Multiaqua™

MHRC2 CHILLER

OPERATION MANUAL

MHRC2

with MCS MAGNUM Controls

Rev.62016NRC

Multiaqua, Inc.
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Our commitment to creating innovative air conditioning products has made us one of the most respected organizations in the industry. From concept to market, Multiaqua takes a hands-on approach to ensure that each and every step meets our stringent standards of quality, durability and dependability.

All Multiaqua products are designed with the future in mind. That's why all air conditioning chiller products are flexible, which makes it easy to adapt to virtually all kinds of building applications.

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1. Table of Contents

2. Introduction to Multiaqua and MCS-Magnum

2.1. About the Multiaqua Heat reclaim chiller (MHRC)

A multi heat source/sink capable refrigerant management system designed to satisfy the Heating & Cooling requirements of the global residential and commercial markets including, but not limited to, new construction, retrofit, add-on, and process hydronic applications.

The MHRC is currently available in 5 ton nominal size and scalable to 100 tons in air cooled configuration . Variable speed and Variable capacity Digital scroll compressors allow the system to modulate its capacity to match the Heating and or Cooling requirements. The MHRC is a self-contained machine with no add-on module requirements or additional assembly needed to simultaneously heat and cool water (SHC) or independently make hot or cold water. The Multiaqua MHRC is designed with great care to provide easy servicing by incorporating readily available components and diagnostics.

This family of equipment can be combined with groundwater or earth loops for enhanced efficiency operation. It can also be combined with solar thermal or natural gas for low cost and extreme cold weather applications. Low starting amperage makes the MHRC2 particularly compatible with solar/battery power systems.

2.2. About the MCS-MAGNUM

The MCS-MAGNUM is a rugged microprocessor based controller that is designed for the hostile environment of the HVAC industry. It is designed to provide primary control, no mechanical controls; interface with building management systems; communicate both locally and remotely. The MCS-MAGNUM provides flexibility with setpoints and control options that can be selected prior to commissioning a system or when the unit is live and functioning. Displays, alarms and other interfaces are accomplished in a clear and simple language that informs the user as to the status of the controller.

The MCS-MAGNUM is designed to safeguard the system that is being controlled, eliminate the need for manual intervention and to provide a simple but meaningful man-machine-interface.

2.3. About PC Support Software for MCS-MAGNUM

MCS-CONNECT program provides both local and remote communications to the MCS-MAGNUM. Through this program the status of the controller can be viewed and with proper authorization changes can be made to the system. Configuration files can be transmitted to or received from an MCS-MAGNUM unit. The MCS-MAGNUM automatically performs history logging; this program will graph selected items. This program is written in the Java programming language. A general user's manual is available with this software package.

This program runs under Windows 7 or greater and makes use of the Microsoft Windows Help function to assist the user.

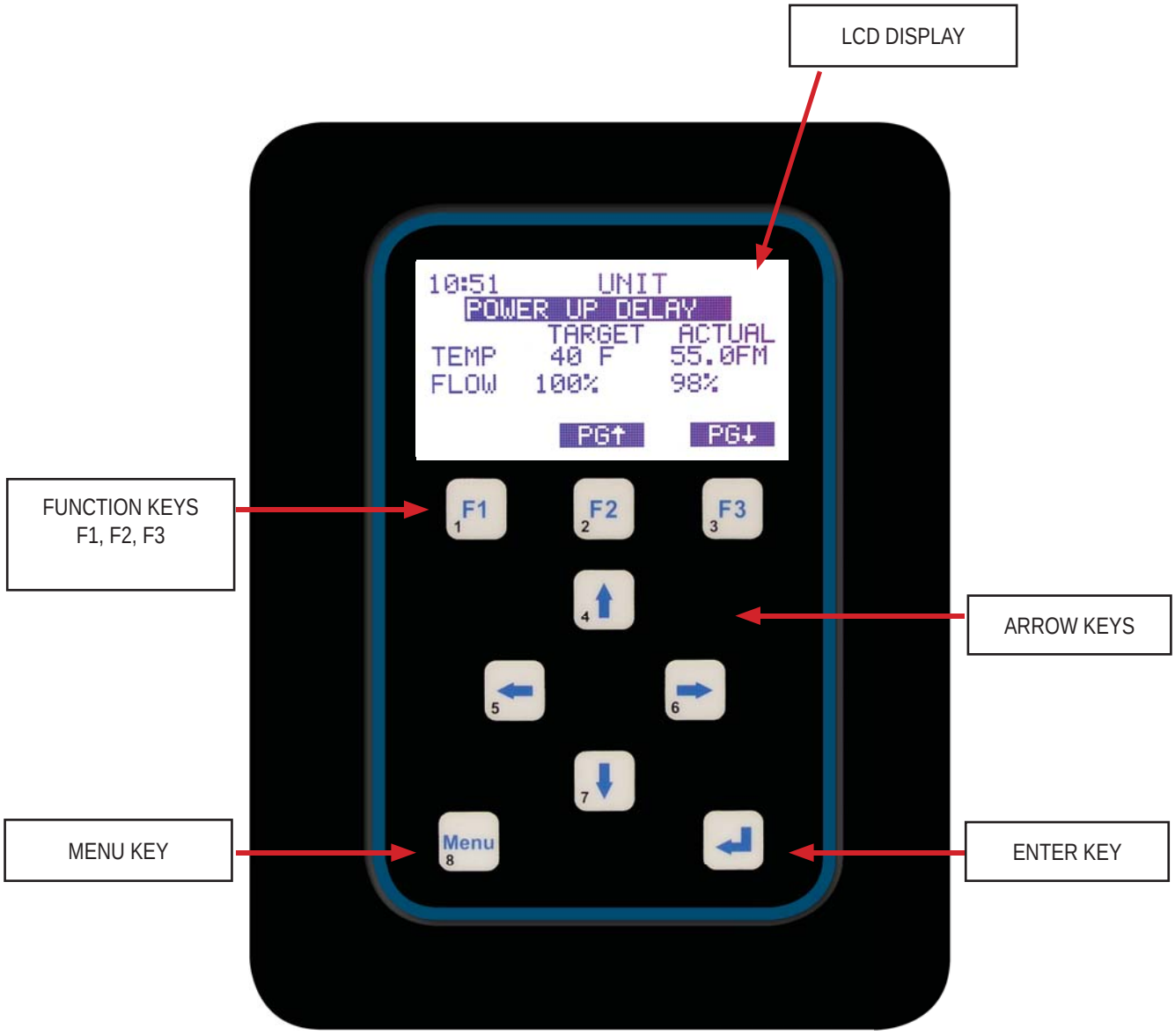
2.4. Requirements for PC Software

Minimum System Required to Run Program

- PC with a Pentium2-class processor communications
- Windows 7 or later operating system or Linux operating system
- Ethernet 10/100/1000
- 14.4k baud modem or higher for remote
- 1280 x 800 pixel or higher display
- Minimum 1GB of RAM
- Minimum 4GB Drive
- USB Port 2.0 or higher

2.5. MCS- MAGNUM KEYPAD - Keys and their functions

- LCD DISPLAY - displays current condition of controller. Pressing the Menu key, displays the 10 available Menu items.
- **FUNCTION KEYS** - F1, F2, F3 are used to Page Up and Page Down as shown below, F2 - PG↑(page up), F3 - PG↓(page down). Function keys are also used when a numerical digit is needed, F1 = 1, F2 = 2, F3 = 3.
- **ARROW KEYS** - ↓↑ ←→used to move between items on screen and also as numerical digits when needed.
- **ENTER KEY** ↵ - used to accept highlighed item on screen and to move to next screen.
- **MENU KEY** - used to move to main menu, also used as numerical digit 8.



3. MHRC Start Up Screens

(MCS-MAGNUM controller sensors are in manual mode for purpose of display)

The MCS-MAGNUM controller is a state computer, that is, decisions are made based upon setpoints, timers and sensor inputs, the controller moves from one state to another. The controller will change states to ensure the proper functioning of the MHRC package.

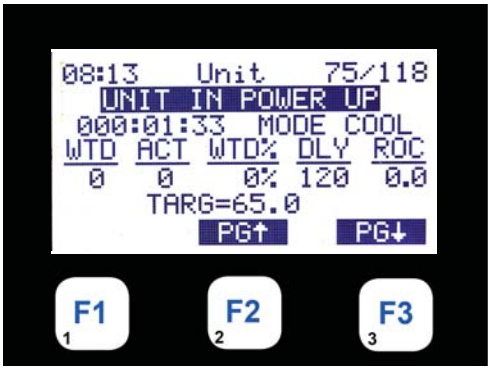
As we review the various states, we must remember the MHRC package consists of a number of different parts: the compressors, evaporators and condensers plus the mode of operation.

The following sequence occurs at Power Up:

3.1. MHRC OPERATIONAL

MULTIAQUA LOGO SCREEN
THIS DISPLAY APPEARS FOR A FEW SECONDS
IT IS YOUR INDICATION THAT THE MAGNUM IS
OPERATIONAL

3.2. MHRC UNIT STATUS – POWER UP



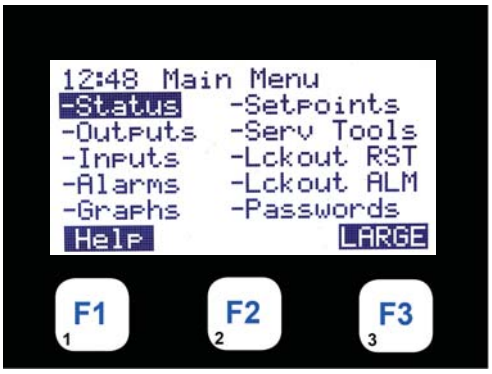
HH:MM C TNK / H TNK
CURRENT MHRC STATUS – POWER UP DELAY
UNIT IN POWER UP, TIME IN THIS STATE BASED ON SETPOINT #23
TEMP & FLOW TARGETS WITH CURRENT VALUES DISPLAYED
PRESS F3 ↓ PAGE DOWN

C TNK = COLD TANK TEMPERATURE
H TNK = HOT TANK TEMPERATURE

4. Status Displays

The current status can be viewed on the LCD display by depressing the 'Menu' key and selecting STATUS, then depressing the ↵ 'ENTER KEY'. Or it can be accessed via the MCS-CONNECT program under status screen section (See MCS-CONNECT Manual for further details).

4.1. PRESS MENU – SELECT STATUS



HH:MM MAIN MENU

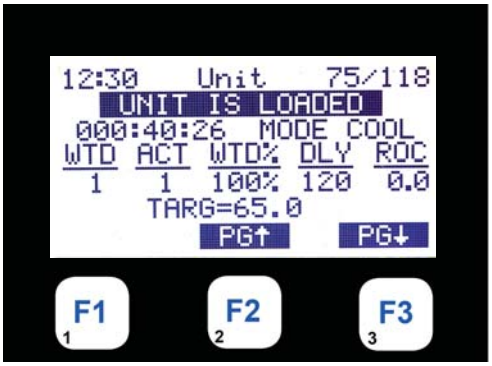
MENU KEY, SELECT STATUS, PRESS (↵) ENTER KEY

THIS WILL ALLOW USER TO DISPLAY DETAILS

OF THE UNIT STATUS

PRESS F3 PG ↓TO CONTINUE REVIEWING STATUS

4.2. UNIT COMPRESSOR LOADED



HH:MM C TNK / H TNK

CURRENT MHRC STATUS – UNIT IS LOADED

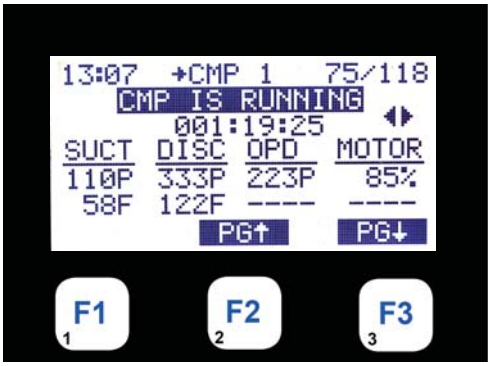
TIME IN COOL MODE

SHOWS WANTED, ACTUAL, % LOADED, DELAY

AND RATE OF CHANGE

PRESS F3 PG ↓TO CONTINUE REVIEWING STATUS

4.3. COMPRESSOR 1 STATUS- RUNNING



HH:MM C TNK / H TNK

COMPRESSOR 1 IS RUNNING

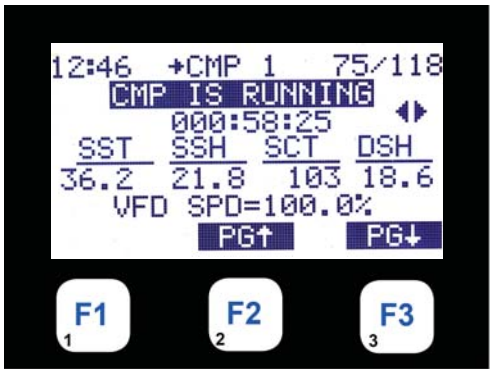
TIME IN THIS MODE

PROVIDES SUCTION, DISCHARGE & OIL PSI WITH MOTOR %

AS WELL AS TEMPERATURES

PRESS F3 PG ↓TO CONTINUE REVIEWING STATUS

4.4. COMPRESSOR 1 STATUS- RUNNING



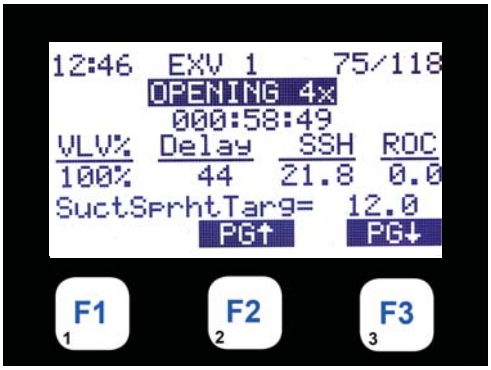
HH:MM	CMP 1 STATUS	C TNK / H TNK

COMPRESSOR IS RUNNING

PROVIDES SATURATED SUCTION, SUCTION SUPERHEAT, SATURATED CONDENSING & DISCHARGE SUPERHEAT

PRESS F3 PG ↓TO CONTINUE REVIEWING STATUS

4.5. EXV VALVE OPENING



HH:MM	EXV 1 STATUS	C TNK / H TNK

OPENING EXV 1

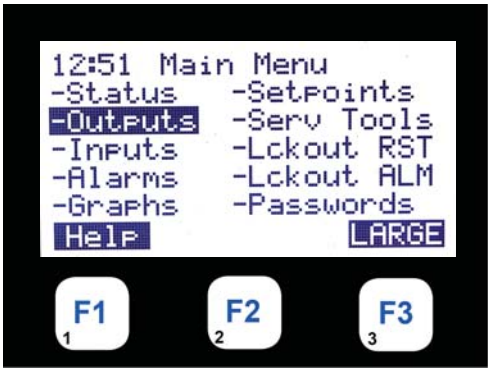
TIME IN THIS MODE

PROVIDES VALVE %, TIME TO NEXT CHANGE, SUPERHEAT & RATE OF CHANGE, PROVICES CONTROL & TARGET

PRESS F3 PG ↓TO CONTINUE REVIEWING STATUS

5. Status Outputs

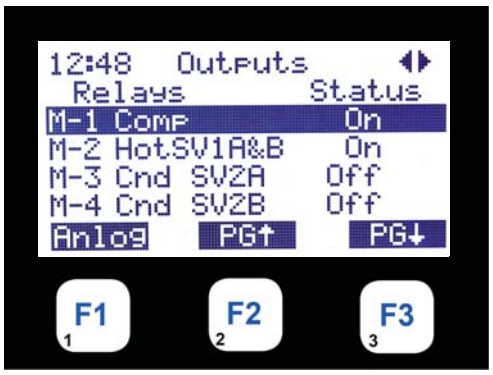
5.1. MAIN MENU - SELECT OUTPUTS STATUS



HH:MM

MENU, SELECT OUTPUTS
THIS WILL ALLOW THE USER TO DISPLAY DETAILS
OF THE OUTPUTS STATUS
BOTH ANALOG & DIGITAL
PRESS ↵ (ENTER KEY) TO SELECT

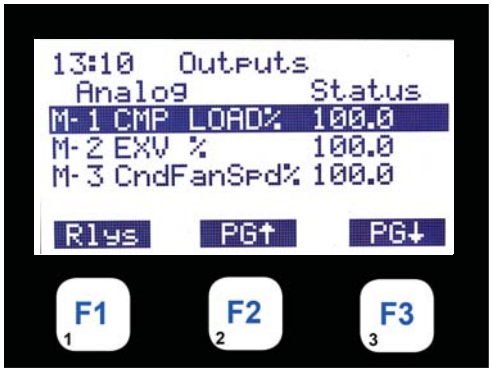
5.2. UNIT RELAYS STATUS



HH:MM

OUTPUTS (RELAY & ANALOG)
THE 1ST FOUR RELAY OUTPUTS ARE PRESENTED
← → ↓ ↑ KEYS ALLOW THE USER TO SCROLL THROUGH THE DATA
FUNCTION KEY F1 ALLOWS THE USER TO DISPLAY ANALOG OUTPUTS
PAGE UP / DOWN DISPLAYS NEXT 4 OUTPUTS

5.3. RELAY ANALOG STATUS

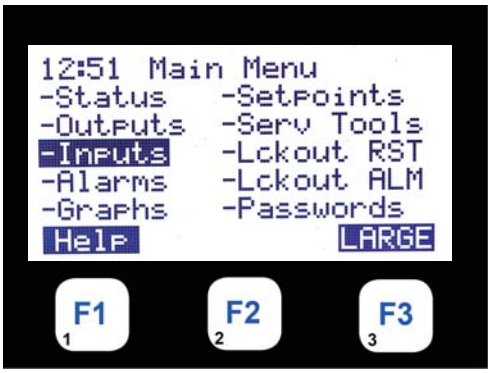


HH:MM

PRESSING F1 SELECTS ANALOG OUTPUTS
THE SCREEN SHOWS 3 ANALOG OUPUTS IN THIS UNIT
← → ↓ ↑ KEYS ALLOW THE USER TO SCROLL THROUGH THE DATA
FUNCTION KEY F1 ALLOWS THE USER TO DISPLAY ANALOG OUTPUTS
PAGE UP / DOWN DISPLAYS NEXT OUTPUTS

6. Status Inputs

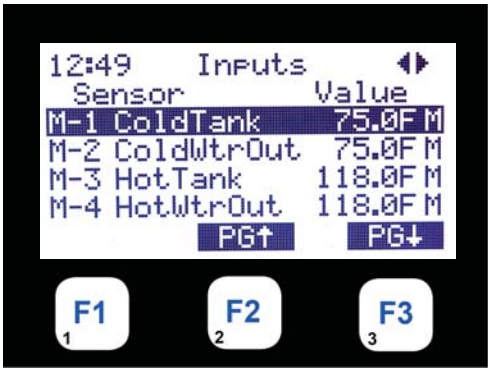
6.1. PRESS MENU - SELECT INPUTS



HH:MM

MENU KEY, SELECT INPUTS
PRESS ↵ ENTER
THIS WILL ALLOW USER TO DISPLAY DETAILS
OF THE INPUTS
BOTH ANALOG & DIGITAL

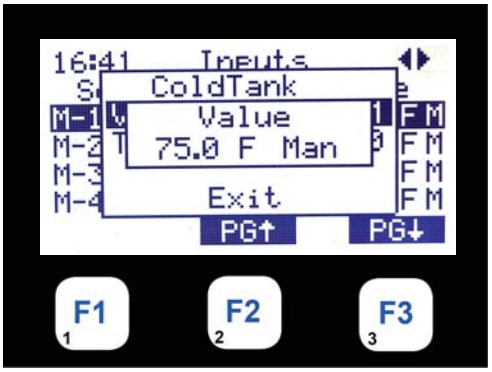
6.2. INPUTS (SENSOR STATUS)



HH:MM

INPUTS (ANALOG & DIGITAL)
THE FIRST FOUR INPUTS ARE PRESENTED
← → ↓ ↑ KEYS ALLOW THE USER TO SCROLL THROUGH THE DATA
FUNCTION KEY F1 ALLOWS THE USER TO DISPLAY ANALOG OUTPUTS
PAGE UP / DOWN DISPLAYS NEXT 4 OUTPUTS

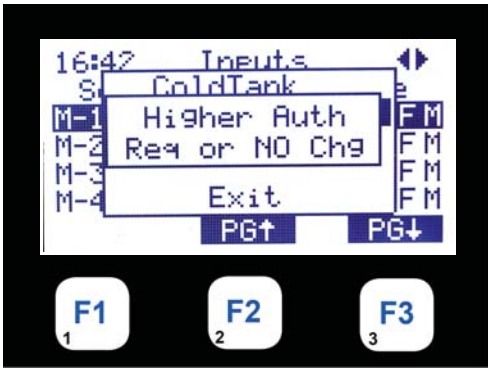
6.3. INPUT VALUE FOR M1 SENSOR



HH:MM

INPUT SHOW CURRENT VALUE
PRESS ↵ ENTER TO CHANGE VALUE

6.4. CHANGE VALUE REQUIRES HIGH AUTHORIZATION

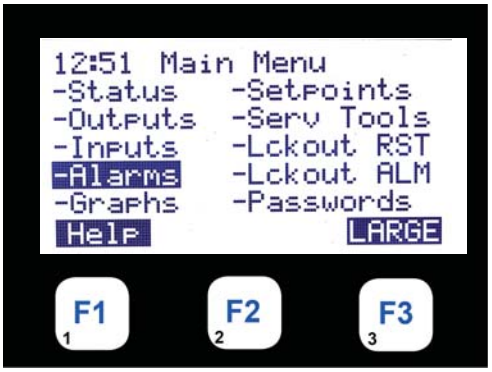


HH:MM

NEXT SCREEN SHOWS HIGHER AUTH NEEDED
TO CHANGE VALUE
PRESS ↵ ENTER TO RETURN TO INPUTS

7. Alarms

7.1. PRESS MENU - SELECT ALARMS



HH:MM

MENU KEY, SELECT ALARMS

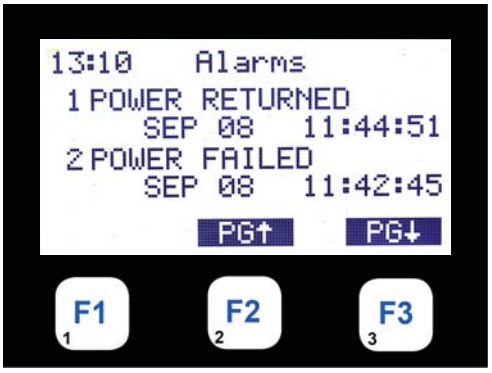
↵ ENTER

THIS WILL ALLOW USER TO DISPLAY DETAILS OF THE ALARMS

THERE ARE A MAXIMUM OF 100 ALARMS

PRESENTED TWO TO A SCREEN WITH MOST CURRENT FIRST

7.2. ALARMS



HH:MM

ALARMS

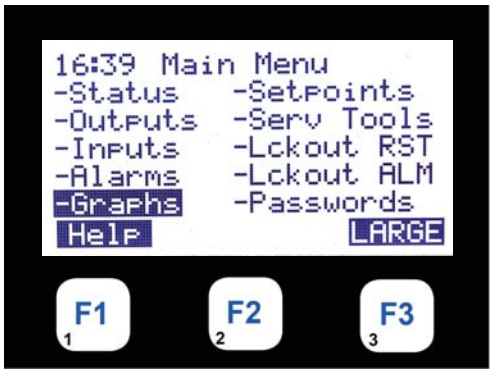
THE FIRST TWO ALARMS ARE PRESENTED

↓↑ ALLOWS THE USER TO SCROLL THROUGH THE ALARMS

PAGE UP / DOWN DISPLAYS NEXT ALARMS

8. Graphs

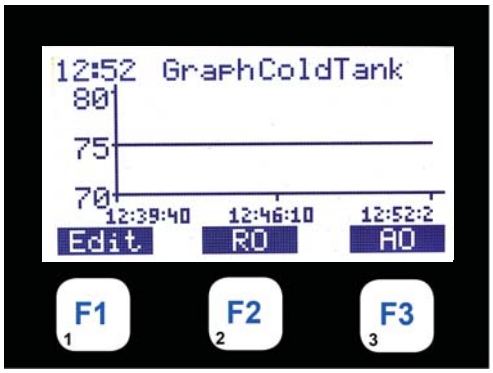
8.1. PRESS MENU - SELECT GRAPHS



HH:MM

MENU KEY, SELECT GRAPHS, PRESS (↵) ENTER
THIS WILL ALLOW USER TO DISPLAY DETAILS OF A GRAPH
ONE ITEM IS GRAPHED AT A TIME
IT WILL BE PLOTTED IN REAL TIME

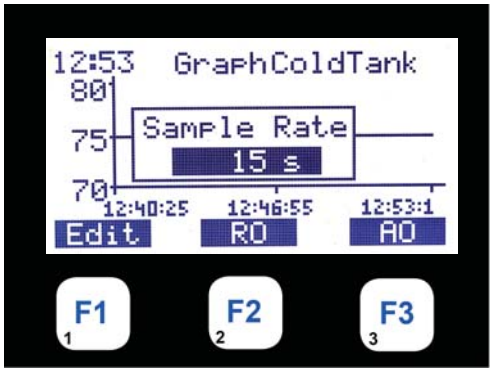
8.2. GRAPH 1ST SENSOR INPUT



HH:MM

GRAPHS
THE 1ST SENSOR INPUT IS GRAPHED
↑ ↓ KEYS LETS THE USER SCROLL THRU THE DATA
USING THE FUNCTION KEYS
SELECT EDIT, RELAY OUTPUTS OR ANALOG INPUT

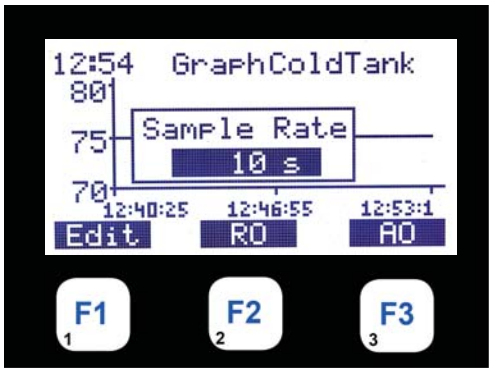
8.3. GRAPH SAMPLE RATE



HH:MM

GRAPHS
PRESSING F1 "EDIT' BRINGS UP THIS DISPLAY
WITH CURRENT VALUE HIGHLIGHTED
PRESS THE ↵ ENTER KEY
USING ↓↑ ADJUST THE SAMPLE RATE

8.4. GRAPH EDIT SAMPLE RATE

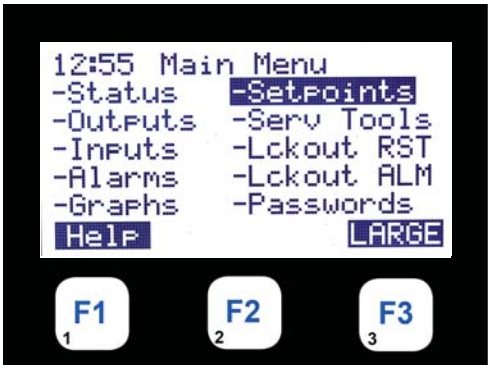


HH:MM

GRAPHS
ONCE THE SAMPLE RATE IS CORRECT
PRESS THE ↵ ENTER KEY
NOTE YOU MUST BE AUTHORIZED TO MAKE THE CHANGE

9. Set Points

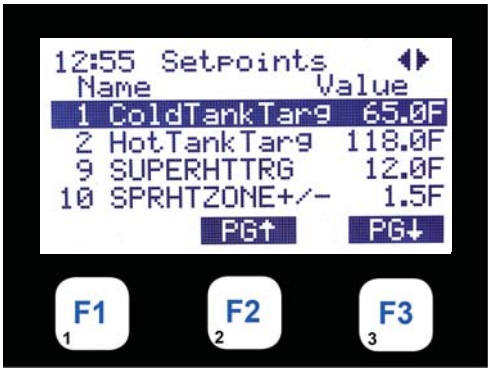
9.1. PRESS MENU - SELECT SET POINTS



HH:MM

MENU KEY, SELECT SETPOINTS
PRESS ↵ ENTER KEY
THIS WILL ALLOW THE USER TO DISPLAY DETAILS OF SETPOINTS
SETPOINTS CAN BE DISPLAYED
BASED ON AUTHORIZATION LEVEL

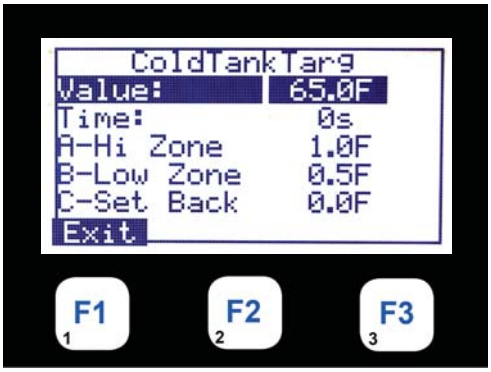
9.2. DISPLAY SET POINTS



HH:MM

THE 1ST FOUR SETPOINTS ARE DISPLAYED
← → ↓ ↑ KEYS ALLOW THE USER TO SCROLL THROUGH THE DATA
FUNCTION KEY F1 ALLOWS THE USER TO DISPLAY SETPOINT DATA
PRESS ↵ ENTER KEY TO SEE VALUE OF SETPOINT 1

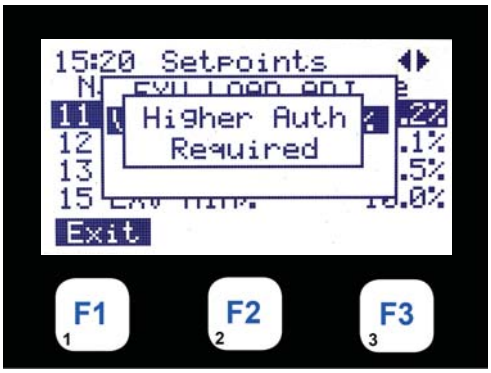
9.3. EDIT SETPOINT



HH:MM

SETPOINT 1 VALUE SHOWN
SETPOINTS VALUES CAN BE CHANGED
BASED ON AUTHORIZATION LEVEL
PRESS ↵ ENTER KEY TO CHANGE VALUE

9.4. HIGHER AUTH NEEDED

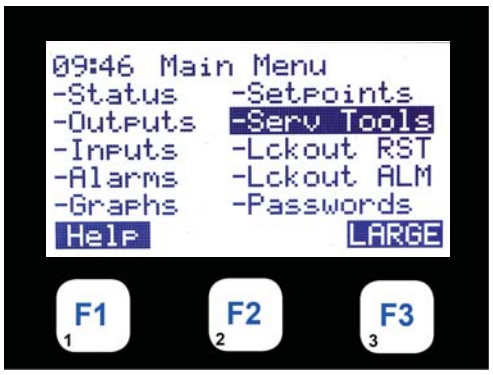


HH:MM

SCREEN SHOWS
HIGHER AUTHORIZATION LEVEL REQUIRED
TO CHANGE SETPOINT'S VALUE

10. Service Tools

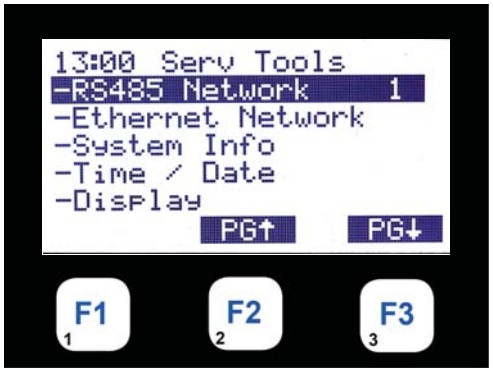
10.1. PRESS MENU - SELECT SERV TOOLS



HH:MM

MENU KEY, SELECT SERV TOOLS, PRESS (↵) ENTER
THIS WILL ALLOW USER TO DISPLAY
DETAILS OF SERV TOOLS

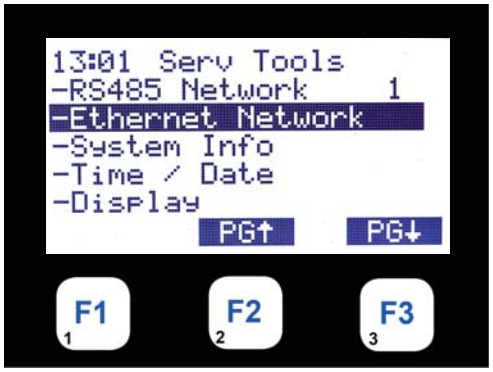
10.2. SERV TOOLS OPTIONS



HH:MM

SERV TOOLS
THE SERV TOOL OPTIONS ARE DISPLAYED
↑ ↓ KEYS ALLOW THE USER TO SCROLL
THROUGH THE OPTIONS
FUNCTION KEYS ALLOW PAGE UP/DOWN
PRESS ↓ PG DOWN SELECT SYSTEM INFO

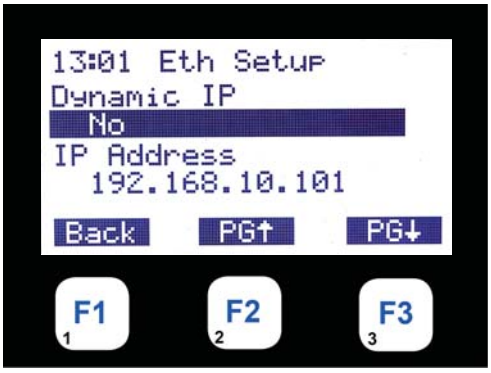
10.3. SYSTEM INFO OPTION



HH:MM

SELECT SYSTEM INFO - ETHERNET NETWORK
PRESS (↵) ENTER TO SELECT
FUNCTION KEYS ALLOW PAGE UP/DOWN

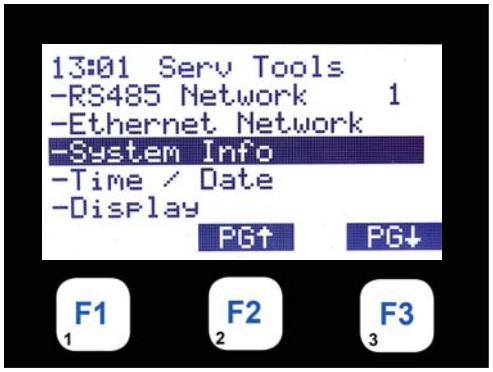
10.4. SYSTEM INFO SCREEN 1



HH:MM

SYSTEM INFO
SCREEN SHOWS ETHERNET SETUP
DYNAMIC IP
& IP ADDRESS SETTING
PRESS ↓ PG DOWN CONTINUES NEXT SERV TOOLS

10.5. SYSTEM INFO SCREEN 2



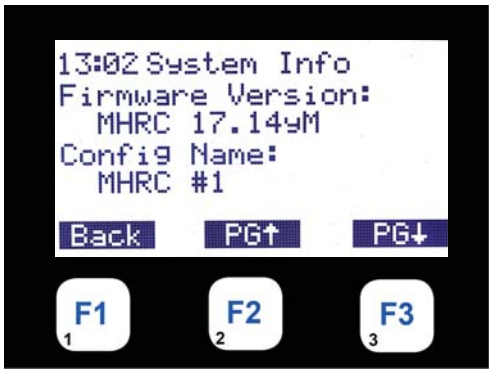
HH:MM

SERV TOOLS

SYSTEM INFO

PRESS↵ ENTER KEY TO SELECT

10.6. SYSTEM INFO SCREEN 3



HH:MM

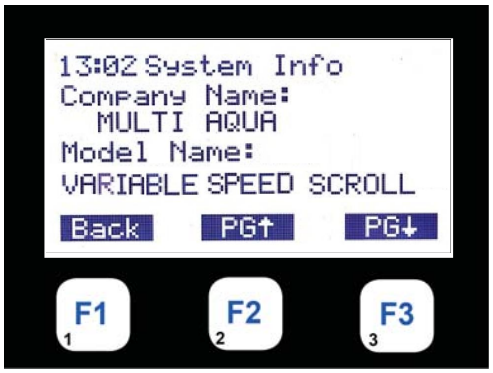
SYSTEM INFO

SHOWS FIRMWARE VERSION

& CONFIG NAME

PG ↓ CONTINUES TO NEXT SYSTEM INFO

10.7. SYSTEM INFO SCREEN 4



HH:MM

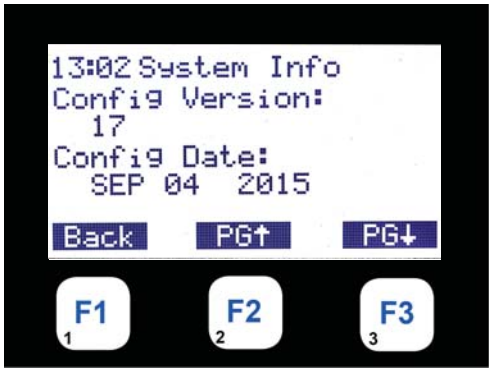
SYSTEM INFO

SHOWS COMPANY NAME

& TYPE OF UNIT BEING CONTROLLED

PG ↓ CONTINUES TO NEXT SYSTEM INFO

10.8. SYSTEM INFO SCREEN 5



HH:MM

SYSTEM INFO

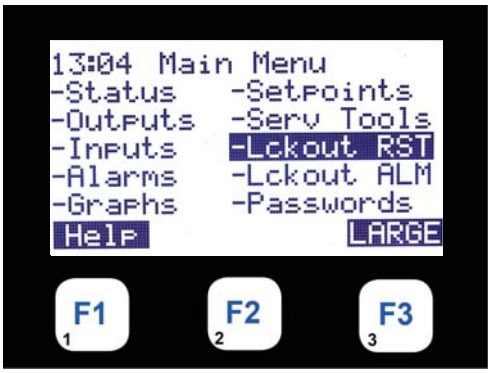
SHOWS CONFIG VERSION NUMBER

& CONFIG DATE

PG ↓ CONTINUES TO NEXT SYSTEM INFO

11. Lockout Reset Alarms

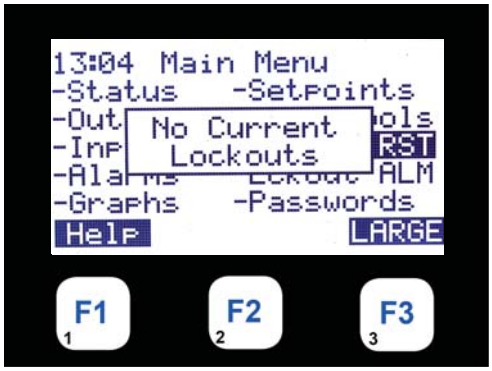
11.1. PRESS MENU - SELECT LCKOUT RST



HH:MM

MENU KEY, SELECT LCKOUT RST
↵ ENTER KEY
THIS WILL ALLOW USED TO
DISPLAY ANY LOCKOUTS

11.2. NO CURRENT LOCKOUTS

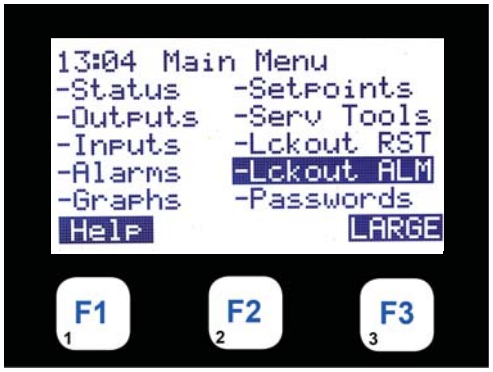


HH:MM

IF NO LOCKOUTS EXIST YOU WILL BE NOTIFIED
IF THE UNIT IS IN LOCKOUT YOU WILL BE ALLOWED TO RESET.
YOU ARE LIMTED TO 10 RESETS A DAY
MAKE SURE THE CAUSE OF THE RESET IS FIXED
BEFORE TRYING AGAIN

12. Lockout Alarms

12.1. PRESS MENU - SELECT LCKOUT ALARM



HH:MM

MENU KEY, SELECT LCKOUT ALARMS, PRESS (↵) ENTER
THIS WILL ALLOW USER TO
DISPLAY ANY LOCKOUTS ALARMS

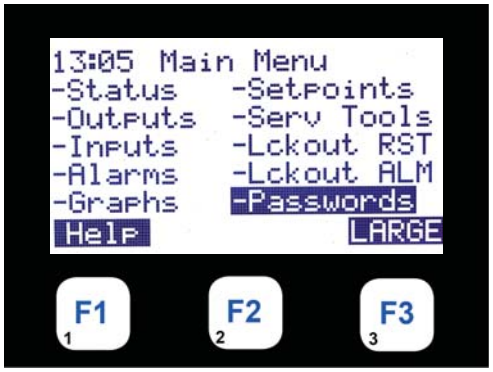
12.2. 1ST LCKOUT ALARM DISPLAYED

HH:MM

SYSTEM INFO LOCKOUT ALARM
NO LOCKOUT ALARMS

13. Passwords

13.1. PRESS MENU - SELECT PASSWORDS

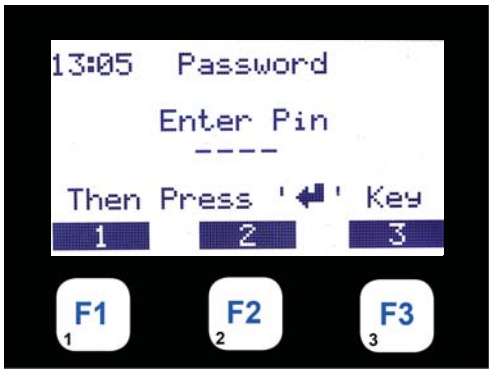


HH:MM

MENU KEY, SELECT PASSWORD, PRESS (↵) ENTER

THIS WILL ALLOW USER TO GET AUTHORIZED

13.2. ENTER PASSWORD



HH:MM

ENTER YOUR 4 DIGIT PASSWORD
MUST BE NUMBERS BETWEEN 1 & 8 TO ENTER
FROM KEYPAD
CAN BE ANY COMBINATION FROM LAPTOP

13.3. ENTER TO GET AUTHORIZED

HH:MM

AS EACH DIGIT IS ENTERED AN (*) ASTERICK SHOWS
UP ON DISPLAY
WHEN COMPLETED PRESS ENTER (↵)

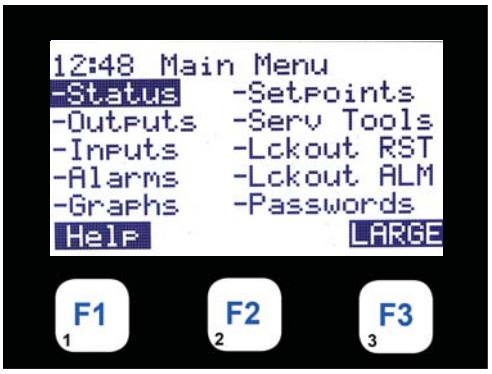
13.4. PASSWORD ACCEPTED

HH:MM

IF A CORRECT PASSWORD IS ENTERED
YOU WILL BE NOTIFIED AT WHAT
LEVEL YOU ARE AUTHORIZED

14. Main Menu Functin Keys

14.1. MAIN MENU



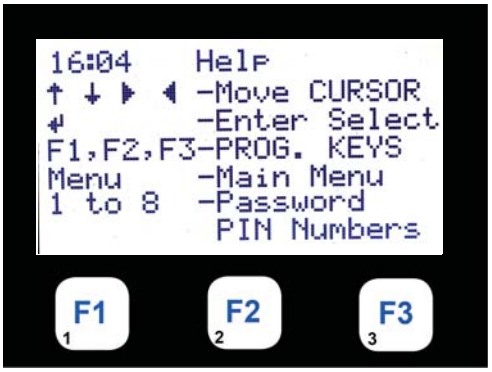
HH:MM

PRESS MENU KEY

F1 KEY FOR HELP

PRESS ↵ ENTER

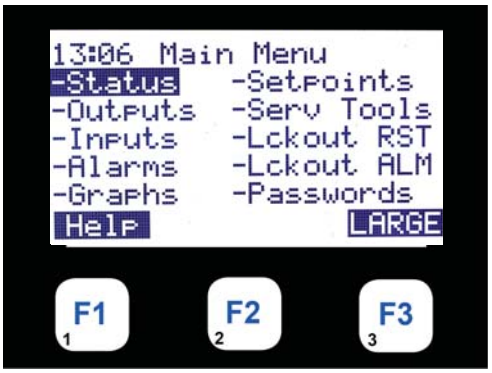
14.2. HELP DISPLAY



HH:MM

DESCRIPTION OF THE SYMBOLS USED
TO MOVE CURSOR
& KEYS USED TO ENTER PASSWORD

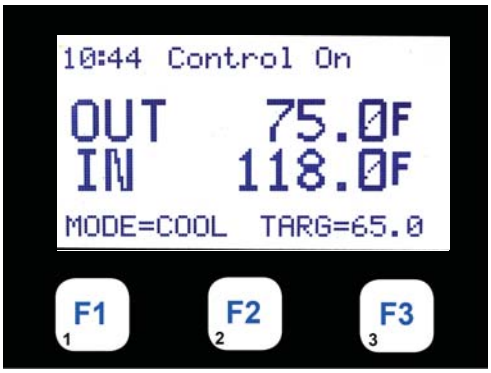
14.3. MHRC LARGE TYPE DISPLAY



HH:MM

PRESS F3 KEY AT MAIN MENU

14.4. LARGE TYPE DISPLAY



HH:MM

DISPLAY SHOWS LARGE TYPE
OF STATUS WINDOW

15. MHRC MODES

15.1. UNIT IN POWER UP

This state is entered when the Magnum is powered up or the system has been reset. The system will remain in this state for the time specified in set point #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.

15.2. NO RUN- I/O LOSS

This state will be entered whenever the Magnum loses communications with any of the I/O boards that are connected through the MCS I/O network. When this state is entered the Magnum 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 Magnum 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 Magnum, after the lost I/O has been corrected. This will generate a “LOCKOUT RESET.” In this state all RO’s except ALARM and OIL HEATER are turned OFF.

15.3. 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 RO’s are turned OFF and placed in the “LOCKOUT” state. Note: If the Lockout Reset is pressed more than the programmed allowable number of times in one day the unit cannot be reset during the current day except through MCS-Connect and requires Factory authorization. This number is selected from a drop down menu under the Setup Information button, with a range of 2 to12.

15.4. 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.

15.5. UNIT IS HOLDING

This state is entered when one of three conditions exists:

1) The control sensor reading is being maintained with in 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. 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.

15.6. 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.

15.7. 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.

15.8. 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.

15.9. 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.

15.10. 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.

15.11. 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.

15.12. 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.

15.13. SWITCHING MODES

This state is entered when the unit is switching between cooling mode and heating mode. Only heat pump units or units with electric heat and a Sensor Input selects either the cooling or heating mode will enter this state. Select this information under the MAG V8 screen.

16. MHRC Sequence of Operation

1. At power up, the Magnum does not start its algorithm until Set Point 23, POWERUP DELAY time has been satisfied. (This allows the power to stabilize)
2. At startup the MAGNUM verifies the status of the 'NO RUN CAPACITY CONTROL STATES'. If all stsates are satiffied the hot and cold pumps are started. **Refer to Appendix A.**
3. If any one of the 'NO RUN CAPACITY CONTROL STATES' is not satisfied, the following sequence occurs:
    a. All compressors are not allowed to run. Any running compressor which has satisfied its minimum run time (set point #64) will have its liquid line solenoid turned off and the evaporator pump down and compressor turned off.
    b. The AO pump continues to run for 120 seconds (Set Point #108 "PUMP DELAY") after the last compressor is turned off.
4. If all of the 'NO RUN CAPACITY CONTROL STATES' are satisfied, the capacity control logic is now allowed to run to maintain the Chiller target within the control zone defined by:
    a. Set Point #1 "CTL TNK' (Cold Tank Targ ± High and Low Zone Values)
    b. Set Point #2 "CTL ZONE+" (Hot Tank Targ ± High and Low Zone Values)
5. Once the pumps are on and the proof of flow is on the Capacity control logic now determines if heating, cooling or both are required based on the set points and the current status of the compressor. It will increase or decrease its capacity as required. This is done for both heating and cooling. If additional capacity is added and results in ether heating or cooling reaching its target the system will switch modes as required.
6. The Capacity control logic will increase/decrease the compressor capacity and the 'WANTED ON verses ACTUAL ON' to maintain the capacity required. Capacity control logic for loading & unloading the chiller is as follows:
    a. If the MHRC temperature is above the target and the Chilled Water Rate Of Change (ROC) is not indicating the MHRC temperature is already decreasing at a sufficient rate, the chiller's capacity control logic will decrement step delay. When it reaches zero the system will increase the capacity of the running compressor or will ask for step delay and more capacity by adding to the "Steps Wanted On" parameter(if additional steps ae available). Once "Step Wanted On" parameter has been increased the capacity control logic has a time delay before allowing the "Steps Wanted On" to be increased again. The time delay is dependant on how far away the temperature is from target, Set Points #25 "STEP SENSIT" and Set Point #26 "STEP DELAY"
    b. If the ROC indicates a sufficient decrease in MHRC Out Temperature (ROC < Set Point #27 "MAX ROC-") the capacity control logic stops loading and holds the current capacity.
    c. If the MHRC out temperature is in the control zone, special logic functions to keep the chiller within the control zone.
    d. If the MHRC out temperature is below the control zone and if the Chilled Water Rate Of Change (ROC) is not indicating the water temperature is already increasing at a sufficient rate, the chiller's capacity control logic asks for less capacity by decrement step delay. When it reaches zero the system will decrease the capacity of the running compressor(s) or will reduce the "Steps Wanted On" parameter. Once "Step Wanted On" parameter has been decreased the capacity control logic has a time delay before allowing the "Steps Wanted On" to be decreased again. The time delay is dependant on how far away the temperature is from target, Set Points #25 "STEP SENSIT" and Set Point #26 "STEP DELAY".
    e. If the ROC is indicating a sufficient increase in MHRC Out Temperature (ROC < Set Point #27 "MAX ROC-") the capacity control logic stop unloading and holds the current capacity.

7. Once it has been determined that a compressor is wanted on, the MAGNUM reviews the ‘NO RUN CIRCUIT CONTROL STATES’ for an available compressor.
8. The condenser fan control logic runs once every second. Pumps and fans are cycled based on the compressor(s) discharge pressure and Set Point #45 to #55, depending on condenser type.
9. The Capacity State & Circuit/Compressor State can be viewed via the ‘STATUS’ option under the ‘Menu’ Key on the MAGNUM keypad or using PC-Connect software on a Windows based computer.
10. The chiller safeties (Comp No Stop, Phase Loss, Emergency Stop, Chilled Water Freeze Protection), are checked once every second. (All of chiller safeties are options features). Once a chiller safety has occurred the user is required to correct the problem and reset the unit using the ‘Lckout RST’ from the Menu on the MAGNUM’s keypad or thru MCS-CONNECT.
11. If the compressor relay output is turned on, either by computer or manual, the compressor safeties are checked once every second. The follow compressor safeties are supported:
    a. Low & Unsafe Suction Pressure
    b. Low & Unsafe Differential Oil Pressure
    c. Low & High Discharge Pressure
    d. High Discharge temperature
    e. Low & High Motor Ampere
    f. No Compressor Proof
    g. Freeze protection

17. MCS-MAGNUM EXV Suctin/Discharge Superheat Logic

MCS-MAGNUM EXV Setpoints

#9 SUPERHT TARG = Target temperature setting for Superheat ('Time (sec)' is the seconds between samples used for calculating the Superheat Rate of Change).

#10 SPRHT ZONE+- = This value is added to and subtracted from setpoint #9 to calculate the upper and lower zones of the superheat control zone.

#11 EXV LOAD ADJ = The opening adjustment that will be made to the EXV when the compressor load solenoid is pulsed, or the closing adjustment when the compressor unload solenoid is pulsed.

#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 = As the compressor amp draw % changes, this divides the EXV % change. It is calculated as follows: (Last FLA % - Current FLA %)/Setpoint #14

#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 = Maximum Delay (sec) between valve adjustments.

#20 EXV STRT TME = Delay (sec) to remain in EXV IN STARTUP when the compressor first starts.

#65 EXV ZONE1 DB = When set up as a setpoint or target type, the value field is added to and subtracted from setpoint #9 "Superheat Target" ± setpoint #10 "Superheat zone" to develop the upper and lower limits for "EXV is Opening" and "EXV is Closing" zones in zone 1. When set up as a target, the night setback field is used as an offset that is added to setpoint #9 (Superheat Target) to calculate the bottom value for the limit of where Low PSI opening is allow to operate.

#66 EXV ZONE2 DB = The offset added to and subtracted from setpoint #9 "Superheat Target" ± (setpoint #10 "Superheat zone" × 2 OR setpoint #65 "EXV ZONE1 DB" if active) to develop the upper and lower limit for "EXV Opening 2x" and "EXV Closing 2x" zones in zone 2.

#67 EXV ROC ZN1 = The superheat's Rate Of Change (ROC) holding limit for the "EXV Opening" and "EXV Closing" zone. This setpoint value is entered as a positive number and for "EXV is Opening" zone multiplied by -1. Time in seconds = Minimum time to hold when ouside the zone and the ROC is moving in the right direction. The EXV will be forced into a hold state for this minimum time.

#69 EXV ROC ZN2 = 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. Time in seconds = Minimum time to hold when ouside the zone and the ROC is moving in the right direction. The EXV will be forced into a hold state for this minimum time.

#70 EXV ROC ZN3 = 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. Time in seconds = Minimum time to hold when ouside the zone and the ROC is moving in the right direction. The EXV will be forced into a hold state for this minimum time.

#71 EXV ROC HD2x = 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. Time in seconds = Minimum time to hold when ouside the zone and the ROC is moving in the right direction. The EXV will be forced into a hold state for this minimum time.

#72 EXV ROC HD1x = 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 (See chart for calculation).

#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 (See chart for calculation).

MICRO CONTROL SYSTEMS Inc.	
DATE:	07-23-12 Page 1 of 3
DRAWN BY:	M. Schreiber
REVISION :	G
DWG NAME:	MCS-MAGNUM EXV SUCTION-DISCHARGE SUPERHEAT LOGIC - REV G.DWG

MCS-MAGNUM EXV SUCTION/DISCHARGE SUPERHEAT LOGIC

MCS-MAGNUM EXV Setpoints

#199 MOP TARG PSI = The Maximum Operation Suction pressure (MOP). If the suction pressure is greater than this value plus setpoint #200, then the EXV is forced to close. The EXV state is set to "EXV IS MOP CLS".

#200 MOP PSI ZONE = If the suction pressure is greater than setpoint #199 minus this value, then the EXV is force into "EXV IS MOP HLD" and the EXV will not be allowed to open.

#201 MOP ADJ % TME = 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.

MICRO CONTROL SYSTEMS Inc.	
DATE:	07-23-12 Page 2 of 3
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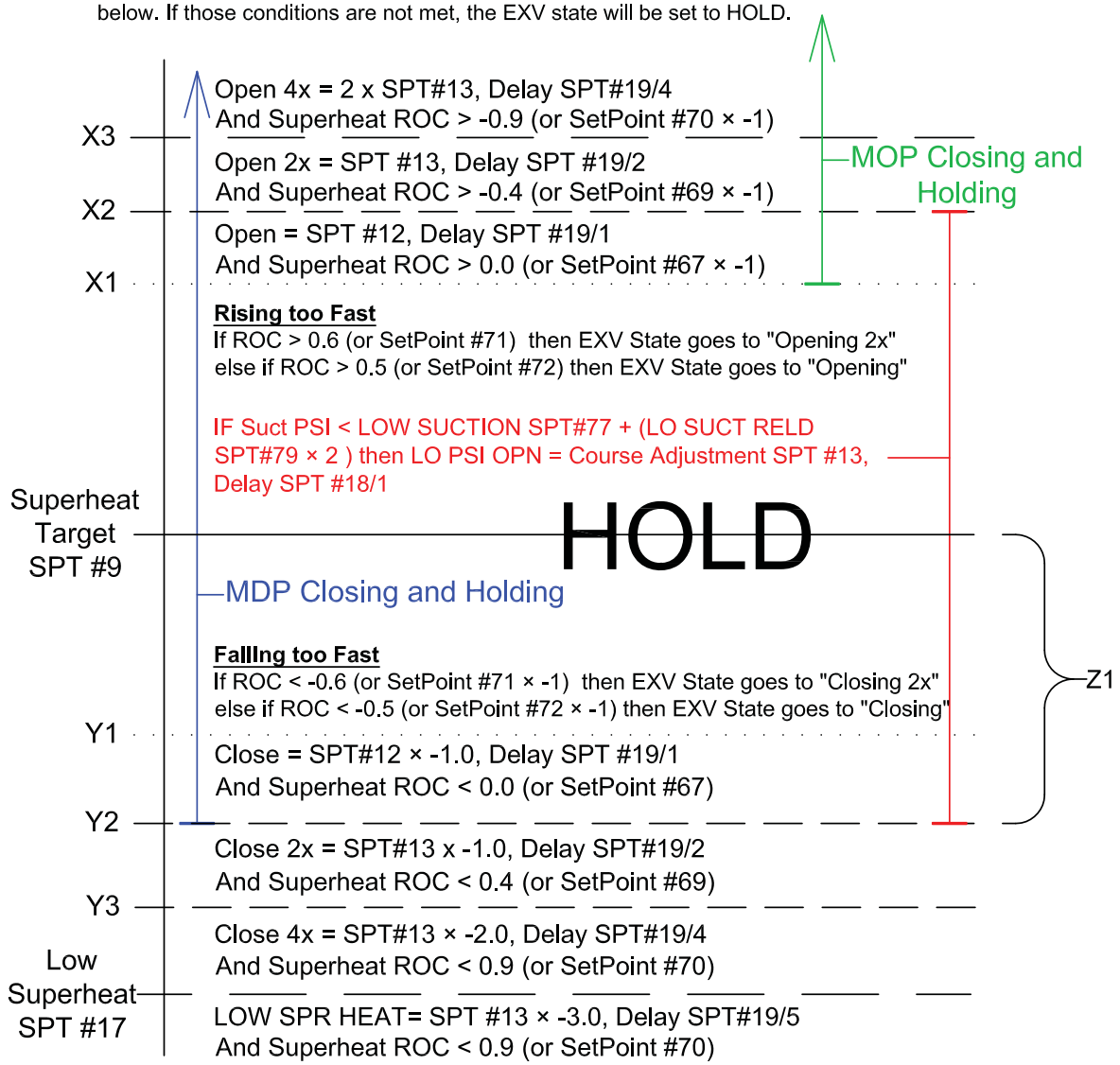
Legend:

Calculated Zone Limit

EXV State = Adjustment to EXV when delay reaches 0, Adjustment to delay every second
Superheat Rate of Change requirement to stay out of HOLD state

If Superheat exceeds the Calculated Zone Limit and the Rate of Change requirement is satisfied then EXV State, EXV Adjust, and Delay Adjust will all equal the corresponding values in the chart below. If those conditions are not met, the EXV state will be set to HOLD.



X1 = Stpt #9 + Stpt #10
X2 = X1 + Stpt #10
or if Setpoint #65 is active
then X2 = X1 + Stpt #65
X3 = X2 + Stpt #10
or if Setpoint #66 is active
then X3 = X2 + Stpt #66

Y1 = Stpt #9 - Stpt #10
Y2 = Y1 - Stpt #10
or if Setpoint #65 is active
then Y2 = Y1 - Stpt #65
Y3 = Y2 - Stpt #10
or if Setpoint #66 is active
then Y3 = Y2 - Stpt #66

Z1 = If setpoint #65 is not defined as a "TARGET" type then Y2 is the bottom limit where "LO PSI OPN" logic is allowed to work.
If setpoint #65 is defined as a "TARGET" type then setpoint #65 night setback field is added to setpoint #9 valve to calculate the bottom limit where "LO PSI OPN" logic is allowed to work.

MICRO CONTROL SYSTEMS Inc.	
DATE:	07-23-12 Page 3 of 3
DRAWN BY:	M. Schreiber
REVISION :	G
DWG NAME:	MCS-MAGNUM EXV SUCTION-DISCHARGE SUPERHEAT LOGIC - REV G.DWG

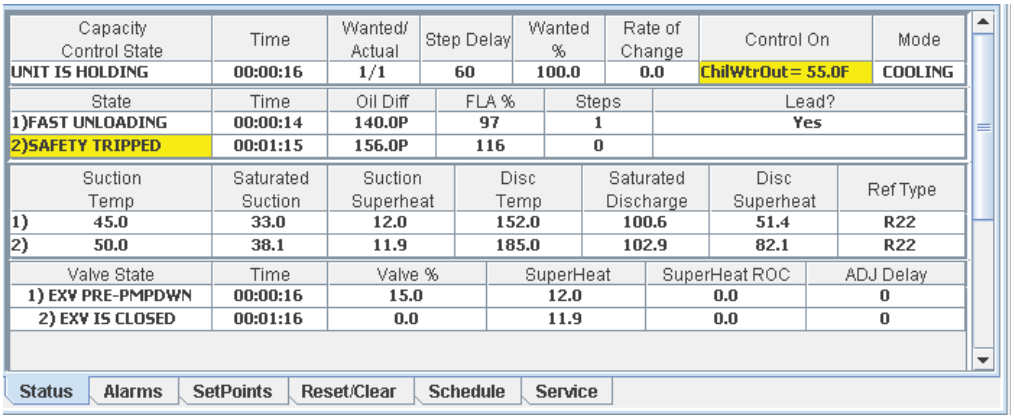
17.1.1. EXV Related Setpoints.

(Refer Setpoints 9-20, 65-72, 109-110, 199-201, 205, 215, 217, and 230).

These Setpoints were added to provide fine-tuning to the testing of the movement of the superheat temperature. Refer to EXV control logic chart in a previous section.

17.1.2. EXV Control States

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



Capacity Control State	Time	Wanted/ Actual	Step Delay	Wanted %	Rate of Change	Control On	Mode
UNIT IS HOLDING	00:00:16	1/1	60	100.0	0.0	ChilWtrOut= 55.0F	COOLING

State	Time	Oil Diff	FLA %	Steps	Lead?
1)FAST UNLOADING	00:00:14	140.0P	97	1	Yes
2)SAFETY TRIPPED	00:01:15	156.0P	116	0	

	Suction Temp	Saturated Suction	Suction Superheat	Disc Temp	Saturated Discharge	Disc Superheat	Ref Type
1)	45.0	33.0	12.0	152.0	100.6	51.4	R22
2)	50.0	38.1	11.9	185.0	102.9	82.1	R22

Valve State	Time	Valve %	SuperHeat	SuperHeat ROC	ADJ Delay
1) EXV PRE-PMPDWN	00:00:16	15.0	12.0	0.0	0
2) EXV IS CLOSED	00:01:16	0.0	11.9	0.0	0

Status | Alarms | SetPoints | Reset/Clear | Schedule | Service

To view the EXV status through the Keypad LCD, select Status from the Main Menu and then page to the EXV screen.

EXV States:

LOCKED OUT	The compressor is in a Lockout state.
IS CLOSED	The associated compressor is OFF and the valve is closed
PRE-PMPDWN	The valve has been in a closed state and the system is now requiring the valve action.
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%.
IS HOLDING	Refer to EXV Logic Chart, superheat is in control zone and ROC is acceptable.
IS OPENING	Refer to EXV Logic Chart, superheat is in control zone but rising too fast, ROC less than 1.0.
IS CLOSING	Refer to EXV Logic Chart, superheat is in the control zone and the rate of change is acceptable, ROC greater than –0.5.
LOW SPRHT	Refer to EXV Logic Chart, force a course valve adjustment.
OPENING 4x	Refer to EXV Logic Chart, superheat is above control zone.
OPENING 2x	Refer to EXV Logic Chart, superheat is in control zone but rising too fast, the ROC is greater than 1.0.
LO PSI OPN	Refer to EXV Logic Chart, state indicates that a low suction pressure condition exists. The suction pressure is less than Setpoint #77 "LOW SUCTION" plus twice the value of Setpoint #79 "LOW SUCT RELOAD" and the superheat is greater than Setpoint #9 "SUPERHT TRGT" plus twice the value of Setpoint #10 "SPRHT ZONE+-".
CLOSING 2x	Refer to EXV Logic Chart, superheat is in the control zone and the rate of change is acceptable, the ROC is less than -0.5 and greater than -1.0.
CLOSING 4x	Refer to EXV Logic Chart, superheat is in control zone but falling too fast, ROC less than -1.0.
HI LVL CLS	This state indicates that a high refrigerant level. This state is entered if Setpoint #109 "HiRefLevel" is active and the superheat is greater than the value of this Setpoint.

18. MAGNUM Condenser Control Strategy

Modulating Step Common - This type of condenser has a common fan bank for the system. The control will be on the systems highest discharge pressure. The Relay Outputs are also supported along with an Analog Output

When the system is in SHC (Simultaneous Heating and Cooling), the condenser fan is not used.

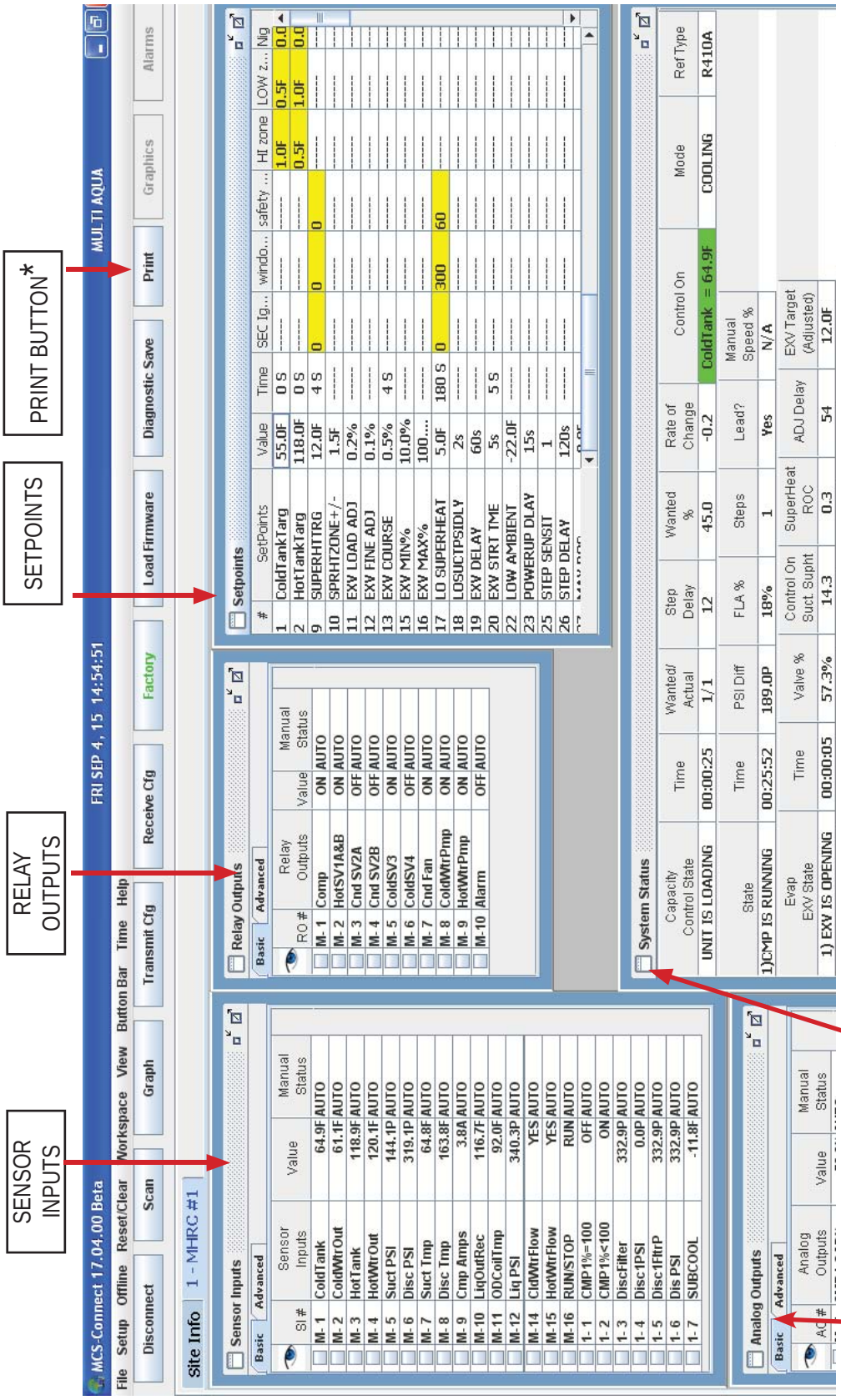
When the unit is in cooling only mode the condenser control is as described in the set points below.

When the unit is in heating only mode the control is as described below with the exception that Set Point 163 ('CondHtOffst') is added to Set Point 50 ('CND TRGT').

49	CND START % (Modulating Type)	If active, then the value is the starting % for the AO when the RO that is tied to it turns on. The value in the "Time (SEC)" cell is the AO starting stage. If no Relays are used when CMP starts set value.
50	CND TRGT (Modulating Type)	Target the logic will try to maintain by modulating the AO.
51	CND ADJ DIV (Modulating Type)	Controls scaling of the amount the AO is adjusted (usually 1). The larger the number the smaller the AO adjustment as the adjustment will be divided by this value.
	CND VFD MIN	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 MIN % (Modulating Type)	Minimum AO % allowed. If compressor is off, then check the "Time (SEC)" field: If 0, then the AO % will be set to the value of this setpoint. If 2 and the run/stop is set to run, then set the AO % to 100%, else set the AO % to 0%. This option is selected in the "Default Valve Opening % when Comp. is OFF" box in the condenser information section in the MAG HVAC screen.
53	CND ROC- (Modulating Type)	Maximum negative rate of change allowed. If the rate of change is less than this setpoint, then stop modulating the AO. 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 modulating the AO.
54	CND ADJ MULT (Modulating Type)	Controls scaling of the amount the AO is adjusted. The larger the number the larger the AO adjustment as the adjustment will be multiplied by this value.
55	CND MIN ADJ (Modulating Type)	The value in this setpoint is the minimum % the AO will be modulated when a change is made.
163	CondHtOffst	This value will be added to the target pressure discharge pressure target during heating mode.

19. "MCS-CONNECT" - CONTROL STATUS DISPLAY

MCS-CONNECT screen shown here has been setup to display critical information as to the status of Relay Outputs, Analog Outputs, Set Points, Sensor Inputs and the system status of the unit. Clicking on 'Advanced' will allow the user to see addtional information. The user can setup different 'Workspaces' and save them for quick viewing (see section on 'setting up custom work-spaces in MCS-CONNECT manual.



***NOTE: USE PRINT BUTTON ON STATUS SCREEN TO CAPTURE A SNAP SHOT OF ALL DATA.**

Reference MCS-CONNECT Manual for additional information.

20. MHRC MAGNUM Setpoints

#	Name	Description
1	Cold Tank Targ	Cold Tank Target. This value is used as the base to develop the Control Zone. The control target is used with the control zone and rate of change of the controlling sensor to determine required action for the Magnum. The ± control zone values are in the High and Low Zone areas of the set point.
2	Hot Tank Targ	Hot Tank Target. This value is used as the base to develop the Control Zone. The control target is used with the control zone and rate of change of the controlling sensor to determine required action for the Magnum. The ± control zone values are in the High and Low Zone areas of the set point.
9	SPRHT TARGET	EXV control is based upon superheat, this is the Superheat target that the Magnum will control to.
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.
11	EXV LOAD ADJ	The adjustment that will be made to the EXV percentage when the circuit changes to the Loading state, or the closing adjustment that will be made when the circuit changes to the Unloading state. Note: In MOP hold state, only closing adjustments are allowed.
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 position of the EXV Valve when running. This value should be set to accommodate for hot gas if available.
16	EXV MAX %	This is the maximum position allowed when opening the valve. 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 Magnum will generate a LOW SUPERHEAT alarm.
18	LOWSUCTPSI 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 48. (When adjusting at 4x rate this will allow 12 seconds for the controller to process the results of the last action before making the next changes.
20	EXV STRT TIME	This is the time in seconds to hold the valve at the starting % 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. The Time In Seconds field if set to zero then there is no delay. If non-zero this is the time delay that allows the EXV to open before the compressor starts.
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	POWERUP DELAY	The time in seconds the system will remain in power up to allow stable power.
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. Used only with the Magnum Control Zone control method.
26	STEP DELAY	Value: This is the integration delay before making adjustments to the system capacity. Used only with the Magnum Control Zone control method. If a value is placed in the time field it will force a minimum time between compressor starts.

#	Name	Description
27	MAX ROC -	If the negative Rate of Change exceeds this value we are approaching the target fast enough. The capacity control state is set to HOLDING. Used only with the Magnum Control Zone control method.
28	MAX ROC +	If the positive Rate of Change exceeds this value we are approaching the target fast enough. The capacity control state is set to HOLDING. Used only with the Magnum Control Zone control method.
29	ROC INTERV	The number of 1 second samples used for calculating the Rate of Change. Used only with the Magnum Control Zone control method. (Maximum 60 seconds)
30	MAX LOAD %	Indicates the maximum compressor load%, or speed allowed. Usually set to 100%.
31	MIN LOAD %	Value: Indicates the minimum compressor load%, or speed allowed (usually 40%).
32	MAX ADJUST %	Indicates the maximum percentage change that can be made to compressor or VFD.
33	MIN ADJUST %	Indicates the minimum percentage change that can be made to compressor or VFD.
34	LOAD SENSITY	This controls the sensitivity of the adjustment made to the Wanted Percentage (adjustments are relative to the difference between the current control sensor and target). The larger the value the larger the adjustment (usually 1).
48	CND ADJ DELAY *(Modulating Type)*	If active this is the time in seconds between condenser adjustments to the AO. If inactive, then 30 seconds will be used as the delay. If type is DELAY: (required for condenser relay delays). -MIN VFD Opening cell contains the time delay between turning on a relay and moving the AO to its minimum position (Setpoint #52). -MAX VFD Opening cell contains the time delay between turning off a relay and moving the AO to 100%.
49	CND START % *(Modulating Type)*	If active, then the value is the starting % for the AO when the RO that is tied to it turns on. The value in the “Time (SEC)” cell is the AO starting stage. If no Relays are used when CMP starts set value.
50	CND TRGT PSI *(Modulating Type)*	Target, the logic will try to maintain by modulating the AO. The High & Low values in this set point define the control zone.
51	CND FAN DIV *(Modulating Type)*	Controls scaling of the amount the AO is adjusted (usually 1). The larger the number the smaller the AO adjustment as the adjustment will be divided by this value.
	CND VFD MIN	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 MIN SPD *(Modulating Type)*	Minimum AO % allowed. If compressor is off, then check the “Time (SEC)” field: If 0, then the AO % will be set to the value of this Setpoint. If 2 and the run/stop is set to run, then set the AO % to 100%, else set the AO % to 0%. This option is selected in the “Default Valve Opening % when Comp. is OFF” box in the condenser information section in the MAG HVAC screen.
53	CND ROC *(Modulating Type)*	Maximum negative rate of change allowed. If the rate of change is less than this Setpoint, then stop modulating the AO. 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 modulating the AO.
54	CND FAN MULT	Controls scaling of the amount the AO is adjusted. The larger the number the larger the AO adjustment as the adjustment will be multiplied by this value.
55	CND MIN ADJ *(Modulating Type)*	The value in this Setpoint is the minimum % the AO will be modulated when a change is made.
56	CMP ADJ DELY	Used with variable capacity compressors. ‘Time (sec)’ field: If used, this is the fast unloading state time delay. This option is selected in the ‘Fast Unload Delay’ box in the ‘Compressor Information’ panel under the MAG V8 screen.
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. Defines the compressor off time before restarting.
61	CMP OFF RPMs	This is the RPM value for turning off the compressor when in PUMP DOWN mode.
62	CMP SpinDown	Maximum time delay (in seconds) that a compressor can remain in the PUMP DOWN or PRE-PUMP down states. The Time in sec field specifies the time the unit can remain in unloading before shutting off the LLS & EXV and pumping down.

#	Name	Description
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. Defines the number of cycles per hour the compressor can have.
64	COMP MIN RUN	This is the minimum run time (in minutes) for a compressor once it is turned on. This minimum run time can be overridden by a safety condition.
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. At 50% of value above FLA the controller will start unloading to provide as much capacity without shutting down.
76	LO AMPS NoSTART	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. (indicates the compressor has not started. Look for a mechanical safety that's holding off the compressor.)
77	LOW SUCTION	If active, the Magnum 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.
78	LO SUCT UNLD	The purpose of this Setpoint is to take corrective action to prevent a low suction pressure safety trip. For variable step compressors: If a compressor has a suction pressure less than the value of Setpoint #77 "LOW SUCTION" plus the value of this Setpoint, then the compressor will be forced to unload. The circuit state will be changed to LO SUCT HOLD, and will remain in this state the time defined in Setpoint #101 "SAFETY HOLD DELAY". At that time, if the suction pressure has increased greater than the value of Setpoint #77 "LOW SUCTION" plus the value of Setpoint #79 "LOW SUCT RELD" the compressor will return to normal control.
79	LOW SUCT RELD	Refer to Setpoint #78 description.
80	UNSAFE SUCT	If active, the Magnum checks for unsafely 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 (3 to 10 seconds). If this Setpoint trips, the compressor will be sent straight to the Lockout state.
81	HI DISC PSI	If active, the Magnum 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. Refers to 'Discharge Pressure' column in the Circuit SI screen.
82	HI DISC UNLD	The purpose of this Setpoint is to take corrective action to prevent a high discharge pressure safety trip. For variable step compressors: If a compressor has a discharge pressure more than the value of Setpoint #81 "HI DISC PSI" minus the value of this Setpoint, then the compressor will be forced to unload. The circuit state will be changed to HI DISC HOLD, and will remain in this state for a minimum of the time in Setpoint #101 "SAFETY HOLD DELAY". At that time, if the discharge pressure has decreased below than the value of Setpoint #81 "HI DISC PSI" minus the value of Setpoint #83 "HI DISC RELD" the compressor will return to normal control.
83	HI DISC RELD	Refer to Setpoint #82 description.
87	HI DISC TMP	If active, the Magnum checks for high discharge temperature for each compressor. If the discharge temperature sensor reading is greater than this Setpoint for the specified period of time, a safety trip will occur. Refers to 'Discharge Temperature' column in the Circuit SI screen.
88	DIS TMP UNLD	The purpose of this Setpoint is to take corrective action to prevent a high discharge temperature safety trip. For variable step compressors: If a compressor has a discharge temperature more than the value of Setpoint #87 "HI DISC TMP" minus the value of this Setpoint, then the compressor will be forced to unload. The circuit state will be changed to HI DISC HOLD, and will remain in this state for a minimum of the time in Setpoint #101 "SAFETY HOLD DELAY". At that time, if the discharge temperature has decreased below than the value of Setpoint #87 "HI DISC TMP" minus the value of Setpoint #89 "HDISC T RELD" the compressor will return to normal control.
89	DIS TMP RELD	Refer to Setpoint #88 description.

#	Name	Description
91	LOW DIF PSI	Pressure differential between SUCT and DISCH. pressure is lower than this value, a safety trip occurs.
92	Unsafe DifPsi	If active, the Magnum checks for unsafe differential oil pressure. If the calculated differential oil pressure is less than this value for the specified period of time, a lockout occurs. NOTE: The time period specified should be very short (3 to 5 seconds). If this Setpoint trips, the compressor will be sent straight to the Lockout state. Refers to 'Oil Pressure' column in the Circuit SI screen.
101	SAFETY HOLD	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 Low refrigerant temperature High discharge pressure High discharge temperature High amperage
105	NO FLOW	If active, flow is lost, and only one pump is present, then the system 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. If 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. If looking at individual pumps for each circuit in the Circuit base. Make this Setpoint a "Lockout". If flow is not made within the value of this Setpoint the first time than, an alarm will be generated. The system counts through the value of this Setpoint a second time, if flow is made then the unit will run as normal. If flow is not made the second time, the pump and all associated compressors for that circuit will be locked out.
108	PUMP 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 Magnum 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.
139	HI PSI SW	If activated this is the elapsed time before a trip occurs and compressor shuts down on safety.
151	UNLOADED OFF	If active, the system is fully unloaded and the control temperature is greater than this value, then the capacity state will be set to holding. 'Time (sec)' field: If non-zero, then the value of this Setpoint is used as a differential and not a set temperature. The value of this Setpoint is subtracted from Setpoint #1.
153	SftyUnld DLY	The time delay in seconds between compressor capacity adjustments when safety unloading.
154	SftyUnld Adj	The VFD percentage adjustment to be made after every amount of time in Setpoint #153 "SftyUnld Del" when safety unloading.
157	HP LoSuctAdj	This Setpoint is only used when the heat pump option has been selected in the 'Unit Type' box in the 'General Information' panel under the MAG V8 screen. When in heating mode, the low suction value Setpoint #77 "LOW SUCTION" is reduced by the value of this Setpoint.
158	DEF START TMP	If a defrost option has been specified and either coil #1 or coil #2 temperature is less than or equal to this Setpoint a defrost cycle will be started if sufficient time has elapsed since the last defrost.
159	DEF START DEL	Time in minutes between defrost cycles.
161	DEF STOP TMP	If both coil #1 and coil #2 temperature are greater than the value of this Setpoint, then the defrost cycle can be terminated.
162	DEF STOP DEL	The length of time in minutes of the defrost cycle.
163	CND HP OFFSET	If active, then this value will become the target temperature during heating mode.
164	SwModeDelay	Default delay when MHRC2 is switching modes, heat to cool, cool to heat, etc...
171	FLA COMP#1	Full Load Amps for compressor #1. This is the amps at design suction and discharge pressures referenced in the MCS-Config RO screen. This value is used to calculate the high and the low amperage safety limits. Refer to Set points #75 and #76.
212	CmpVFDFault	If activated this is the elapsed time before a trip occurs and compressor shuts down on safety.

21. MHRC MAGNUM Alarms and Safeties

21.1 Introduction

There are three types of alarms that are generated by the MHRC MAGNUM control logic:

- Information only alarms,
- MHRC MAGNUM system alarms and
- MHRC MAGNUM setpoint safety alarms.

All of the alarms have the same format. The alarm is identified and it is date time stamped. Alarms can be viewed from the MCS-MAGNUM by pressing the ALARM STATUS (4) key or from the MCS-CONNECT program.

21.2 Information only alarms

21.2.1 System generated alarms

The following alarms are generated to provided 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 Magnum was lost.
- **POWER RETURNED** – Generated when power to the Magnum 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 Magnum from running. It means the historical data may be incorrect (run times, cycles, min/max values, and trend/graph data).
- **WATCHDOG RESET** – The Magnum has reset itself because of improper operator of the Magnum board. Please consult the manufacturer if this alarm has occurred.
- **LOST A/D CONVTR** – The Magnum 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 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 Magnum is not getting power from the Battery.

21.2.2 Alarms as a result of user actions

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

- **LOCKOUT RESET** – Generated when a user resets a compressor other unit from a locked condition.
- **COMPUTER RESET** – Generated when the manual reset button on the Magnum is pressed.
- **ALARMS CLEARED** – Generated when a user clears the alarm history.
- S**TPT 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 Magnum real time clock.
- CFG DOWNLOADED – Generated when a user uploads a new configuration file into the Magnum.
- **ETHERNET CHANGE** – Generated when a user makes a change to the Ethernet settings through the Keypad/Display.

21.2.3 Alarms generated by the control algorithm

The following alarms indicate that the control algorithm took action:

- DAYLIGHT SAVINGS

21.3 MHRC MAGNUM system alarms

21.3.1 Alarms are generated by the MHRC MAGNUM control algorithm:

21.**3**.1**.1** Configuration problem alarms

These alarms indicate a problem with the configuration file that has been loaded into the system. The system is not operational, a configuration must be transmitted to the unit form MCS-CONNECT or the config chip must be replaced with a valid one.

- INVALID CONFIG. (check sums are incorrect)
- INVALID CFG VER (version number of the configurator is invalid)
- INVALID CFG TYPE (the type does not agree with software, MHRC software with a home unit configuration)

21.**3.1.2** MCS I/O network problem alarms

These alarms indicate problems with the MCS I/O network, the system can be accessed but the system is in a lock out state, LOST I/O.

- LOST IO SHUTDOWN

21.**3.1.3** Sensors fault alarms

This alarm indicate a problem with a key sensor, it is either shorted or open. The alarm will contain ALARM followed by the 8-character name of the sensor.

The following sensors related to the entire system are tested:

- Supply Air Temperature - if failure occurs unit is LOCKED OUT.
- Ambient temperature - if failure occurs unit continues to run and alarm is generated.

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

- Suction pressure - if failure occurs compressor is LOCKED OUT.
- Discharge pressure - if failure occurs compressor is LOCKED OUT.

21.4 MHRC Unit Safeties

21.4.1 Introduction

The MHRC MAGNUM algorithm incorporates a number of safety checks to ensure MHRC unit operates in a safe matter. When a unit safety trip occurs the MHRC's control state goes to " NO RUN-LOCK OUT". The unit will remain in this state until a lockout reset is perform via the LCD/Keypad or MCS-CONNECT.

21.4.2 Unit Safeties

For a safety to be interrogated, both the associated sensor input and the lockout setpoint must be active. If a safety trips, the alarm name will consist of the setpoint name.

LOW SUPPLY TEMPERATURE

If the supply temperature falls below the value in calculated value of setpoint #1 "SUPPLY TARG" minus the value in set point #54, "LO SUPPLY-T1" and it remains there for the time specified in the safety time of that setpoint, a "LO SUPPLY- T1" alarm generated. No change to system status will be made.

HIGH SUPPLY TEMPERATURE

If the supply temperature is greater than the value in calculated value of setpoint #1 "SUPPLY TARG" plus the value in set point #55, "HI SUPPLY-T1" and it remains there for the time specified in the safety time of that setpoint, a "HI SUPPLY- T1" alarm is generated. No change to system status will be made.

UNSAFE SUPPLY TEMPERATURE

If the supply temperature is greater than the value in set point #59, "UnsafeSupply" and it remains there for the time specified in the safety time of that setpoint, the MHRC will be locked out and a "UnsafeSupply" alarm is generated.

VFD FAULT

If the VFD FAULT input goes ON and it remains there for the time specified in the safety time of setpoint #57 "VFD FAULT", the MHRC will be locked out and a "VFD FAULT" alarm generated. This fault requires a manual reset via the LCD/Keypad or MCS-CONNECT.

PHASE LOSS

If the digital input for the phase loss indicator is on and it remains on for two seconds, the MHRC will be locked out and a “PHASE LOSS” alarm generated. This fault requires a manual reset via the LCD/Keypad or MCS-CONNECT.

HIGH CONDENSATION

If the digital input for the high condensation indicator is on and it remains on for the time specified in the safety time of that setpoint, #58, a “HI SUMP LVL” alarm is generated. This alarm will identify which indicator is on. No change to system status will be made.

21.5. MHRC Compressor Safeties

21.5.1 Introduction

The MHRC MAGNUM algorithm incorporates a number of safety checks to ensure that the various components that make up the MHRC package are not damaged. These types of safeties are based upon setpoints. When a safety trip occurs the compressor’s state goes to “SAFETY TRIPPED”. The compressor state will remain as “SAFETY TRIPPED” for ten minutes before the compressor’s state is set to “CMP IS OFF” state. If a second safety trips occurs within two hours of the first trip, the compressor state becomes “CMP LOCKED OUT”. In this matter the MHRC MAGNUM attempts to take corrective action before any internal safeties of the compressors are activated or the MHRC unit is damaged.

21.5.2 Compressor safeties

For a safety to be interrogated, both the associated sensor input and the lockout setpoint must be active. If a safety trips, the alarm name will consist of the setpoint name plus a number indicating which compressor tripped.

The following are a list of safeties that are incorporated in the MHRC control for scroll compressors. These safeties are checked every second. Each compressor is tested individually. If a safety condition exists, action will be taken on that compressor only, other compressor will continue to function normally.

LOW SUCTION PRESSURE

If the suction pressure drops below the value of the setpoint #45 “LOW SUCTION” and it remains there for the time specified in the safety time of that setpoint, the compressor’s safety will trip and a : LOW SUCTION #?” alarm will be generated.

For the first 5 minutes after a compressor start, the safety time is extended by 2 minutes. This enables the setpoint safety time to be set much tighter for normal operation.

UNSAFE SUCTION PRESSURE

Similar to the low suction pressure safety except this setpoint is set up with a lower value and a very short safety time. If the suction pressure drops below the value of the setpoint #46 “UNSAFE SUCT” and it remains there for the time specified in the safety time of that setpoint, the compressor is locked out (this safety is not give two trips before locking out) and an “UNSAFE SUCT #?” alarm generated.

For the first 5 minutes after a compressor start, the safety time is extended by 2 times the normal safety time. This enables the setpoint safety time to be set much tighter for normal operation.

LOW DISCHARGE PRESSURE

If the discharge pressure drops below the value of the setpoint #49 “LO DISCH PSI” and it remains there for the time specified in the safety time of that setpoint, the compressor’s safety will trip and a “LO DISCH PSI #?” alarm will be generated.

HIGH DISCHARGE PRESSURE

If the discharge pressure raised above the value of the setpoint #47 “HI PSI ALARM” and it remains there for the time specified in the safety time of that setpoint, the compressor’s safety will trip and a “HI PSI ALARM #?” alarm will be generated.

UNSAFE DISCHARGE PRESSURE

If the discharge pressure raised above the value of the setpoint #48 “UNSAFE DISCH” and it remains there for the time specified in the safety time of that setpoint, the compressor’s safety will trip and a “UNSAFE DISCH #?” alarm will be generated.

HI COMP AMPS

Hi compressor amps safety is based on the calculated value of the setpoint #39 “HI COMP AMPS” times the value of the compressor’s setpoint for FLA (setpoints #35 thru #38). If the ampere raises above the calculated value and it remains there for the time specified in the safety time of that setpoint, the compressor’s safety will trip and a “HI COMP AMPS#?” alarm will be generated.

This safety is bypassed for the first 3 seconds after a compressor is started.

LO COMP AMPS

Low compressor amps safety is based on the calculated value of the setpoint #40 “LO COMP AMPS” times the value of the compressor’s setpoint for FLA (setpoints #35 thru #38). If the ampere falls below the calculated value and it remains there for the time specified in the safety time of that setpoint, the compressor’s safety will trip and a “LO COMP AMPS#?” alarm will be generated.

This safety is bypassed for the first 3 seconds after a compressor is started.

21.6 Condenser Fan safeties

For a safety to be interrogated, both the associated sensor input and the lockout setpoint must be active. If a safety trips, the alarm name will consist of the setpoint name plus a number indicating which condenser fan tripped.

The following are a list of safeties that are incorporated in the MHRC control for condenser fans. These safeties are checked every second. Each condenser fan is tested individually. If a safety condition exists, action will be taken on that condenser fan only, other condenser fans will continue to function normally.

HI COND AMPS

Hi condenser fan amps safety is based on the calculated value of the setpoint #52 “HI COND AMP” times the value of the condenser fan FLA setpoint #51. If the ampere raises above the calculated value and it remains there for the time specified in the safety time of setpoint #52, the condenser safety will trip and a “HI COND AMPS#?” alarm will be generated. The condenser fan is locked out and must be reset manual via the LCD/ Keypad or MCS-CONNECT.

LO COND AMPS

Low condenser fan amps safety is based on the calculated value of the setpoint #53 “LO COND AMP” times the value of the condenser fan FLA setpoint #51. If the ampere falls below the calculated value and it remains there for the time specified in the safety time of setpoint #53, the condenser safety will trip and a “LO COND AMPS#?” alarm will be generated. The condenser fan is locked out and must be reset manual via the LCD/ Keypad or MCS-CONNECT.

21.7 Heating Stages Safeties

For a safety to be interrogated, both the associated sensor input and the lockout setpoint must be active. If a safety trips, the alarm name will consist of the setpoint name plus a number indicating which condenser fan tripped.

The following are a list of safeties that are incorporated in the MHRC control for heating stages. These safeties are checked every second if the associated heating stage is on. Each heating stage is tested individually. If a safety condition exists, action will be taken on that heating stage only, other heating stages will continue to function normally.

HIGH HEAT AMP

High heating stage amps safety is based on the calculated value of the setpoint #89 “HI HEAT AMP” times the value of the heating stage FLA setpoint #83 through #88. If the ampere raises above the calculated value and it remains there for the time specified in the safety time of setpoint #89, the heating stage safety will trip and a “HI HEAT AMP#?” alarm will be generated. The heating stage is locked out and must be reset manual via the LCD/Keypad or MCS-CONNECT.

LOW HEAT AMP

Low heating stage amps safety is based on the calculated value of the setpoint #90 “LO HEAT AMP” times the value of the heating stage FLA setpoint #83 through #88. If the ampere raises above the calculated value and it remains there for the time specified in the safety time of setpoint #(), the heating stage safety will trip and a “LO HEAT AMP#?” alarm will be generated. The heating stage is locked out and must be reset manual via the LCD/Keypad or MCS-CONNECT.

HTR OFF AMP

The heating stage is off but the amp drawn sensor indicates current. This indicates a heater welded condition

21.8 EVAPORATOR SAFETIES

FAN VFD ALM

Indicates a fault with the evaporator’s fan VFD

22. APPENDIX A - MAGNUM No Run Capacity Run States

There are a number of functions that will not allow the MHRC to run, as follows: (These may be viewed by pressing selecting ‘Status” from the Menu key.)

1. UNIT IN POWER UP-

The MAGNUM Chiller V8 software utilizes Set Point #23 “Power Up Delay” (Typically 60 seconds) prior to starting the algorithm.

2. RUN/STOP SW OFF-

(Optional)- Hard wired to a sensor input.

3. NETWORK SW OFF-

(Optional)- This is wired via a communication port from a BMS system.

4. OFF- NO EVAP FLOW-

Flow switch input is not made.

5. NO RUN-I/O LOST-

Communication to the Input and Output expansion boards is checked once every second. (Visual verification can be made by viewing the LED next to the MAGNUM-I/O communications terminal block. If communications is lost to any board the entire LCC is shut down & locked out and a “LOST I/O SHUTDOWN” alarm is generated. The user is required to correct the communication lost and press the Lockout Reset button on the MAGNUM’s Keypad or thru MCS-CONNECT.

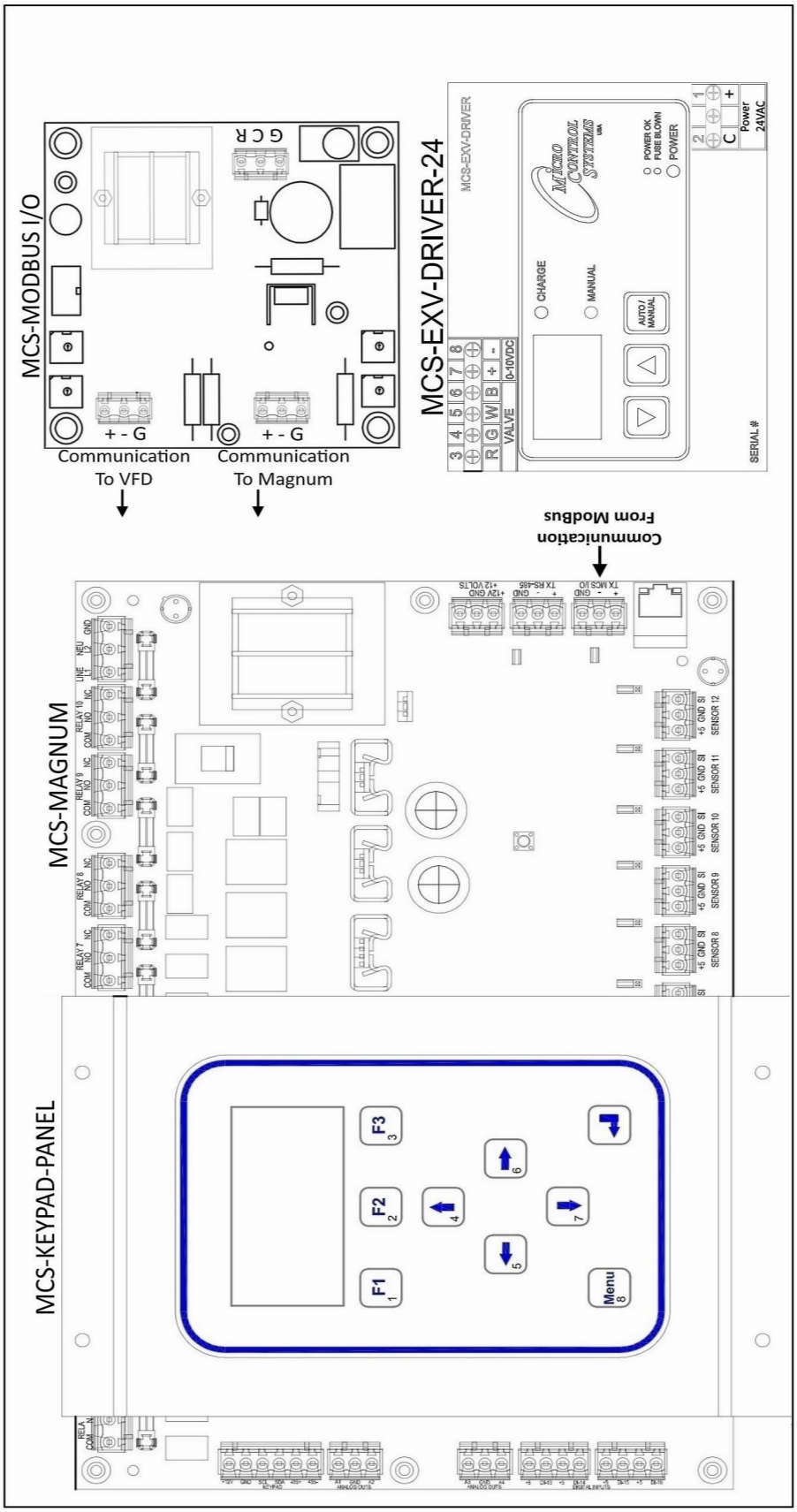
6. UNIT IN LOCKOUT-

This state is entered whenever a critical situation is encountered that could cause harm to the MHRC. Items such as no flow, invalid critical sensor 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 RO’s except ALARM RO and the oil heater RO for screws with an oil pump are turned OFF & placed in the ‘LOCKOUT’ state.

7. SCHEDULED OFF-

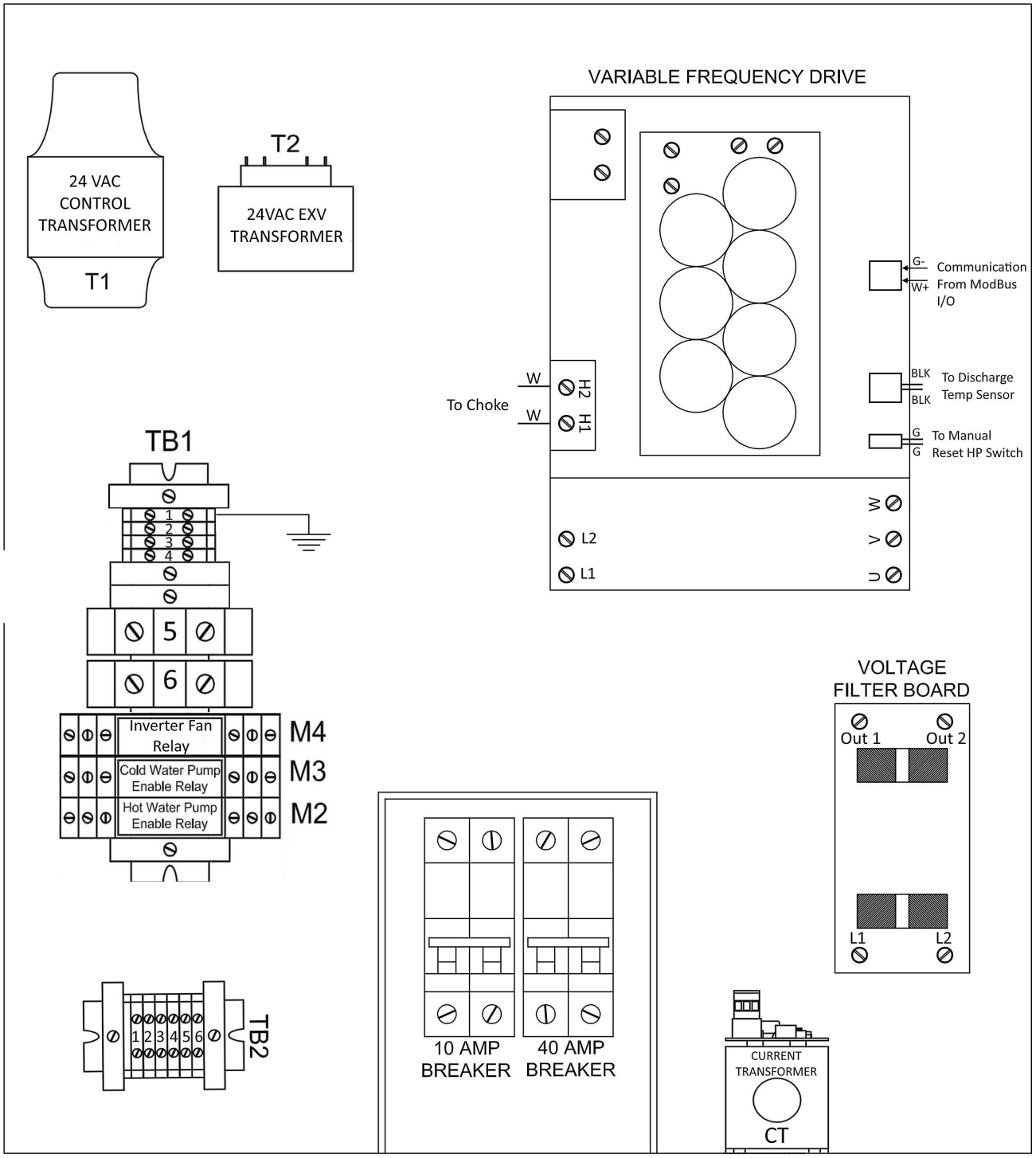
This state is entered when the schedule is calling for the chiller to be off.

APPENDIX C - Controls Layout Page 1 of 2



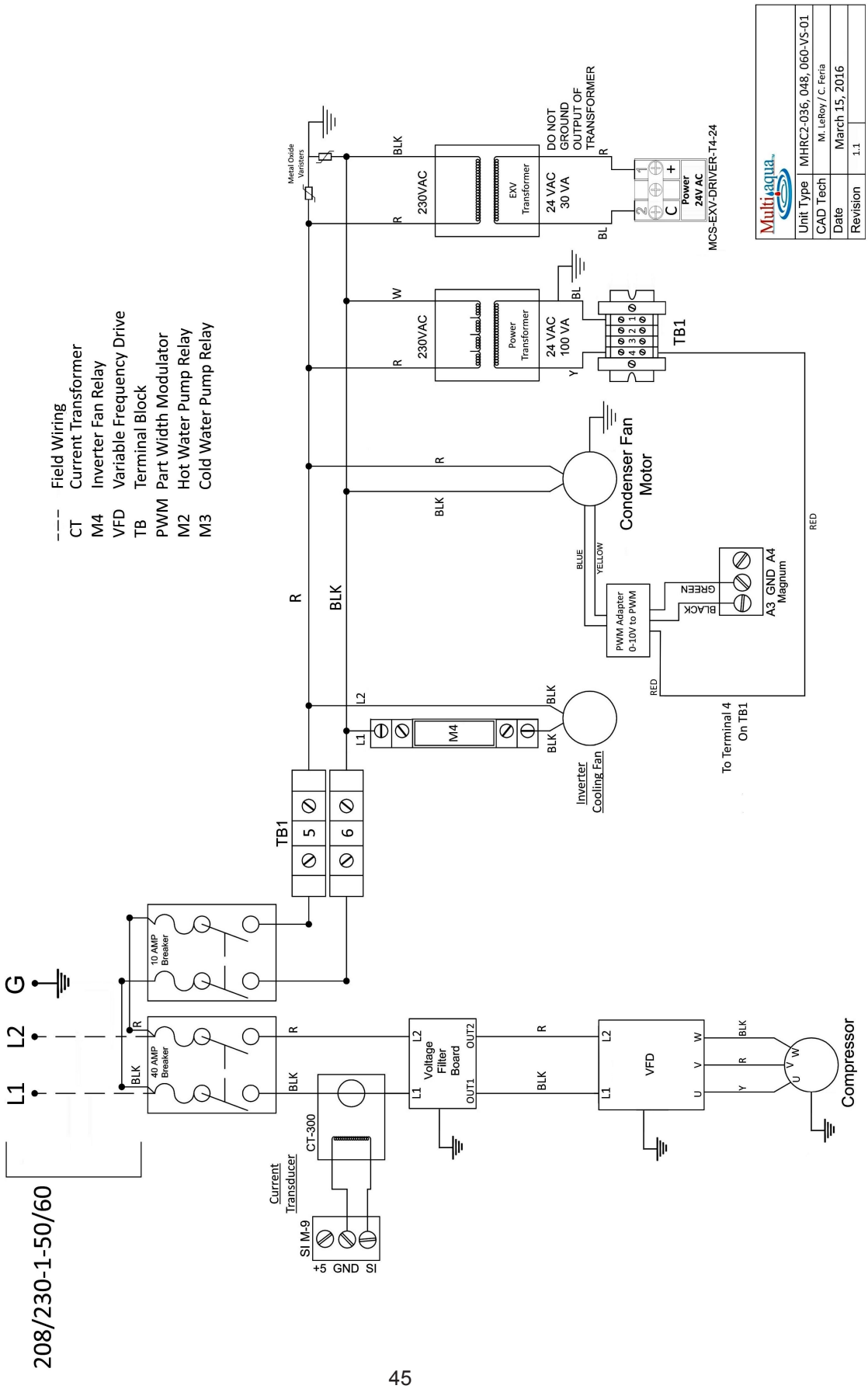
Unit Type	MHRC2-036, 048, 060-VS-01
CAD Tech	M. LeRoy / C. Feria
Date	March 15, 2016
Revision	1.1

APPENDIX C - Controls Layout Page 2 of 2

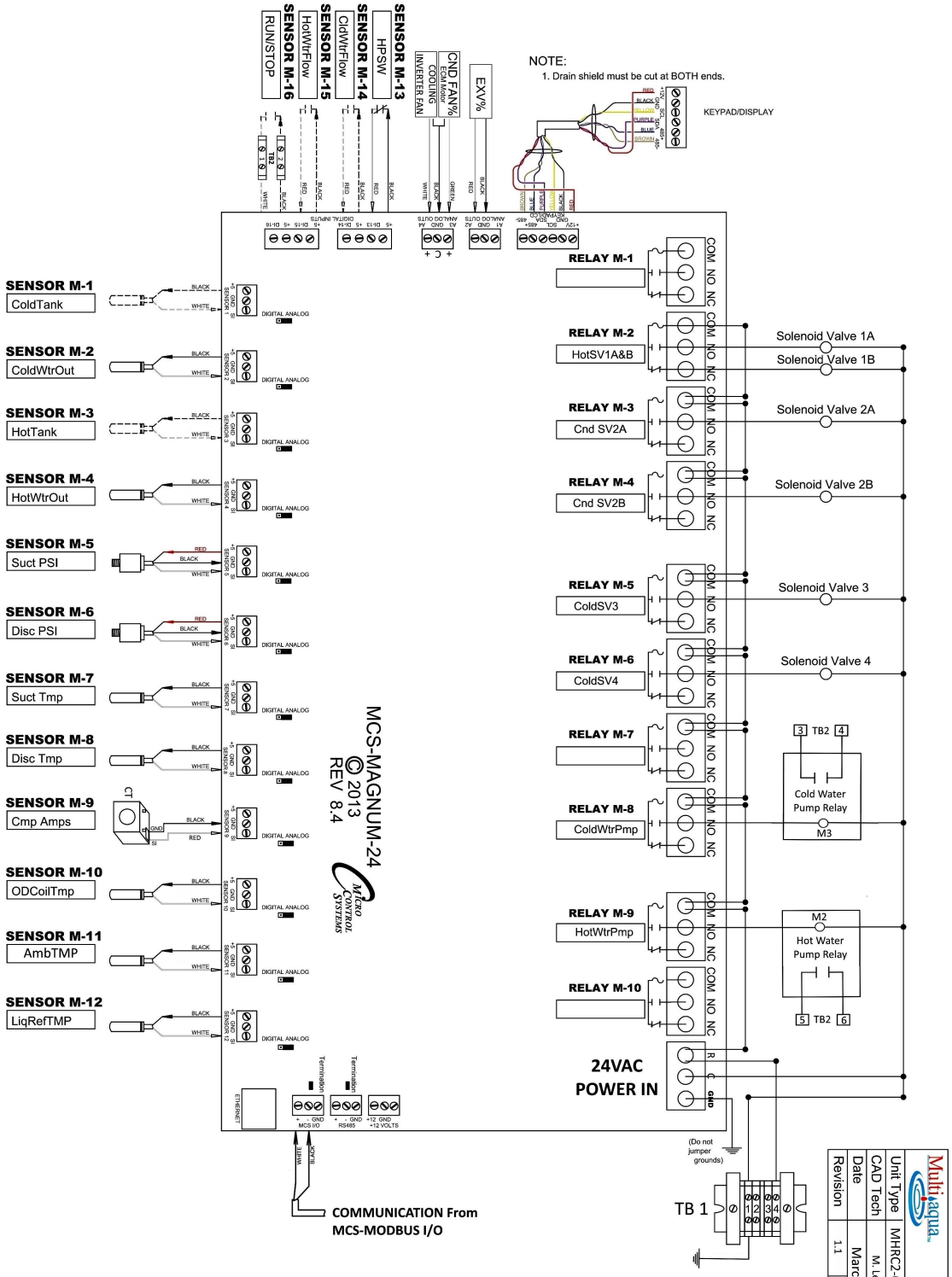


Multiaqua	
Unit Type	MHRC2-036, 048, 060-VS-01
CAD Tech	M. LeRoy / C. Feria
Date	March 15, 2016
Revision	1.1

APPENDIX D - Wiring Diagram



APPENDIX E - MHRC Frequency Drive Drawings



NOTES:

1. Sensors MUST use shielded cable and shield must not be broken. The shield must be connected only at the Sensor Input terminal block

2. All sensor inputs are 0 to 5vdc.

3. Amp input sensors are field wired and must be shielded cable. They generate their own voltage and do not require 5vdc from the MCS unit.

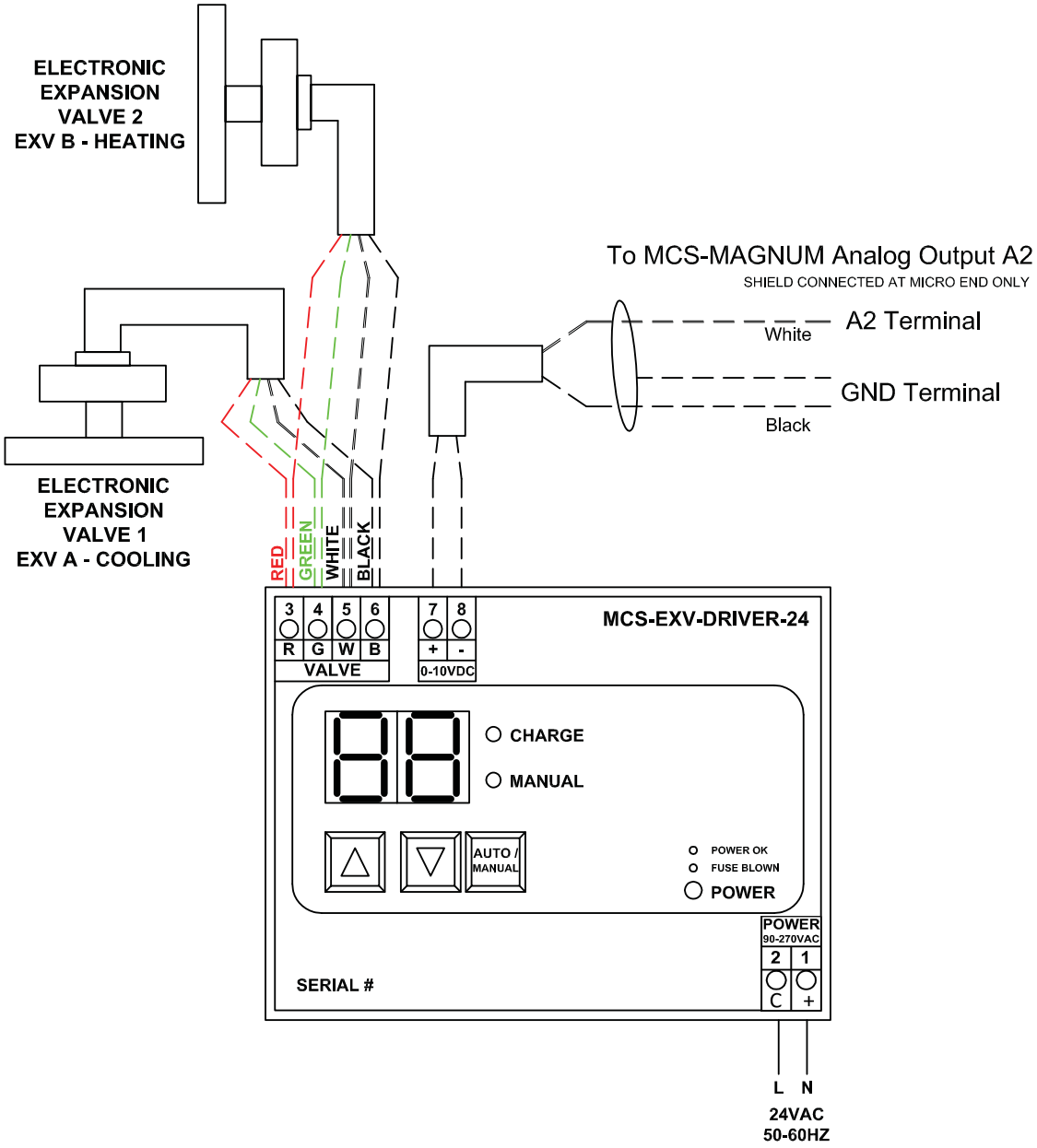
4. Digital input sensors are field wired and must be shielded cable. The 5vdc is taken out from the sensor terminal and wired through the switch. The jumper must then be set to digital.

5. Factory wired: _____
Field wired: _____

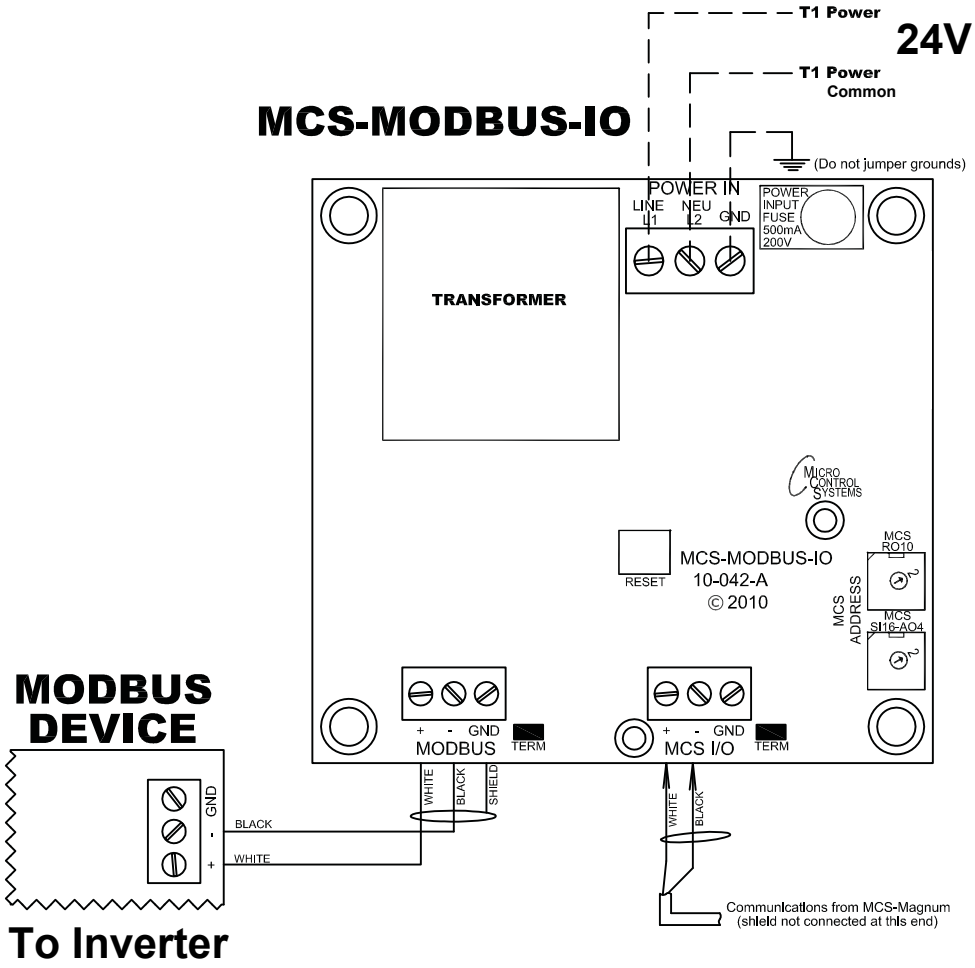
6. Digital Sensor Jumper : ▬
Analog Sensor Jumper : ▪

Unit Type	MHRC2-036, 048, 060-VS-01
CAD Tech	M. LeRoy / C. Feria
Date	March 15, 2016
Revision	1.1

APPENDIX E - MHRC Frequency Drive Drawings



Unit Type	MHRC2- FREQUENCY
CAD Tech	C. Feria
Date	4-15-16
Revision	



Unit Type	MHRC2- FREQUENCY
CAD Tech	C. Feria
Date	4-15-16
Revision	

28. APPENDIX **F** - Configuration Files - Frequency Drive

System Information

Company Name:	MULTI AQUA
Site and/or Unit Name:	MHRC #1
Model Name:	VFD SCROLL
Serial Number:	2015-07-0000001
Config Version:	17
Config Type:	MHRC Mag
Technician Initials:	BWW
Revision Number:	C
Firmware Version:	
Installation date:	
Date and Time of creation and/or last modification:	4-18-16 at 11:35 PM

MAGNUM Controller Information

Display Units	Deg F \ PSI
Default Display Key	UNIT STATUS

Total Number of RO's	10
Total Number of AO's	7
Total Number of SI's	32
Total Number of RO Boards	0
Total Number of SI Boards	1
Type of I/O Boards	RO-10 & SI-16-AO4
MCS-Thermostat?	No
Max Lockout Resets per Day:	6
Lockout Reset SI:	Not Used
Display Alarm Character(a) On Keypad LCD Screen:	No
AUTH Level Bypass:	Supervisor Level
History Sample Rate:	1
Activate Keypad Cursor Quick Move Feature?	No
Generate Alarm for Network Time Synchronization:	No
Generate Alarm When Configuration is Updated:	No

Daylight Savings Time Active	Yes	DOW	Sunday	Hour	2
Spring Forward Month	MAR	Begin Date	8	End Date	14
Fall Back Month	NOV	Begin Date	1	End Date	7

RS485 Communication

MCS Network Address:	1
Protocol Type:	MCS
Baud Rate:	19200
Disable Alarm Grid Pop-Up In MCS-Connect?	No

Ethernet Communication

IP Adress:	192 . 168 . 100 . 10
Subnet Mask:	255 . 255 . 255 . 0
Default Gateway:	0 . 0 . 0 . 0
TCP/IP Port:	5001
BACnet Port:	47808
Extended BACnet Device ID:	18100
BACnet MV Values Start At:	One

Graphic file : C://MCS/Graphics/

Output and Input Information for Magnum

#	Output Name	Type
M-1	COMP	Step w\ EXV
M-2	HotSV1A&B	Standard
M-3	Cnd SV2A	Standard
M-4	Cnd SV2B	Standard
M-5	ColdSV3	Standard
M-6	ColdSV4	Standard
M-7	COND FAN	Standard
M-8	PUMP COLD	Standard
M-9	PUMP HOY	Standard
M10	ALARM	Standard

#	Input Name	Type	Digital or OffSet
M-1	C TANK TMP	MCST100	0
M-2	C WTR OUT	MCST100	0
M-3	H TANK TMP	MCST100	0
M-4	H TANK OUT	MCST100	0
M-5	SUCT PSI	MCS-667	0
M-6	DISC PSI	MCS-667	0
M-7	SUCT TMP	MCST100	0
M-8	DISC TMP	MCST100	0
M-9	AMPS	CT-300	0
M10	ODCoilTmp	MCST100	0
M11	L PSI OUT	MCS-667	0
M12	L TEMP OUT	MCST100	0
M13	HPSI MANSW	DIGITAL	Closed=OFF
M14	FLOW COLD	DIGITAL	Open=OFF
M15	FLOW HOT	DIGITAL	Closed=OFF
M16	RUN/STOP	DIGITAL	Open=OFF
1-1	SUB COOL	SUBCOOL	0
1-2	HEAT MODE	User Logic	0
1-3	CND OFFSET	User Logic	0
1-4	MB RPM	MODBUS	0
1-5	MB AMPS	MODBUS	0
1-6	MB PHASE	MODBUS	0
1-7	MB DISCTMP	MODBUS	0
1-8	MB CMP TMP	MODBUS	0
1-9	SPARE1-9	SPARE	0
1-10	SPARE1-10	SPARE	0
1-11	SPARE1-11	SPARE	0
1-12	SPARE1-12	SPARE	0
1-13	SPARE1-13	SPARE	0
1-14	SPARE1-14	SPARE	0
1-15	SPARE1-15	SPARE	0
1-16	RPM CALC	User Logic	0

#	AO Name
M-1	COMP %
M-2	EXV %
M-3	CND FAN %
M-4	SPAREM-4
1-1	COMP ENABL
1-2	COMP SPEED
1-3	VFD RESET

Sensor Input Detailed Information for Magnum

#	Sensor Name	Display Type	Offset Value	Manual or NC/NO	Display Text	Temp Sensor	Humid Sensor	Auto Manual	Circuit Index	Multiplier	Divisor	Offset	Select Display Type	Filter (in Sec.)	SF Low	SF High	Enable/Disable Sensor Faults	BMS_SI High Limit	BMS_SI Low Limit	BMS_SI Def Value	BMS_SI Index
M-1	C TANK TMP	MCST100	0	60	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-2	C WTR OUT	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-3	H TANK TMP	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-4	H TANK OUT	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-5	SUCT PSI	MCS-667	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-6	DISC PSI	MCS-667	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-7	SUCT TMP	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-8	DISC TMP	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M-9	AMPS	CT-300	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M10	ODCoilTmp	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M11	L PSI OUT	MCS-667	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M12	L TEMP OUT	MCST100	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
M13	HPSI MANSW	DIGITAL	Not Used	Closed=OFF	OK/TRIP	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	Not Used	Not Used	DISABLED	Not Used	Not Used	Not Used	Not Used
M14	FLOW COLD	DIGITAL	Not Used	Open=OFF	NO/YES	Not Used	Not Used	Manual ON	Not Used	Not Used	Not Used	Not Used	Not Used	0	Not Used	Not Used	DISABLED	Not Used	Not Used	Not Used	Not Used
M15	FLOW HOT	DIGITAL	Not Used	Closed=OFF	NO/YES	Not Used	Not Used	Manual ON	Not Used	Not Used	Not Used	Not Used	Not Used	0	Not Used	Not Used	DISABLED	Not Used	Not Used	Not Used	Not Used
M16	RUN/STOP	DIGITAL	Not Used	Open=OFF	STOP/RUN	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	Not Used	Not Used	DISABLED	Not Used	Not Used	Not Used	Not Used
1-1	SUB COOL	SUBCOOL	0	0	Not Used	L TEMP OUT	L PSI OUT	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
1-2	HEAT MODE	User Logic	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Spare	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-3	CND OFFSET	User Logic	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	PSI GAGE	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
1-4	MB RPM	MODBUS	0	0	Not Used	Not Used	Not Used	Auto	Not Used	1	10	0	RPM'S	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-5	MB AMPS	MODBUS	0	0	Not Used	Not Used	Not Used	Auto	Not Used	1	0.1	0	AMPS/CT	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
1-6	MB PHASE	MODBUS	0	0	Not Used	Not Used	Not Used	Auto	Not Used	1	1	0	TEMP	0	-99.9	999.9	DISABLED	Not Used	Not Used	Not Used	Not Used
1-7	MB DISCTMP	MODBUS	0	0	Not Used	Not Used	Not Used	Auto	Not Used	1	10	0	Spare	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-8	MB CMP TMP	MODBUS	0	0	Not Used	Not Used	Not Used	Auto	Not Used	1	1	0	Spare	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-9	SPARE1-9	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-10	SPARE1-10	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-11	SPARE1-11	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-12	SPARE1-12	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-13	SPARE1-13	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-14	SPARE1-14	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-15	SPARE1-15	SPARE	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	Not Used	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used
1-16	RPM CALC	User Logic	0	0	Not Used	Not Used	Not Used	Auto	Not Used	Not Used	Not Used	Not Used	RPM'S	0	-999	9999	DISABLED	Not Used	Not Used	Not Used	Not Used

APPENDIX F

MAG V17 CHL Information

General Information

Number of Circuits:	1	
Total Capacity Steps:	1	
Unit Type	Cooling Only	
1st MOD Motor Limit:	Not Used	
Turbo Ice Machine:	No	
Lost BMS Comm.:	Run	

Unit Control

Run/Stop Switch:	SI M16	RUN/STOP
Network Run/Stop:	Not Used	
Emergency Stop Switch:	Not Used	

Heat Control

Heat Mode Indicator	Not Used	
Common Reversing Valve	Not Used	

Unit Indicators

Warning Relay:	Not Used	
Alarm Output:	RO M10	ALARM
Control Relay:	Not Used	
Lag On/Off RO:	Not Used	
Unit Status Relay:	Not Used	

Unit Power

Phase Loss:	Not Used	
Voltage A:	Not Used	
Voltage B:	Not Used	
Voltage C:	Not Used	
Amps A:	SI 3-9	SPARE3-9
Unit KW:	Not Used	

Unit Sensors

Smoke Indicator:	Not Used
Enthalpy Sensor:	Not Used
Ambient Temperature:	Not Used
Ambient Humidity:	Not Used
Demand Limit FLA%:	Not Used
Demand Limit Steps:	Not Used

Vestibule Control

Temp Control Sensor:	Not Used
Fan Relay:	Not Used
Cooling Relay:	Not Used
Heating Relay:	Not Used

Compressor Information

Compressor Type:	VFD Scroll
Keep Running Comp. at 100% when Starting next?	No
Unload Compressor before Starting next?	0 Seconds
Fast unload Delay?	30 Seconds
Minimum Delay between Comp. starts?	120 Seconds
Pre-Pumpout?	Yes
Last Stage to 100% (Override Setpoint)?	No
Lube State Oil Setpoint?	Actual Temp Value
Oil Heater Control Setpoint?	Actual Temp Value
Rotate On?	Run Time
Vane Control Method	Compressor FLA%
Wanted FLA-Starting Next Comp.	Use Min FLA-(Stpt #31)
Control of Oil Pump	Pump Always On

Evaporator Information

Capacity Control

Control Method:	Control Zone	
Control Temperature On:	Leaving Temp	
Entering Temperature:	SI M-3	H TANK TMP
Leaving Temperature:	SI M-1	C TANK TMP
Target Reset:	Normal AI 0-5 Volts	
Target (SP #1) Reset:	Not Used	
Refrigerant Type:	R410A	

Pump/Fan

Flow Switch A:	SI M14	FLOW COLD
Pump/Fan #1A:	RO M-8	PUMP COLD
Pump/Fan #2A:	Not Used	
Flow Switch B:	SI M15	FLOW HOT
Pump/Fan #1B:	RO M-9	SPARE5-7
Pump/Fan #2B:	Not Used	

Circuit Valve/Pump Control

Force One Always On?	No

Process Control

Process Output Type is Modulating (AO)	
Process Pump Relay #1:	Not Used
Process Pump Relay #2:	Not Used
Process Control Type is VFD	
VFD Speed AO #1:	Not Used
VFD Speed AO #2:	Not Used
Pressure SI IN #1:	Not Used
Pressure SI IN #2:	Not Used
Pressure SI OUT #1:	Not Used
Pressure SI OUT #2:	Not Used
VFD Fault #1:	Not Used
VFD Fault #2:	Not Used
Evap Tonnage:	Not Used

Heat Control

Defrost Type:	Reverse Cycle
Barrel Heater Relay:	Not Used
Reheat Control:	Not Used

Condenser Information

Condenser Type:	Modulating Step Common	
Starting Condenser Relay:	RO M-7	COND FAN
Number of Condenser Stages:	1	
Fan AO:	AO M-3	CND FAN %
AO Starting Stage:	1	
Condenser Starting Fault:	Not Used	
Number of Condenser Faults:	0	
Sump Temperature:	Not Used	
Condenser Reset:	SI 1-3	CND OFFSET
Control Condenser On:	Disc PSI	
Fluid Cooler Economizer?	No	
Newly Started Comp Controls Common Fan Bank		No
Default Analog Output % When Compressor is OFF		0%
Start Control on Analog Output:		Below, But Near, Control Zone

Lockout Information

Lockouts based on I/O boards not enabled

Boiler Information

Boiler Logic Not Enabled

Circuit Information on Next Page ---->

Circuit Information

Name	Circuit #1	Circuit #2	Circuit #3	Circuit #4	Circuit #5	Circuit #6	Circuit #7	Circuit #8
Number of Compressor ROs	6	0	0	0	0	0	0	0
Starting Compressor RO	COMP	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Part Winding?	No	No	No	No	No	No	No	No
Start Unload Bypass?	No	No	No	No	No	No	No	No
Fast Unloader?	No	No	No	No	No	No	No	No
Liquid Line Solenoid	EXV & LLS	None	None	None	None	None	None	None
Second Liquid Line?	No	No	No	No	No	No	No	No
Economizer?	No	No	No	No	No	No	No	No
Economizer Control	Slide %	Slide %	Slide %	Slide %	Slide %	Slide %	Slide %	Slide %
Number of ULS per Compressor	0	0	0	0	0	0	0	0
Loader Type	Unloaders	Unloaders	Unloaders	Unloaders	Unloaders	Unloaders	Unloaders	Unloaders
Hot Gas Bypass?	None	None	None	None	None	None	None	None
Hot Gas Reheat?	No	No	No	No	No	No	No	No
Liquid Injection?	No	No	No	No	No	No	No	No
Oil Equalization?	No	No	No	No	No	No	No	No
Mod Motor Control?	No	Yes	No	No	No	No	No	No
Low Discharge Super Heat?	No	No	No	No	No	No	No	No
External Oil Pump Option	No	No	No	No	No	No	No	No
External Oil Heater Option	No	No	No	No	No	No	No	No
Liq. Inj. on w/ Fast Unld?	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Alarm Relay	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Compressor Proof	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Compressor Speed AO	COMP %	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Compressor speed fault	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Pump Down	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Evap EXV Output	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Flow	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Circuit Pump RO	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
IGV Open Percentage AO	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Cond Fan Bank:	1	2	3	4	5	6	7	8
Coil Temp #1	ODCoilTmp	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Coil Temp #2	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Tandem EXV Circuit Index	1	2	3	4	5	6	7	8
Evap EXV Control	Suct Spht	Suct Spht	Suct Spht	Suct Spht	Suct Spht	Suct Spht	Suct Spht	Suct Spht
Suction Group:	1	2	3	4	5	6	7	8
Circuit Alarm ID	1	2	3	4	5	6	7	8
Subcooler EXV AO	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Subcooler Suction PSI	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Subcooler Suction Temp	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Subcooler Refr Level	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Suction Pressure	SUCT PSI	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Discharge Pressure	DISC PSI	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Suction Temperature	SUCT TMP	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

Circuit Information Continued on Next Page ---->

Circuit Information

Name	Circuit #1	Circuit #2	Circuit #3	Circuit #4	Circuit #5	Circuit #6	Circuit #7	Circuit #8
Discharge Temperature	DISC TMP	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Oil Pressure	DISC PSI	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Oil Temperature	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Motor Temperature	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Oil Flow Switch	HPSI MANSW	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Liquid Temperature	L TEMP OUT	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Liquid Pressure	L PSI OUT	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Oil Seal Cooler Temp	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Pre Oil Filter	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Oil Float	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Leaving Temperature	C WTR OUT	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Refrigerant Temp	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Refrig Level	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Refr. Leak Sensor	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Vane Position	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Vane Control Method	FLA%	FLA%	FLA%	FLA%	FLA%	FLA%	FLA%	FLA%
EXV Target Adjust	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Low Si Off	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
High Si Off	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Purge Full Indic.	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
User Defined Sensor	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Motor Amps A	AMPS	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Motor Amps B	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Motor Amps C	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Purge Pressure	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
Compressor RPM	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

SetpointInformation

#	Name	Value	Low	High	Adjust Value	Time (SEC)	Max Time Allowed (SEC)	Lockout Delay Hours	Safety Down Time(Min)	Display Type	Auth Level To Display	Type of Setpoint	Sec to Ignore Safety	Window to Extend Sfty Time(Sec)	Safety Time Ext.(Sec)	High Zone	Low Zone	Night Setback	MIN VFD Opening	MAX VFD Opening	MAX VFD Adjustment	BMS Writable
1	ColdTankTarg	44	44	65	0.5	0	0			TEMP	View Only	Target	-----	-----	-----	1.0	1.0	0	-----	-----	-----	No
2	HotTankTarg	115	80	140	0.5	0	0			TEMP	View Only	Target	-----	-----	-----	0.5	1	0	-----	-----	-----	No
9	SUPERHTTRG	17	10	20	0.5	4	10	2	5	TEMP	View Only	Alarm	0	0	0	-----	-----	-----	-----	-----	-----	No
10	SPRHTZONE+/-	1.0	1	4	0.1	0	0			TEMP	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
11	EXV LOAD ADJ	0.3	0.1	1	0.1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
12	EXV FINE ADJ	0.1	0.1	2	0.1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
13	EXV COURSE	0.5	0.2	5	0.1	4	5			HUMD or %	View Only	Time	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
15	EXV MIN%	10	5	50	1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
16	EXV MAX%	100	25	100	1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
17	LO SUPERHEAT	3	3	6	1	180	240	2	10	TEMP	View Only	Alarm	0	300	60	-----	-----	-----	-----	-----	-----	No
18	LOSUCTPSIDLY	2	2	30	1	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
19	EXV DELAY	60	30	120	1	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
20	EXV STRT TME	5	1	10	1	5	10			SECONDS	View Only	Time	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
22	LOW AMBIENT	-22	-40	70	1	0	0			TEMP	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
23	POWERUP DLAY	15	10	120	5	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
25	STEP SENSIT	1	1	10	1	0	0			DIGITAL/SW	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
26	STEP DELAY	180	60	600	10	120	120			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
27	MAX ROC-	-0.8	-2	-0.6	0.1	0	0			TEMP	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
28	MAX ROC+	0.8	0.6	2	0.1	0	0			TEMP	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
29	ROC INTERVAL	60	30	60	5	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
30	MAX LOAD%	77	50	100	1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
31	MIN LOAD%	40	20	50	1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
32	MAX ADJUST%	6	1	20	1	1	1			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
33	MIN ADJUST%	2	1	5	1	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
34	LOAD SENSIT	1	1	10	1	0	0			DIGITAL/SW	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
48	CND DELAY	10	5	120	1	0	0			SECONDS	View Only	Delay	-----	-----	-----	-----	-----	-----	1	1	0	No
49	CdFanStrt%	20	20	100	5	1	1			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
50	CND TARG PSI	330	225	450	5	0	0			PSI GAGE	View Only	Target	-----	-----	-----	7.5	7.5	0	-----	-----	-----	No
51	CND FAN DIV	7	1	25	1	1	1			DIGITAL/SW	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
52	CND MIN SPD	10	15	50	1	1	1			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
53	CND ROC-	-8	-20	-1	1	0	0			PSI GAGE	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
54	CND FAN MULT	1	1	25	1	0	0			DIGITAL/SW	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
55	CND MIN ADJ	1	0.5	10	0.5	0	0			HUMD or %	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
56	CMP ADJ DELY	2	1	5	1	30	30			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
59	A-CYC OFF-ON	60	30	600	10	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
61	CMP OFF RPMs	1100	0	0	0	0	0			RPM	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
62	CMP SpinDown	60s	15	0	0	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
63	A-CYC ON-ON	120	60	1500	10	0	0			SECONDS	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
64	COMP MIN RUN	2	1	10	1	0	0			MINUTES	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
75	HI AMPS %	115	20	125	1	5	5	2	5	HUMD or %	View Only	Lockout	0	0	0	-----	-----	-----	-----	-----	-----	No
76	LOampNoSTART	5	5	40	1	40	40	2	10	HUMD or %	View Only	Lockout	0	0	0	-----	-----	-----	-----	-----	-----	No
77	LOW SUCTION	65.0	80	180	1	120	300	2	10	PSI GAGE	View Only	Lockout	0	300	120	-----	-----	-----	-----	-----	-----	No
78	LO SUCT UNLD	3	1	5	1	0	0	2	10	PSI GAGE	View Only	Alarm	0	0	0	-----	-----	-----	-----	-----	-----	No
79	LO SUCT RELD	5	2	8	1	0	0			PSI GAGE	View Only	Setpoint	-----	-----	-----	-----	-----	-----	-----	-----	-----	No
80	UNSAFE SUCT	80	0	10	1	3	10	0	0	PSI GAGE	View Only	Lockout	0	120	6	-----	-----	-----	-----	-----	-----	No
81	HI DISC PSI	575	300	620	10	2	2	2	10	PSI GAGE	View Only	Lockout	0	0	0	-----	-----	-----	-----	-----	-----	No

Continued on Next Page--->

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SetpointInformation

#	Name	Value	Low	High	Adjust Value	Time (SEC)	Max Time Allowed (SEC)	Lockout Delay Hours	Safety Down Time(Min)	Display Type	Auth Level To Display	Type of Setpoint	Sec to Ignore Safety	Window to Extend Sfty Time(Sec)	Safety Time Ext.(Sec)	High Zone	Low Zone	Night Setback	MIN VFD Opening	MAX VFD Opening	MAX VFD Adjustment	BMS Writable
82	HI DISC UNLD	35	10	50	1	0	0			PSI GAGE	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
83	HI DISC RELD	50	20	80	1	0	0			PSI GAGE	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
87	HI DISCH TMP	230	180	230	1	2	5	2	10	TEMP	View Only	Lockout	0	0	0	-----	-----	-----	-----	-----	----	No
88	DIS TMP UNLD	5	3	10	1	0	0			TEMP	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
89	DIS TMP RELD	10	5	15	1	0	0			TEMP	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
91	LOW DIF PSI	15	80	180	1	50	60	2	10	PSI GAGE	View Only	Lockout	30	0	0	-----	-----	-----	-----	-----	---	No
92	UnsafeDifPsi	5.0	40	80	1	40	90	0	0	PSI GAGE	View Only	Lockout	15	0	0	-----	-----	-----	-----	-----	---	No
101	SAFETY HOLD	120	60	600	10	2	2			SECONDS	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
105	NO FLOW	120	5	120	1	0	0			SECONDS	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
108	PMP OFF DLAY	120	30	300	10	0	0			SECONDS	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
111	FREEZE	35	33	50	0.5	3	3	0	10	TEMP	View Only	Lockout	0	0	0	-----	-----	-----	-----	-----	----	No
139	HI PSI SW	0	2s	1	0	0	0			PSI GAGE	View Only	Lockout	0	----	-----	-----	-----	-----	-----	-----	-----	No
151	Unloaded Off	2	1	3	0.5	1	1			TEMP	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
153	SftyUnld Dly	5.0	2	30	1	0	0			SECONDS	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
154	SftyUnld Adj	5	2	10	1	0	0			HUMD or %	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
157	HP LoSuctAdj	80	5	50	1	0	0			PSI GAGE	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
158	DEF START TMP	5.0	0	50	1	0	0			TEMP	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
159	DEF START DEL	30	0	300	1	0	0			MINUTES	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
161	DEF STOP TMP	55	30	180	1	0	0			TEMP	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
162	DEFSTOPDelay	5.0	0	60	1	0	0			MINUTES	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
163	CND HP OFSET	230	80	150	0.5	0	0			TEMP	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
164	SwModeDelay	45s	0	0	0	0	0			SEC	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
171	FLA COMP#1	35	8	40	1	0	0			AMPS/CT	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No
212	CmpVFDFault	1	0	0	2	2	0			PSI GAGE	View Only	Setpoint	-----	-----	---	-----	-----	-----	-----	-----	-----	No

Schedule Information

Operating Schedule

Day of the Week	On Sched #1	Off Sched #1	On Sched #2	Off Sched #2
Sunday	00:00	24:00	00:00	24:00
Monday	00:00	24:00	00:00	24:00
Tuesday	00:00	24:00	00:00	24:00
Wednesday	00:00	24:00	00:00	24:00
Thursday	00:00	24:00	00:00	24:00
Friday	00:00	24:00	00:00	24:00
Saturday	00:00	24:00	00:00	24:00
Holiday	00:00	24:00	00:00	24:00

Holidays

Number	Month	Day
# 1	N/A	1
# 2	N/A	1
# 3	N/A	1
# 4	N/A	1
# 5	N/A	1
# 6	N/A	1
# 7	N/A	1
# 8	N/A	1

BMS Points Compressor State Chart

State # MCS & Modbus	State # BACnet	State Text/Name
0	1	LOST IO LOCKED
1	2	CMP LOCKED OUT
2	3	SWITCHED OFF
3	4	UNLD & PMPDWN
4	5	CMP ANTICYCLE
5	6	CMP OFF/READY
6	7	OIL PMP LUBING
7	8	CMP IN STARTUP
8	9	CMP UNLOADED
9	10	CMP UNLD STEP1
10	11	CMP UNLD STEP2
11	12	CMP IS HOLDING
12	13	CMP IS LOADING
13	14	CMP IS UNLDING
14	15	CMP IS RUNNING
15	16	FAST UNLOADING
16	17	LO SUCT UNLOAD
17	18	LO SUCT HOLD
18	19	HI DISC UNLOAD
19	20	HI DISC HOLD
20	21	SAFETY TRIPPED
21	22	LO TEMP UNLOAD
22	23	LO TEMP HOLD
23	24	HI AMP HOLD
24	25	HI DIS TMP HLD
25	26	CMP IS AT 40%
26	27	CMP IS AT 70%
27	28	HI WATER HOLD
28	29	EXTRA 70% STEP
29	30	OFF-LO OIL TMP
30	31	HI AMP UNLDING
31	32	DEF PREPMP OUT
32	33	DEFROSTING
33	34	DEF PUMP DOWN
34	35	HI TEMP UNLOAD
35	36	HI TEMP HOLD
36	37	SCROLL STEP 1
37	38	SCROLL STEP 2
38	39	SCROLL STEP 3
39	40	SCROLL STEP 4
40	41	ON OIL RECOVRY
41	42	WAIT P-RATIO
42	43	CMP GROUP OFF

No Lookup Table SI Information

S:\! Customer Jobs\Multiaqua\VFD unit\MHRC VFD 9-15-15-B.cfg
CONFIG DATE = 9/15/15 at 04:09 PM **PRINT DATE = 9/24/15 02:36 PM**

No Lookup Table AO Information

S:\! Customer Jobs\Multiaqua\VFD unit\MHRC VFD 9-15-15-B.cfg
CONFIG DATE = 9/15/15 at 04:09 PM **PRINT DATE = 9/24/15 02:36 PM**

Modbus Write AO Information

AO 1-1 COMP ENABL =
Display Type = FPM
If Relay COMP is Off, Then AO = 0
Else:

Min:
AO 1-2 COMP SPEED =
Display Type = RPM'S
If Relay COMP is Off, Then AO = 0
Else:

Min:

Lookup Table Detail Information for Magnum

Lookup Table Setup

#	Number Of Rows	Input Column Name	Output Column Name	Input Column Display Type	Output Column Display Type	Minimum Auth Level
1	0	Input #1	Output #1	Spare	Spare	View Only
2	0	Input #2	Output #2	Spare	Spare	View Only
3	0	Input #3	Output #3	Spare	Spare	View Only
4	0	Input #4	Output #4	Spare	Spare	View Only
5	0	Input #5	Output #5	Spare	Spare	View Only

Lookup Table #1

#	Input Column Input #1	Output Column Output #1
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0

Lookup Table #2

#	Input Column Input #2	Output Column Output #2
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0

Lookup Table #3

#	Input Column Input #3	Output Column Output #3
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0

Lookup Table #4

#	Input Column Input #4	Output Column Output #4
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0

Lookup Table #5

#	Input Column Input #5	Output Column Output #5
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0

29. APPENDIX G - MCS Trouble Shooting Reference

(A more detailed troubleshooting guide is available on our website: *www.MCScontrols.com*)

PROBLEM	POTENTIAL SOLUTION
No Sensor + 5 vdc or sensor +5 vdc output is 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 for faulty 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 minute 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 for faulty 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 through the offset capability in the software. (Transducers by design need to be calibrated based on construction and altitude.) ■ You must use the MCS-Connect with a valid Authorization code to change sensor offsets ■ 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 Magnum and last I/O. ■ Verify Magnum and I/O address's set correctly. ■ Verify wiring from Magnum 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 SITE INFO or STATUS screen in MCS-Connect, click the 'View Only' button at the top of the screen, or click on the 'Passwords' menu option on the lower right of your Keypad/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 by the color of the Authorization button. **Red = View Only** **Light Blue = User level** **Purple = Service level** **Dark Blue = Supervisor level** **Green = Factory level**
Invalid authorization	This indicates an invalid authorization 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

PROBLEM	POTENTIAL SOLUTION
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
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 MCS-485-GATEWAY from MCS-Connect not working.	■ Verify red LED on the gate way is blinking. This indicates that MCS-Connect 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 Magnum board is blinking. This indicates that the Magnum is responding to the gateway. ■ If both of these LED are blinking, check the address of the Magnum and any other Magnums that are on the network. Each must have a unique address. This address can be changed from the Magnum. Proper authorization is required. Enter the UNIT INFORMATION screen by pressing the SERVICE DIAGNOSTIC key and scrolling to this item. Press the enter key and scroll to the NETWORK ADDRESS screen. Change address if needed. ■ Verify + 12 vdc to MCS-485-GATEWAY
INVALID CONFIG	Indicates Checksum invalid ■ Either set to factory defaults on reset settings.

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