits are based on our Bacnet vendor ID that is 181, and the last two are set by the Bacnet/MSTP address.

181	XX
↓	↓
Bacnet Vendor ID	Bacnet MS/TP Address

Bacnet address can be verified and changed (with proper authorization code) from the keypad/LCD of a live unit.

To get authorized on Unit Controller do the following:

- Press 'Menu'.
- Using ↑, ↓, →, or ← position cursor to 'Passwords'.
- Press ↵ key.
- Enter 4 digit password (3114) and press ↵
- Press 'Menu' to make next selection.

If you are going to manually assign the IP Address, Subnet Mask, and Default Gateway.

- Press the MENU key and then using ↑, ↓, →, or ← position cursor to Serv Tools then press the ENTER key.
- Select Ethernet Network then press Enter.
- Set "DHCP Enabled" to NO.
- Set the "IP Address".
- Set the "Subnet Mask".
- Set "Default Gateway".

If you are going to let your network assign the IP Address, Subnet Mask, and Default Gateway:

- Press the MENU key and then Using ↑, ↓, →, or ← position cursor to Serv Tools then press the ENTER key.
- Select Ethernet Network then press Enter.
- Set "DHCP Enabled" to YES; Connect the Unit Controller to the network and cycle power to the board.

Modbus RTU:

The Modbus RTU address can be verified and changed (with the proper authorization code) from the keypad/LCD of a live unit.

To get authorized on Unit Controller do the following:

- Press 'Menu'.
- Using ↑, ↓, →, or ← position cursor to 'Passwords'.
- Press ↵ key.
- Enter 4 digit password (2112) and press ↵
- Press 'Menu' to make next selection.

The following steps will display the Modbus RTU Network address, and the Baud Rate:

(To change the address and the Baud Rate you must be authorized)

- Press the MENU key and then Using↑, ↓, →, or ← position cursor to Serv Tools then press the ENTER key.
- Select RS485 Network then press Enter.
- Select Protocol then press Enter. Change the protocol to Modbus.
- Select address then press Enter. Change the address then press Enter.
- Select Baud then press Enter. Set the baud rate then press Enter.
- Connect the communication wires to the TX RS485 three-position terminal located above the Ethernet connector.

Modbus TCP/IP:

This protocol is always active.

Make sure the Unit Controller network settings are set correctly.

The following steps will display the Ethernet Network settings:

(To change the settings you first must be authorized)

To get authorized on Unit Controller do the following:

- Press 'Menu'.
- Using ↑, ↓, →, or ← position cursor to 'Passwords'.
- Press ↵ key.
- Enter 4 digit password (3114) and press ↵ key.
- Press 'Menu' to make next selection.

If you are going to manually assign the IP Address, Subnet Mask, and Default Gateway.

- Press the MENU key and then Using ↑, ↓, →, or ← position cursor to Serv Tools then press the ENTER key.
- Select Ethernet Network then press Enter.
- Set "DHCP Enabled" to NO.
- Set the "IP Address".
- Set the "Subnet Mask".
- Set "Default Gateway".

If you are going to let your network assign the IP Address, Subnet Mask, and Default Gateway:

- Press the MENU key and then Using ↑, ↓, →, or ← position cursor to Serv Tools then press the ENTER key.
- Select Ethernet Network then press Enter.
- Set "DHCP Enabled" to YES; Connect the unit controller to the network and cycle power to the board.

Setpoints for Unit Controller HVAC V17 Software

Table 10. Setpoints

#	Name	Description
1	CW OUT TRGT	Control target. This value is used as the base to develop the Control Zone. Refer to setpoints # 2 and #3. The control target is used with the control zone and rate of change of the controlling sensor to determine required action for the system. The controlling sensor is usually one of the following: Leaving Temperature – Most common used as a target, fitting for most applications. Return Temperature – Used in sites with large air masses, ice rinks, common areas, etc.
2	Ctrl Zone +	Added to the CTL TARGET to create the upper limit of the control zone.
3	Ctrl Zone -	Subtracted from the CTL TARGET to create the lower limit of the control zone.
6	HGS PSI ON	Turns on hot gas injection solenoid when suction pressure falls below this value.
7	HGS PSI OFF	Turns off hot gas injection solenoid when suction pressure rises above the value.
9	SPRHT TARGET	If EXV control is based upon superheat, this is the Superheat target that the system will control from. 'Time (sec)' field: Seconds between samples used for calculating the Superheat Rate of Change
10	SPRHT ZONE +/-	The value in this setpoint is added and subtracted to setpoint #9 to determine the upper and lower limits of the control zone respectively. 'Time (sec)' field: If non-zero, skip ROC adjustment logic in the control zone.
12	EXV FINE ADJ	The adjustment is made when in the 1st zone above or below the control zone.
13	EXV COURSE	This adjustment is made when in the 2nd zone above or below the control zone and the adjustments are made in 1/2 the time. When above or below the 2nd control zone the adjustments are made in 1/4 the time.
15	EXV MIN %	This is the minimum valve position allowed when modulating the expansion valve. This value should be set so when hot gas is applied the valve opening is adequate.
16	EXV MAX %	This is the maximum position allowed when modulating the expansion valve to maintain the superheat target. This value should be the valve % opening at full capacity plus a 10 to 15% margin.
17	Lo Superheat	If the calculated superheat remains below this value for the time specified, the system will generate a LOW SUPERHEAT lockout alarm.
18	LOW SUC PSI DLY	Delay in seconds when in 'Low Suction PSI Opening' between adjustments to the EXV valve.
19	EXV DELAY	Delay in seconds between valve adjustments. Should not be less than 40. (When adjusting at 4x this will allow 10 seconds for the controller to process the results of the last action before making the next adjustment.)
20	EXV STRT TIME	This is the time in seconds to hold the valve at the start % setpoint when the compressor starts. Since the superheat calculation is not valid when the compressor is not running the EXV logic sets the valve to a given position for a set time to allow the system to develop a valid superheat. 'Time (sec)' field: If zero, then there is no delay when a compressor is ready to start. If non-zero, this is the time delay to allow EXV and solenoid to open before compressor starts.
21	Max CW Reset	This value is used to adjust setpoint #1 "CW OUT TRGT". The sensor input value will vary between 0 and 5 volts and the adjustment to the control target will be modulated from negative "MAX CW Reset" to the positive "MAX CW Reset" value.
22	Low Ambient	If the ambient temperature is below this value the system will be disabled and the unit state will be AMBIENT OFF. The unit will remain off until the ambient temperature rises above this setpoint value by 5.0F (2.5C).
23	Power up Delay	The time in seconds that the system will remain in the START UP state before moving to the next state.
25	STEP SENSTIY	This value is used to adjust the rate of response to changes in the control algorithm. 1 is the fastest response, whereas higher numbers will mean a more gradual response.
26	STEP DELAY	Value: This is the time delay before making adjustments to the system capacity.
27	MAX ROC -	Maximum negative Rate of Change allowed before preventing the unit from loading. If the ROC is less than this value the capacity control state is set to HOLDING
28	MAX ROC +	Maximum positive Rate of Change allowed before preventing the unit from unloading. If the ROC is greater than this value the capacity control state is set to HOLDING
29	ROC INTERVAL	Seconds between samples used for calculating the Rate of Change (Maximum 60 seconds)
45	CND STG1 ON (Air cooled)	When the discharge pressure is above this value, turn on the first stage of the condenser fans.
46	CND STG1 OFF (Air cooled)	If stage 1 of condenser capacity is on and the discharge pressure drops below this value, then turn this stage off.
47	CND DIFF ON (Air cooled)	Differential pressure added to setpoint #45 to set the threshold at which each additional stage of condenser capacity will turn on.

Table 10. Setpoints (continued)

#	Name	Description
48	CND VLV DLAY (Water cooled)	If active, this is the time in seconds between adjustments to the water valve. If inactive, then 30 seconds will be used as the delay.
48	CND DIFF OFF (Air cooled)	Differential pressure added to setpoint #46 to set the threshold at which each additional stage of condenser capacity will turn off.
49	CND VLV START (Water cooled)	If the valve opening is less than setpoint 52 and this setpoint is active, then make the valve opening equal to this setpoint. This enables the minimum opening to be set at a larger percentage.
49	CND MIN RUN (Air cooled)	Once a condenser stage has been turned on, it will remain on for at least the amount of minutes specified in this setpoint.
50	CND VLV TARG (Water cooled)	Target discharge pressure which the condenser valve will try to maintain by modulating open or closed.
51	CND VLV DIV (Water cooled)	Controls scaling of the amount the valve is adjusted (Usually 10). The larger the number the smaller the valve adjustment as the adjustment will be divided by this value.
51	CND VFD MIN (Air cooled)	If there is a VFD associated with the condenser, this is the starting minimum speed. 'Time (sec)' field: This field contains the condenser stage that must be on before the VFD is modulated.
52	CND VLV MIN (Water cooled)	Minimum valve opening percentage allowed. If the compressor is off, then check the 'Time (sec)' field: If 0, then set the valve to the value of this setpoint. If 3 and the run/stop is set to either, then set the valve to 100%, else set the valve to 0%. This option is selected in the 'Default Valve Opening% when Comp. is OFF' box in the 'Condenser Info' section under the MAG HVAC V17 tab.
53	CND VLV ROC- (Water cooled)	Maximum negative discharge pressure rate of change allowed. If the rate of change is less than this setpoint, then stop opening the valve. The absolute value of this setpoint also serves as the maximum positive rate of change allowed. If the rate of change is greater than the absolute value of this setpoint, then stop closing the valve.
54	CND MIN SPD (Air cooled)	Minimum speed percentage for variable speed condenser control.
55	CND MIN ADJ (Water cooled)	Minimum valve adjustment%.
59	ACYC OFF->ON	This is the anti-cycle time delay (in seconds) from when the compressor was turned off. This value is used in a calculation to determine how long a compressor should be in the anti-cycle state. Refer to the Standard Control Options on page 23, Compressor Anti-Cycle Logic (OFF to ON).
61	PMP DOWN OFF	This is the suction pressure valve for turning the compressor off when in the PUMP DOWN state.
62	PMP DOWN DLAY	Maximum time delay (in seconds) that the compressor can remain in the PUMP DOWN state.
63	ACYC ON->ON	This is the anti-cycle time delay (in seconds) from when the compressor was turned on. This value is used in a calculation to determine how long a compressor should be in the anti-cycle state. Refer to the Standard Control Options on page 23, Compressor Anti-Cycle Logic (ON to ON).
65	EXV ZONE 1	Temperature differential used to build the EXV Zone 1 both plus and minus.
75	HI AMPS %	This setpoint is a percentage of the FLA; it is used to create the high amp draw limit. The value of this setpoint is multiplied by the respective compressor's full load amps setpoint (#171 through #190) to obtain its upper limit. If the compressor's amps exceed this value for the time specified in this setpoint, then a safety trip occurs.
76	PSI SW/NO AMPS	This setpoint is a percentage of the FLA; it is used to create the low amp draw limit. The value of this setpoint is multiplied by the respective compressor's full load amps setpoint (#171 through #190) to obtain its lower limit. If the compressor's amps fall below this value for the time specified in this setpoint, then a safety trip occurs. See PSI/NOAMP on page 31.
77	LOW SUCTION	If active, the system checks for low suction pressure for each running compressor. If suction pressure is less than this value for the specified period of time, a safety trip occurs.
80	UNSAFE SUCT	If active, the system checks for unsafe low suction pressure for each running compressor. If suction pressure is less than this value for the specified period of time a lockout occurs. NOTE: The time period specified should be very short (2-5 seconds). If this setpoint trips, the compressor will be sent straight to the Lockout state.
81	HI DISC PSI	If active, the system checks for high discharge pressure for each running compressor. If the discharge pressure sensor reads greater than this setpoint for the specified period of time, a safety trip will occur.
85	LO DISC PSI	If active, the system checks for low discharge pressure. If the discharge sensor reading is less than this value for the specified period of time, a safety trip occurs.
95	MOTOR FAULT	If active, the system checks for high motor temperature. If the motor temperature sensor reading is ON (Digital) for the specified period of time, a safety trip occurs.

Table 10. Setpoints (continued)

#	Name	Description
101	SAFETY HOLD DELAY	Time in seconds that the circuit will remain in a hold state after the condition that caused it has returned to normal. The circuit can be holding for the following reasons: • Low suction pressure • High discharge pressure • High amperage
103	LEAD COMP	Enables the user to specify the lead compressor. The value of this setpoint will indicate the lead compressor. If zero, then auto rotation is enabled.
104	CMP ROTATION	Specifies the number of days between rotations (setpoint #103 must be set to zero to enable auto rotation). If zero, then rotation will occur with every cycle.
105	CW LOW FLOW (NO FLOW) PUMP FAILURE	If the OFF/Auto switch is turned on and flow is lost, and only one pump is present, then the chiller will shut down. If flow is not reestablished within this time value the chiller and pump will be locked out. If the system has two pumps and flow is lost, then the backup pump will start and the lead pump will be locked out. If the second pump is running and flow is lost again then the entire system will be locked out. A lock out reset will be required to restart the system or to reactivate a locked out pump. A field installed flow switch (required) must be closed and CW differential pressure must be adequate to prevent this alarm. See setpoint 184.
106	LEAD PUMP	Indicates which pump is the lead. If zero, then rotation of the pumps will occur whenever the lead pump is turned off. If no rotation has occurred during the current day, a forced rotation will occur at midnight, ensuring at least one rotation per day. If value is non-zero, then rotation of the pumps is inactive and the value will specify the lead pump. This setpoint can be changed in a live unit and the appropriate action will be taken immediately.
108	PMP OFF DLAY	Time in seconds to keep the chilled water pump running after the last compressor has been turned off to ensure the chiller barrel does not freeze.
111	FREEZE	If active, the system will compare the leaving temperature to this setpoint. If it is less than this value for the specified period of time, a safety trip occurs.
151	UNLOADED OFF	The value of this setpoint is subtracted from Setpoint #1 when only one compressor is running. Increases the lower limit of the control zone during low load conditions to decrease compressor cycling.
155	CORE FREEZE	The system will compare the evaporator core temperature sensor to this setpoint. If it is less than the value for the specified period of time, a safety trip occurs.
166	PHASE LOSS	If active and the phase loss digital input is ON for the specified period of time, a safety trip occurs. The system will attempt to restart after waiting the number of minutes contained in the 'Safety Down Time' field of this setpoint.
171	FLA COMP#1	Full Load Amps for compressor #1. This is the amps at design suction and discharge pressures referenced in the Config program RO screen. This value is used to calculate the high and the low amperage safety limits. Refer to setpoints #75 and #76.
172	FLA COMP#2	Full Load Amps for compressor #2. Refer to setpoint #171.
173	FLA COMP#3	Full Load Amps for compressor #3. Refer to setpoint #171.
174	FLA COMP#4	Full Load Amps for compressor #4. Refer to setpoint #171.
184	CHW DIFF LO FLO	Entering and leaving chilled water differential pressure. If Auto/Off switch is on and differential pressure falls below this setpoint value, the chiller will shut off on NO Flow. See setpoint 105.
186	CND PMP OFF DLY	Seconds to run condenser pump after all compressors are turned off.
203	HiSuctSprHt	If the calculated superheat remains above this value for the time specified, a safety trip occurs.

Note: *Some setpoints are not visible or field adjustable without NAPPS factory support. See* *"Setpoint Safeties," p. 30**.*

Array Controller

General

The array controller is capable of operating the compact chiller array as a single high capacity multistage water cooled package chiller and is located in the array controller control panel. The array controller is capable of maintaining the chiller array leaving chilled water temperature set-point within a control zone by staging individual compact chiller unit compressors. Each compact chiller unit has a standalone unit controller capable of managing the compact chiller units operational and fault related functions during normal operation. Additionally, the unit controller can maintain the compact chiller unit leaving chilled water temperature in the event the array controller fails or if communication is lost between unit controller and array controller. Also the chiller array will continue to cool entering chilled water if a compact chiller unit fails.

The array controller is capable of capacity modulation and equalizing the run time on all compact chiller units. Capacity modulation is accomplished by staging individual compressors on each compact chiller unit using lag/lead logic while performing all operational, annunciation, data retention, and communication functions.

Temperature Control

The array controller monitors the leaving chilled water temperature and stages the individual compressors, within the compact chiller units, to maintain leaving chilled water set-point temperature within the control zone using proportional, integral, derivative (PID) logic. As chilled water load decreases, the array controller will turn only one compressor off in each compact chiller unit until only one compressor in each compact chiller unit is running. A further reduction in load will result in the second compressor in each compact chiller unit being turned off. The reverse is true of an increasing load. Lag/lead logic is utilized to even the run time on individual compressors.

Local Operator Interface

The array controller has a local interface with keypad, with display screen, and RS-232 port. The display screen is a monochrome graphics LCD with 2.8" diagonal viewing area. The array controller has the capability of being accessed using the local keypad and display screen to:

- View chiller array operating conditions
- Adjust chiller array control setpoints
- View and clear chiller array fault history with date and time (up to last 99 occurrences)
- View chiller array alarm and fault history

Remote Operator Interface

The array controller has the capability of being accessed from a remote computer such as a laptop using RS232 or a Ethernet port having all functions that are available through the local interface with the additional ability to download and view fault history graphically. The array Controller can store 1,008 packets of information for graphical presentation on the remote computer. The array controller is capable of having data taken for graphical display based on a set time interval. The time interval is factory set at 15 seconds, but is adjustable from 1 second to 12 hours. The array controller can also store up to 99 fault conditions.

Remote Communication

The array controller also has RS485 and Ethernet communications ports for a Building Management System (BMS), or using an optional BMS interface gateway if required. The exact configuration of the interface shall be coordinated with the ATC.

The array controller is capable of facilitating the following BMS communication:

- Remote start/stop (input from BMS)
- Customer alarm relay (view only from BMS)
- Customer demand limit reset signal (input from BMS)
- Customer chilled water reset signal * (input from BMS)
- Array run indication signal (view only from BMS)
- [Optional] Array entering condenser water temperature (view only from BMS)
- [Optional] Array leaving condenser water temperature (view only from BMS)
- Array entering chilled water temperature (view only from BMS)
- Array leaving chilled water temperature (view only from BMS)
- Remote chilled water flow switch input (view only from BMS)
- Array condenser pump relay (view only from BMS)
- Array chilled water pump relay (view only from BMS)

Note: *If "Customer Chilled Water Reset" through the BMS is not preferred, Array Controller has the capability of having "Customer Chilled Water Reset" through a 0 to 5 VDC input signal.*

The following Compact Chiller Array parameters can be monitored and reported on the Array Controller display:

- Leaving chilled water temperature
- Entering chilled water temperature
- [Optional] Condenser entering water temperature

- [Optional] Condenser leaving water temperature
- Number of chiller array capacity steps available, steps on and steps wanted
- Chiller array fault – low chilled water flow
- Chiller array fault – low leaving chilled water temperature
- Chiller module fault (chiller module number specific)

The array controller has lag/lead logic, capable of scheduling a new compact chiller unit into the lead position based on setpoint #35 "LEAD CHILLER" and setpoint #36 "LEAD CHILLER DAYS". The array controller is factory set to schedule a new lead compact chiller unit every 24 hours. The intent of this logic is to evenly distribute the run time of each compact chiller unit.

N+1 Logic

The array controller has the capability of executing optional factory N+1 Logic when each compact chiller unit in the array is equipped with a chilled water motorized on-off valve and a condenser water regulating valve, and when a standby compact chiller unit is installed in the Array. In the event of a chiller module failure, N+1 Logic automatically performs the following steps:

1. Electrically locks out the failed Compact Chiller unit
2. Opens the chilled and condenser water valves in the standby Compact Chiller unit
3. Closes the chilled and condenser water valves in the failed Compact Chiller unit
4. Enables the standby Compact Chiller unit for normal operation in the Chiller Array.

Array Control Panel

The array control panel contains the array controller, keypad and display (exterior of control cabinet door), 120 VAC 5 amp circuit breaker for input power to the panel, and field connection terminal strip for connection of:

- Flow Proving Device (Required) — dry contact closure from a remote device – input
- Remote Off/Auto — dry contact closure from a remote device – input
- Remote Alarm — dry contact closure for a remote device — output
- Remote Chilled Water Enable — for a maximum of two (2) chilled water pumps (dry contact closure for a remote device – output)
- Condenser Water Pump Enable — for a maximum of two (2) condenser water pumps (dry contact closure for a remote device – output)
- Array On/Off Status — dry contact closure for a remote device – output

Array Controller Software Sequence of Operations

1. When the array controller is first powered on, it will enter a 60 second power up delay.
2. After the 60 second delay is satisfied, the array controller will ensure that it is allowed to run by checking for any unit lockout conditions.

   Note: *If there are unit lockout conditions, the array controller will lock out all compressors and pumps.*
3. If there are no unit lockout conditions, the array controller will check for any stop conditions. If these conditions are satisfied, the array controller will then allow the pumps to operate. Stop conditions include the following:
   - Unit Run/Stop Switch is off
   - Unoccupied if Schedule is set to shut the unit off
   - BMS Run Stop Switch = OFF
4. Once setpoint #47 "CW PUMP PRE DELAY" for the pumps has been satisfied, the array controller will allow the chiller control to change the unit state, see "Array Controller States," p. 62.
5. Once the chiller capacity control is allowed, the array controller will use the chiller control algorithm to determine whether the array controller needs to enter cooling mode.
   a. If the array controller Cooling Target setpoint is active, the array controller is allowed to activate its cooling mode.
   b. The temperature to enter cooling mode is determined the following way:
      i. The array controller cooling target is established from Setpoint #4 "CPM Target - Value"
      ii. The high zone (setpoint #1, Cooling Deadband - Value) is added to the setpoint #4 "CPM Target - Value". Once the chilled water control temperature rises above the temperature required to enter cooling, the array controller will enter cooling mode.
6. Once the array controller is in cooling, the following conditions will cause it to leave cooling:
   - No demand for cooling when array controller is at minimum capacity
   - Run stop Condition
   - Array Controller Safety Condition
   - All pumps locked out
7. In cooling mode, the array controller will use the standard capacity control algorithm to turn chiller stages on and off as needed, see Standard Capacity Control Logic section.

Chiller Control Algorithm

The chiller control algorithm is used to determine how many chiller stages need to be on in order to maintain a target control temperature.

The algorithm will open isolation valves for each chiller as needed.

The chiller control algorithm will only allow the maximum number of primary chillers (as defined in the configuration) on. The other chillers will not turn on unless one of the primary chillers get locked out.

The chiller control uses the standard capacity control algorithm. It uses the following setpoints: (See Table 11, p. 64 for descriptions.)

- Setpoint #1: Cooling Deadband - High Zone

  Note: *Setpoint #1 "CoolDeadband - High Zone" added to Setpoint #4 "CPM Target - Value" determines the cut in temperature for cooling.*
- Setpoint #1: Cooling Deadband - Low Zone

  Note: *Setpoint #1 "CoolDeadband - Low Zone" subtracted from Setpoint #4 "CPM Target - Value" determines the cut off temperature for cooling.*
- Setpoint #4: CPM Target
- Setpoint #6: CPM Max ROC

Array Controller Unit Lockouts

- Freeze protection
  The array controller will lock out the unit due to a freeze protection safety, defined in setpoint #111, value and time delay.

Standard Capacity Control Logic

The standard capacity control logic has the following states:

Note: *Includes states for logic that controls above, and below the zone.*

- Above Zone Loading
- Below Zone Unloading
- In Zone Hold
- ROC Unloading
- ROC Loading
- ROC Holding

Common Definitions for Capacity Control Logic

The states above describe what the capacity control function is doing based on the target, and the control value. For example, in the cooling capacity control function, if the control temperature is 50 degrees, and the target is 40 degrees with a zone of 5 degrees on the positive side, the unit will be above zone and loading.

- Stage Up Hold
  This informs the user that the capacity control is holding while waiting for confirmation that a newly requested stage has turned on
- Wait for Stage
  This informs the user that the capacity control logic is holding for a predetermined amount of time (set up in the config, or hard coded) because it has just turned on or off a stage
- Fully Loaded
  This informs the user that the capacity control is fully loaded.
- Fully Unloaded
  This informs the user that the capacity control is fully unloaded.

This control strategy is based upon developing a control zone and then to step the compressor(s) through their stages to maintain the control sensor reading within this zone. To accomplish this the system will constantly monitor the control value, its rate of change and position in relationship to the control zone.

Target

The control target is specified in setpoint #4 “CPM Target - Value”. This will be the base of developing the control zone.

Control Zone

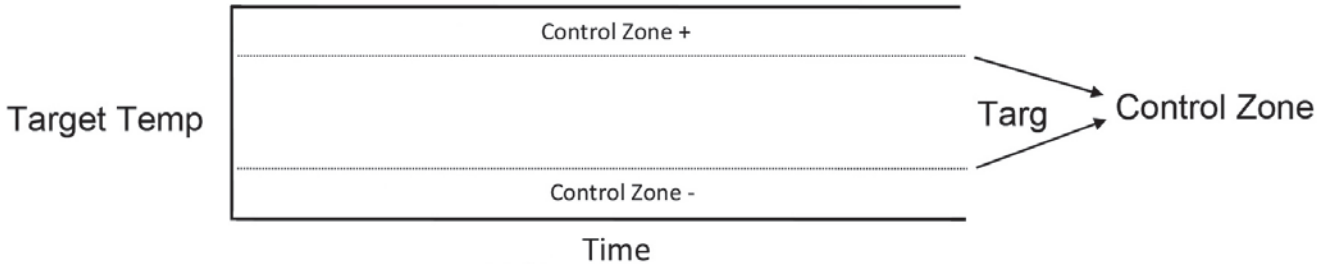
The control zone is set by adding the setpoint #4 “CPM Target - Value” and setpoint #1 “CoolDeadBand - High Zone” to obtain the upper limit.

The lower limit is obtained by subtracting the setpoint #1 “CoolDeadBand - Low Zone” from the setpoint #4 “CPM Target - Value”.

Some control algorithms (pump control, chiller control without setpoint 6 active) use the same value for both the positive and the negative zone.

Once the control zone has been established, the system will attempt to keep the control sensor reading within this range.

Figure 6. Control zone



Controlling Sensor

This is the sensor that has been specified in the factory configuration program as providing the control value reading. It will normally be either the entering, leaving temperature or the suction pressure. The set points must be adjusted to agree with the controlling value.

Rate of Change — Control Input

Rate of change is how fast the control value is changing over a period of time. If the control value is increasing the rate will be positive, if decreasing the rate will be a negative value. How fast the input is changing, direction and current input reading in relation to control zone will determine what action the system will take. Maximum rate of change is configured at the factory. For cooling control, if setpoint 6 is active, there will be separate negative maximum ROC and positive maximum ROC setpoints.

Step Delay

The system will not attempt to take action until the Step Delay reaches zero. The initial value is defined in set point #59 “Cooling Staging Delay”.

Ratio Adjustments

The following ratio adjustment description is for information purposes. Limits are factory set.

There are two different ratio adjustments. These adjustments control either the speed of the step delay, or by how much the capacity control algorithm adjusts its

capacity. The purpose of these ratio adjustments are to both limit, and enhance the speed the system reacts to changes indicated by the control sensor. The higher the multiplier, the faster the system will react. Conversely the higher the divider, the slower the system will react. These are usually set to 1.

The step delay ratio setpoints consist of a multiplier and divider. These setpoints multiply and divide against (respectively) the calculated step delay to determine the final step delay. The final step delay has a minimum limit of 1, and a maximum limit of 20.

The adjust delay ratio setpoints also consist of a multiplier and divider. They work like the step delay ratio setpoints, but rather than controlling the final step delay, they control the final % adjustment to the capacity. The minimum and maximum limits are specified and set at the factory.

Example

Set Points:

- Target = 45°F
- Control Zone + = 2°F
- Control Zone - = 2°F
- Step Delay = 300
- Multiplier = 1
- Divider =2

Current Values:

- Leaving Liquid = 55°F

Using the above values the following would occur:

1. Step delay would reach zero in 60 seconds.
   The difference between the target and leaving liquid is 10 degrees, which is then multiplied by 1, and divided by 2. This results in a reduction to the step delay of 5. In order to decrement 300 down to 0, this would need to repeat 60 times.
2. Assuming the lead chiller is ready, it will be turned on. Step Delay is reset to its initial value 300. It is not decremented for the amount of time specified in the configuration. Its state would indicate a staging delay, to allow the result of the last change to be evaluated.
3. If the slope calculation is less than specified the step delay will again be decremented and the next available stage will be brought on when it reaches 0.
4. Repeat from step 1.

Array Controller States

The control state is displayed on the 2x16 LCD by depressing SERVICE DIAGNOSTIC key and then selecting Control State option or it can be accessed via the MCS-CONNECT program.

Array Controller Unit States

- Power Up – CPM POWER UP DLY
  Array controller goes into a forced 60 second power up state to acquire ROC data for its control algorithms
- Lockout - CPM LOCKED OUT
  The array controller will go into lockout if the chilled water control temperature SI (leaving water) falls below setpoint #111 "Freeze", or has a sensor fault. At this point the array controller will cease operation and shut off its chillers, followed by the pumps and isolation valves
- Scheduled Off - CPM OFF:SCHEDULE
  If the array controller is unoccupied, and the operating schedule setting is set to shut down when un-occupied, the array controller will enter this state. During this mode, the unit will act as if the run/stop switch was turned off.
- Run Stop Off - CPM OFF:SWITCHED
  If the run/stop switch is turned off, the array controller will shut down all chillers, followed by the pumps, then the isolation valves. During this state, there is no control of the module chillers
- Pump Only - CPM ON:PUMP ONLY"
  During this state, the array controller is on, but there is no demand for cooling. The array controller will only operate its pumps at this point. The array controller will run the pump control logic according to how they are configured for that particular unit.
- Cooling - CPM ON: COOLING
  During this state, the array controller has determined that there is a demand for cooling, based on the array controller Setpoint #4 "CPM Target - Value" and Setpoint #1 "CoolDeadband - High Zone". At this point, the pump logic will continue running as in pump only, but the chillers will also begin to be controlled to maintain the leaving water temperature.

Individual Chiller States

- Alarm Off - CHL IN ALARM OFF
  Module chiller has been locked out for some reason. array controller will close the isolation valve when it is possible. Array controller will not request this chiller to be staged on and will instead use the next available chiller.
- Off and Ready – CHL OFF/READY
  Module Chiller is off, but can be controlled by the array controller. Array controller will close the isolation valves for this chiller if not requested by chilled water or condenser water pumps.
- On – CHL IS ON
  Module Chiller is on, its isolation valves open, and is being controlled by the array controller.
- Opening Isolation Valves - CHL OPENING VLVE
  The array controller is opening the isolation valves for the chiller so that it can control the module chiller. If the chiller does not confirm its isolation valves are open, it will go into alarm off mode.
- Establishing Flow - CHL WAITING:FLOW
  The array controller acknowledges a demand for the chiller, but is waiting for flow to be established through the chiller before turning on the chiller.
- No Pumps Available - OFF:NO PMP AVAIL
  The chiller is off and is stuck off due to a lack of pumps available to support it being on.

Individual Pump States

- Off - PUMP OFF
  The pump is off.
- On – PUMP ON
  The pump is on.
- Anticycle - PUMP OFF A-CYC
  The pump is off and in anticycle. Once the anticycle timer is met, the pump state will switch to 'Off'.
- Locked Out - PUMP OFF FAULT
  The pump has been locked out due to a pump fault.
- Low Amp Fault - PUMP OFF LOamp
  The pump has been locked out due to a low amp fault.
- High Amp Fault - PUMP OFF HIamp
  The pump has been locked out due to a high amp fault.
- Flow Fault - PUMP OFF FLOW
  The pump has been locked out due to a lack of flow.

Array Controller Capacity Control States

- Above Zone Unload
- Above Zone Load
- Below Zone Unload
- Below Zone Load
- In Zone Hold
- ROC Unload
- ROC Load
- ROC Hold
- Stage Up Hold
- Staging Delay

- Fully Loaded
- Fully Unloaded
  The states listed above are used by the capacity control algorithm when controlling the chillers. They describe what state the control algorithm is in based on its control input (usually chilled water out temperature) and the target.
- Off and Ready
  There is no demand for cooling, because the chilled water temperature is too low, the unit is set to off, or because pump delay setpoint #48 “CW PUMP POST DELAY” has not been satisfied.

Array Controller Setpoints

Table 11. Array controller setpoints

Setpoint Number	Setpoint Name	Column	Setpoint Type	Function Description
1	CoolDeadband	High Zone	Target	Adds to the CPM Target (setpoint #4) to determine cut in temperature for cooling. This is the temperature that the first compressor will start if none are currently running.
1	CoolDeadband	Low Zone	Target	Subtracts from the CPM Target to determine the cut off temperature for cooling. This is the temperature that the compressor will shut off if only one compressor is running.
3	CPM Ratio	Multiplier B	CPM Ratio	Factory set. Step sensitivity
3	CPM Ratio	Divider B	CPM Ratio	Factory set. Step sensitivity
4	CPM Target	Value	CPM Target	Determines the target temperature for the chiller array to maintain.
4	CPM Target	Time	CPM Target	Step delay timer in seconds. Note that the further away from the leaving temperature is from the target setpoint the faster this timer will decrement.
4	CPM Target	Zone	CPM Target	Determines the zone value (both positive and negative) for the chiller capacity control. This should be set to 0. See setpoint #6.
4	CPM Target	Max Roc	CPM Target	Determines the Maximum positive rate of change for chiller capacity control.
4	CPM Target	ROC Interval	CPM Target	Determines the time in seconds that the rate of is calculated. Usually 60 seconds.
6	CPM MAX ROC-	Value	Setpoint	Determines the Maximum negative rate of change for chiller capacity control. Note that if the leaving water temperature is falling greater than this value then no additional compressors will be turned on.
6	CPM MAX ROC-	High Zone	Setpoint	This determines the top of the CPM Target zone. Usually set at 2 degrees.
6	CPM MAX ROC-	Low Zone	Setpoint	This determines the bottom of the CPM Target zone and should not be set to more than 1 degree.
35	LEAD CHILLER	Value	Setpoint	This is the first chiller on and the last chiller off. If this value is set to 0, the lead will rotate to the chiller with the least run hours if all chillers are cycled off.
36	LEAD CHILLER DAYS	Value	Setpoint	This may be set to any number up to 30. This will be the interval between auto rotation. Setpoint 35 above must be set to zero.
37	LEAD CW PUMP	Value	Setpoint	Same logic as lead chiller above.
38	LEAD CW PUMP DAYS	Value	Setpoint	Same logic as lead chiller days above.
39	COND LEAD PUMP	Value	Setpoint	Same logic as lead chiller pump above.
40	COND LEAD PUMP DAYS	Value	Setpoint	Same logic as lead chiller pump days above.
47	CW PUMP PRE-DELAY	Value	Setpoint	Number of seconds that the pump will run and flow will be proven before any chillers are allowed on.
48	CW PUMP POST-DELAY	Value	Setpoint	Number of seconds the pump will run after the OFF/AUTO switch is turned off.
49	COND PUMP PRE-DELAY	Value	Setpoint	Number of seconds that the pump will run and flow will be proven before any chillers are allowed on.
50	COND PUMP POST-DELAY	Value	Setpoint	Number of seconds the pump will run after the OFF/AUTO switch is turned off.
57	PUMP FLOW FAULT	Value	Lockout Alarm	Number of seconds that a pump should be running but no flow is detected before locking out the array.
58	Max Target Reset	Value	Setpoint	For analog or BMS target reset.
59	Cooling Staging Delay	Value	Setpoint	Delay in seconds after a compressor starts or stops before the CPM makes any more loading or unloading decisions.
60	Isolation Valve Close delay.			
61	Isolation Valve Proof Lockout			
111	Freeze	Value	Lockout	Freeze safety setpoint.

Communicating with the Chiller Array via Wireless Router

The Chiller array can be accessed through the wireless router with a PC/Laptop running MCS-Connect. If MCS-Connect software is not installed on the laptop, it is available for download at http://www.mcscontrols.com/ – Support- PC Software- MCS-Connect. Download the latest version (not the BETA version). To install the software, run it by clicking on the downloaded file and following the instructions given. The MCS-Connect Manual is also available on the same web page. The manual has installation and operation instructions for the software. The PC/Laptop must have wireless network capabilities or a Ethernet port to access the wireless router. For the chiller array network cabling:

- If not using a BMS Gateway card, see Figure 7.
- If using a BMS Gateway card, see Figure 8

Figure 7. Communicating with chiller via wireless router

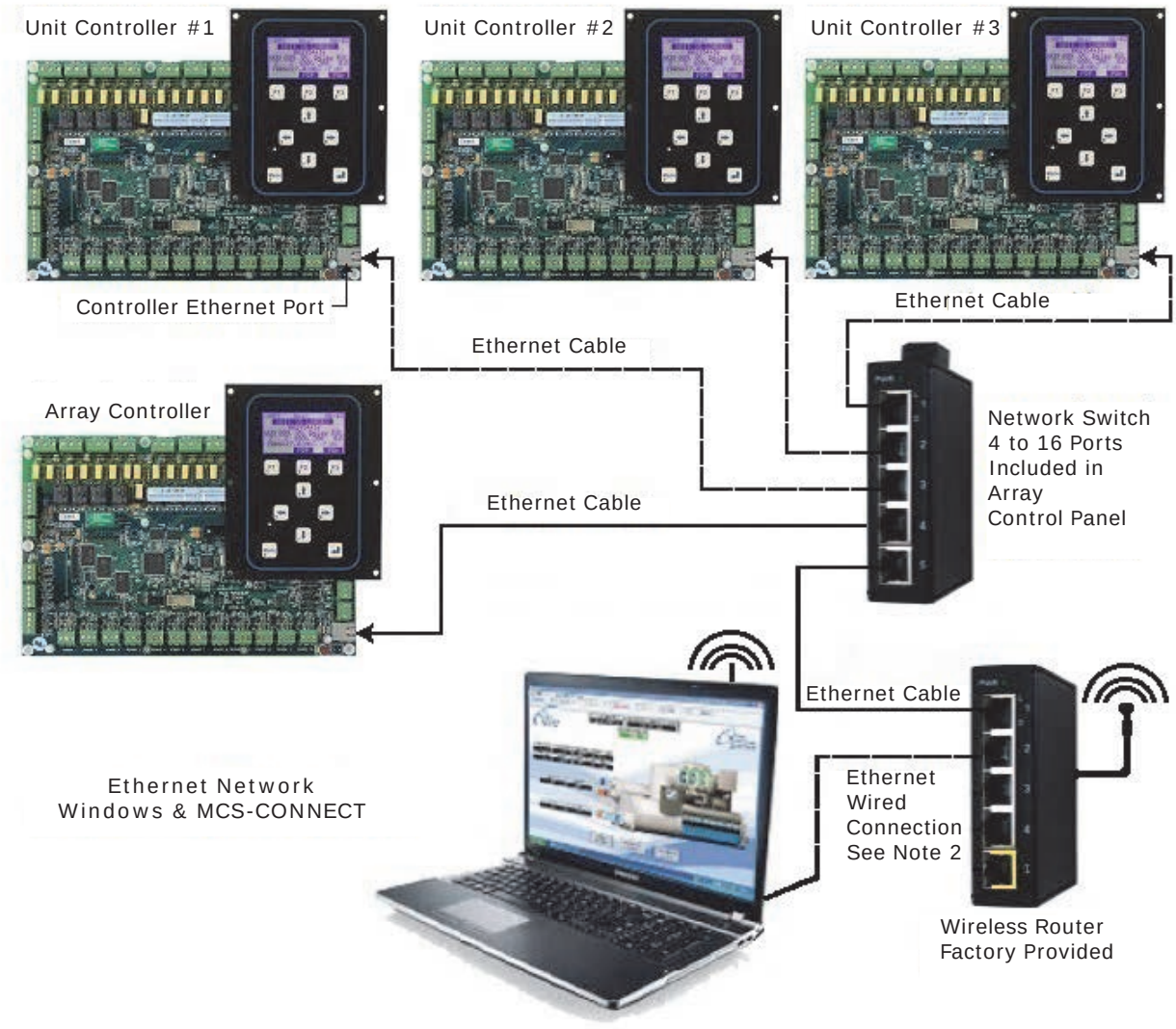
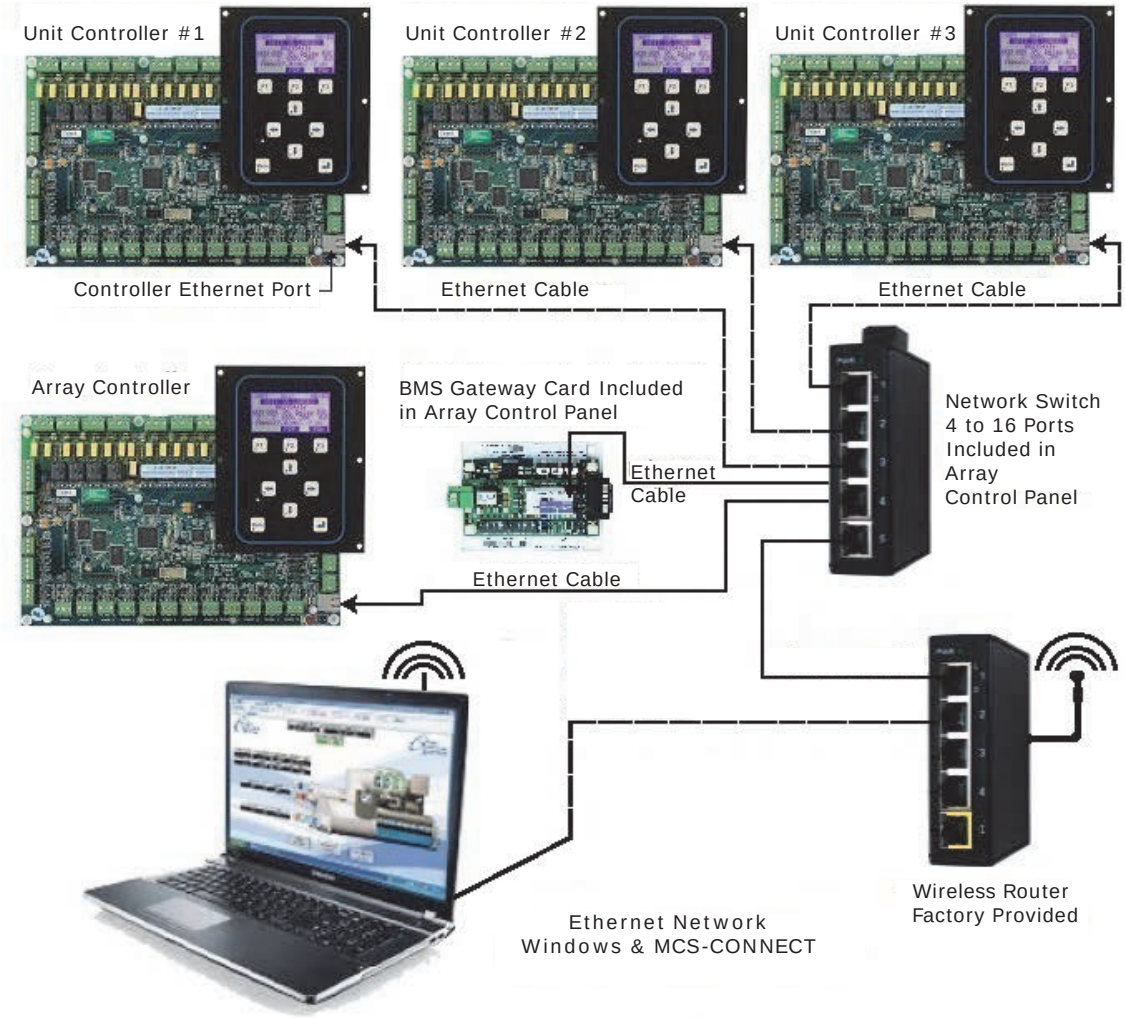


Figure 8. Communicating with chiller array and BMS Gateway card via wireless router

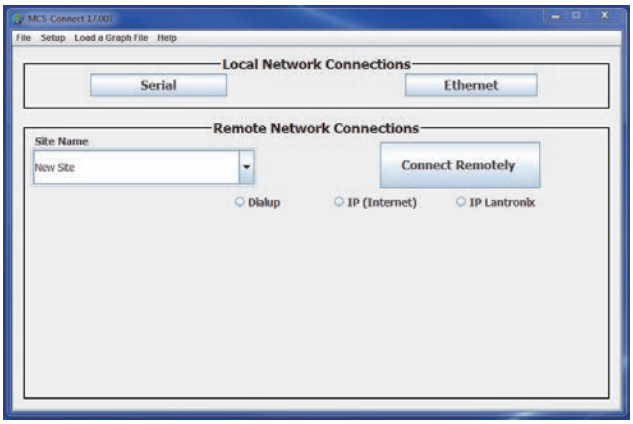


Notes:
1. All cabling in Figure 7 and Figure 8 is Cat 5 or higher Ethernet straight (Patch) cables.
2. Ethernet wired connection may be used if wireless connection not available. See "Instructions: Wired Connection to Router (Windows 7)," p. 67.
3. If using BMS Gateway card, it is preprogrammed from factory for the controller it will connect to. In a chiller array, the array controller is the usual preprogrammed connection point for the BMS Gateway.

Instructions: Wireless Connection to Router

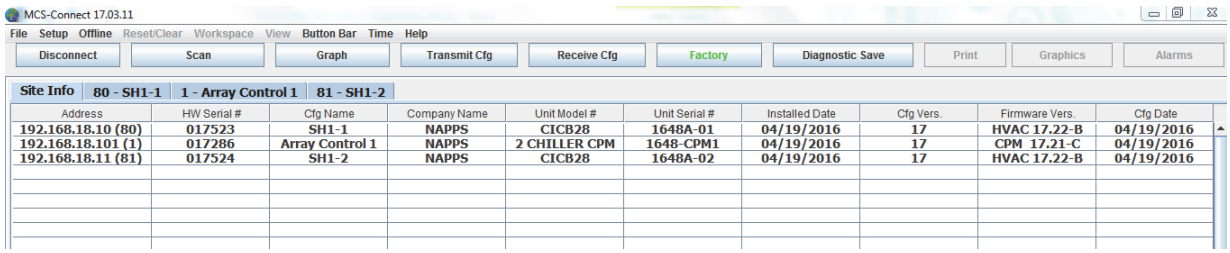
1. With the chiller array and router powered up. Turn on the PC/Laptop and allow it to boot up to the desktop.
2. On your PC/Laptop, find and select the wireless network "**NappsTech**".
3. Join the wireless network and enter the password "**nappstech2112**" (all lower case and no quotation marks).
4. Connection to the wireless router should now be complete. (If there is a problem, check to make sure password is typed in correctly.)
5. Open MCS-Connect on the PC/Laptop, the MCS-Connect start screen will come up.

Figure 9. MCS-Connect start screen



6. Left click on **Setup** in the menu bar.
7. Left click on **Network Options** in the drop down menu.
8. Under **Network** tab, view the **Usable Network Interfaces**, and select the interface that is shown.
9. Left click on **Save** button.
10. Left click on the **Ethernet** button in the **Local Network Connections** box to scan for a unit controller when connected.
11. If this does not find the unit controller, click on disconnect and click IP(Internet). Enter the IP address of the router and click Remote/Connect.
12. After the PC/Laptop is connected and the network scanned, a listing of each IP address for the Chiller unit controllers and the Array controllers will be shown. The tabs above the listings are used to select and view the information for each unit.

Figure 10. MCS-Connect main screen



Instructions:
Wired Connection to Router (Windows 7)

1. At your desktop, left click on **Start**.
2. Left click on **Control Panel** button.
3. Double left click on **Network and Sharing Center** icon.
4. Left click **Change Adapter Settings** on the left side of the screen.
5. Right click the connection that you want to change (Local Area Connection) and select **Properties** from the drop down menu.
6. Under **This connection uses the following items**, left click Internet Protocol Version 4 (TCP/IPv4).
7. Left click on **Properties** tab.
8. Select **Obtain an IP address automatically,** using a Straight (Patch) ETHERNET Cable to the Router.
9. Close all Windows.
10. Open MCS-Connect on the PC/Laptop, the MCS-Connect start screen will come up.
11. Left click on **Setup** tab.
12. Left click on **Network Options** tab.
13. Under **Network** tab, select the **Usable Network Interfaces**, and select the interface that is shown.
14. Left click on **Save** button.
15. Left click on **OK** button.
16. Left click on the **Ethernet** button in the **Local Network Connections** box to scan for a unit controller when connected.
17. If this does not find a unit controller, click on disconnect and click IP (Internet). Enter the IP address of the router and click Remote/Connect.
18. After the PC/Laptop is connected and the network scanned, a listing of each IP address for the Chiller unit controllers and the Array controllers will be shown. The tabs above the listings are used to select and view the information for each unit.

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