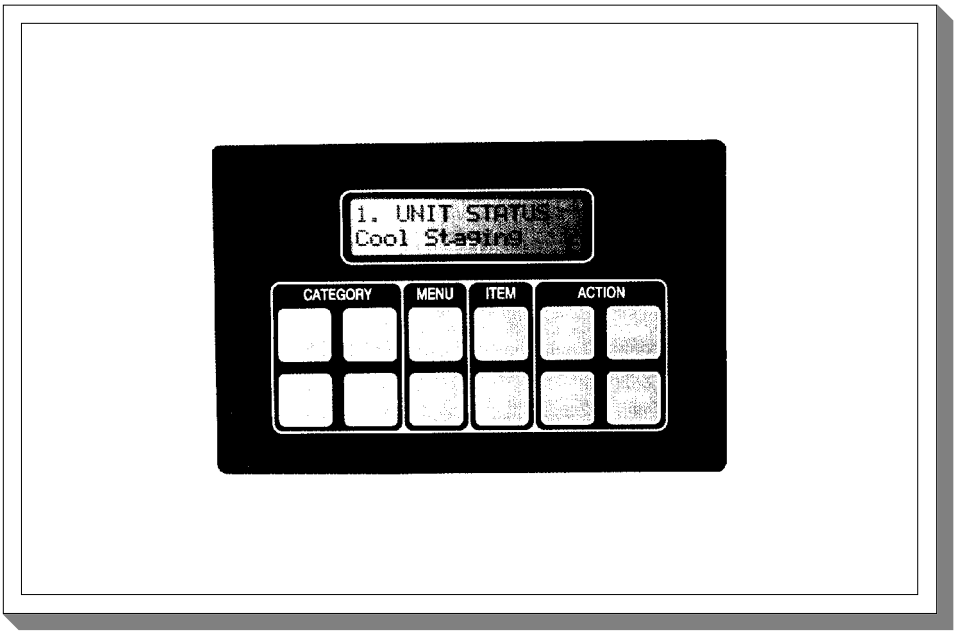
MicroTech™

Reciprocating chiller controller
for ALR & WHR units



- ❏ Installation and maintenance data
- ❏ catalog 130 C 93/01 B

McQuay International

MicroTech control system

WARNING!

ELECTRIC SHOCK HAZARD. MAY CAUSE PERSONAL INJURY OR EQUIPMENT DAMAGE.

Equipment must be properly grounded. Connections and service to the MicroTech control panel must only be performed by personnel knowledgable in the operation of the equipment being controlled.

NOTICE

This equipment generates, uses and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 or the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION!

EXCESSIVE MOISTURE IN THE CONTROL PANEL CAN CAUSE HAZARDOUS WORKING CONDITIONS AND IMPROPER EQUIPMENT OPERATION.

When servicing equipment during rainy weather conditions, the electrical components in the main control panel must be protected form the weather.

CAUTION!

EXTREME TEMPERATURE HAZARD. CAN CAUSE DAMAGE TO SYSTEM COMPONENTS.

The MicroTech controller is designed to operate within an ambient temperature range of - 29°C to 52°C with a non-operating range of - 40°C to 60°C. The controller is designed for 95% relative humidity (non condensing).

CAUTION!

THE MICROTECH CONTROL PANEL CONTAINS STATIC SENSITIVE COMPONENTS. A STATIC DISCHARGE WHILE HANDLING ELECTRONIC CIRCUIT BOARDS CAN CAUSE DAMAGE TO THE COMPONENTS.

To prevent such damage during service involving board replacement, McQuay recommends discharging any static electrical charge by touching the bare metal inside the panel before performing any service work.

Introduction

This manual provides installation, set up and trouble shooting information. For the MicroTech controller as provided on all ALR and WHR models of McQuay reciprocating chillers. A Monitor Program with separate literature, is available for computer monitoring and networking.

This manual is given as a supplement to the appropriate chiller installation manual for unit application information as well as water and refrigerant piping details.

GENERAL DESCRIPTION

The MicroTech Unit Control Panel, available on some McQuay ALR and WHR products, contains a Model 250 (used on the units with two compressors) or Model 280 (used on the units with 3 and 4 compressors) microprocessor based controller which provides all monitoring and control functions required for the safe efficient operation of the unit. The operator can monitor all operating conditions by using the panels built in 2 line by 16 character display and keypad or by using an IBM compatible computer running McQuay Monitor software. In addition to providing all normal operating controls, the MicroTech controller monitors all safety devices on the unit and will shut the system down and close a set of alarm contactors if an alarm condition develops. Important operating conditions at the time an alarm occurs are retained in the controllers memory to aid in troubleshooting and analysis.

The system is protected by a simple password scheme which only allows access by authorized personnel. A valid passwork must be entered into the panel keypad by the operator before any setpoints may be altered.

FEATURES OF THE MICROTECH CONTROL PANEL

• Enhanced head pressure control on air cooled units.

• 12 key keypad for adjusting chiller water temperature set-points, low water temperature cutout, high pressure cutout, suction pressure cutout, and freeze protection. The operator can use the keypad to monitor various operating conditions, setpoints or alarm messages.

• Easy-to-read 2 line by 16 character display for readout of operating temperature and pressure, operating modes or alarm messages.

• Security password protection against unauthorized changing of setpoints and other control parameters.

• Complete diagnostic to inform the operator of pre-alarms and alarms. All alarms are time and date stamped so there is no guessing of when the alarm condition occurred. In addition, some operating conditions that existed at the instant of shutdown can be recalled to aid in isolating the cause of the problem.

• Soft Loading feature to reduce electrical consumption and peak demand charges during loop pull-down.

• Easy integration into building automatic systems via

separate 4-20 milliamp signals for chilled water reset and demand limiting.

• Internal time-clock for on/off scheduling.

• Communications capabilities for local system monitoring, changing of setpoints, trend logging, remote reset, alarm and event detection via IBM compatible PC. The optional modem kit supports the same features from an off-site PC running the McQuay Monitor software.

• Manual control mode to override automatic unit staging. Useful for system checkout.

COMPONENTS DATA

The major component parts to the MicroTech controller are described in the following section and are:

1. MICROPROCESSOR CONTROL BOARD
2. ANALOG/DIGITAL INPUT (ADI) BOARD
3. OUTPUT BOARD AND EXPANSION BOARD
4. KEYPAD/DISPLAY
5. PRESSURE TRANSDUCERS
6. THERMISTOR SENSORS

All MicroTech components are mounted inside the control section side of the unit's control cabinet. The individual components are interconnected by ribbon cable, shielded multiconductor cables or discrete wiring. Power supply for the unit system is 110V provided by T-1 transformer (Furnished by McQuay), while the power supply for the microprocessor system is provided by T-2 and T-3 transformers.

All field wiring must enter the control cabinet through knockouts provided and is terminated on field wiring M1 Terminal.

The standard ALR keypad/display is located inside the control cabinet for protection from the weather while the back light WHR keypad/display is accessible through the exterior of the control cabinet.

1. MICROPROCESSOR CONTROL BOARD

The microprocessor control board is the core processor of the MicroTech Controller. The Model 250 (used on ALR and WHR with 2 compressors) and the 280 (used on ALR and WHR with 3 and 4 compressors), Control Board contains the electronic hardware and software required to monitor and control the unit. The controller recieves input from the ADI board and send commands to the Output Board to maintain the units optimum operating mode for the current condition.

The major components on the controller are:

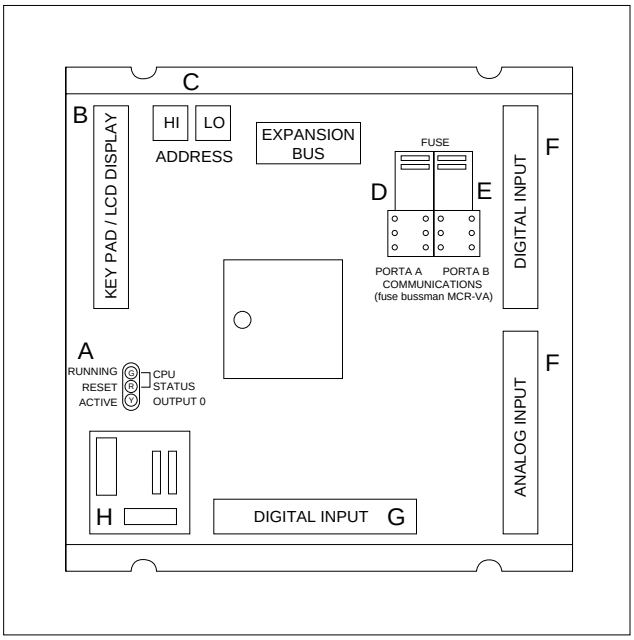
A) Three status light (LED - Light Emitting Diodes) Pos. A on the controller which will indicate the microprocessor's operating condition. The interpretation of the ON/OFF condition of this LED is shown in Tables 1 and 2.

The proper sequence that these LED's follows upon powering up the MicroTech controller is as follows:

1. The RED LED turns on remaining on for approximately 3 seconds after applying power to the controller.

During this period, the microprocessor is checking the control software and performing internal hardware tests.

Figure 2 - MicroTech Control board



2. After the self-check period, the RESET LED will turn off and the green RUNNING LED will illuminate indicating the controller's circuitry and software are operating correctly.

NOTE: If the RESET LED stays on or the RUNNING LED fails to illuminate disconnect the controller power by opening circuit breaker Q9 and re-check the field wiring. Observe the controller's LED's while re-connecting power by closing Q9 switch.

If the RUNNING LED still does not turn on, refer to the troubleshooting section in this manual.

3. The amber OUTPUT Ø ACTIVE LED is associated with the external alarm output on the solid-state relay board and will be illuminated during any alarm conditions.

Table 1 Green and red microprocessor status led's

Green	Red	Indication
Off	Off	No power to controller
Off	On*	Self-test failure controller defective
On	Off	Microprocessor operating normally

(*) For longer than 5 seconds

Table 2 Amber microprocessor status led

Led status	Indication
On continuosly	Normal operation
Off	Loss of power to controller or application
On	program not executing

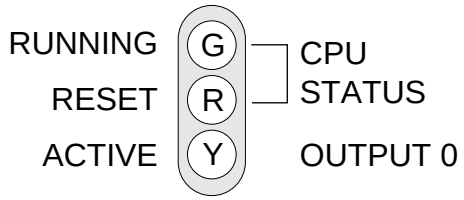


Figure 3 - status LED's

B) KEYPAD/DISPLAY INTERFACE CONNECTION

Input command and operating parameters are receiving by the controller from the user keypad through this port via a plug-in ribbon cable. Information is also sent from the controller to the users display through this same port.

C) HEXADECIMAL ADDRESS SWITCHES

For each unit determine its logical location, for communications between Micro Controller in a MicroTech network. These are two hexadecimal switches (sometimes simply called hex switches) on the Control board - Pos. C.

The switches are shown in Figure 4. The switches have an arrow-shaped screwdriver slot in the center face.

The center face of the square block contains the numbers 0 through 9 and the letters A through F. The switch on the left is designed the "high" switch and the switch on the right is designed the "Low" switch.

If the chiller is not connected to an RS485 communications loop, switches should be factory set to Hi = 0 and Lo = 1

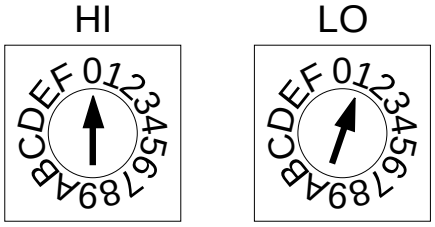


Figure 4 - Hex address switches

IMPORTANT! When changing (if necessary) the hex switch settings, the panel must be powered down, then reenergized, in order to enter the new settings into Microprocessor controller memory. This can most readily be accomplished by opening, then resetting, the Q12 system switch in the main control box.

CAUTION!

COMPRESSOR PUMPDOWN IS REQUIRED BEFORE REMOVING POWER TO THE CONTROLLER OR SYSTEM CAN BE DAMAGED.

The compressors must be pumped down before the Q12 switch is opened.

NOTE: For single unit applications, no changes to these switches are necessary. For two through fifteen unit applications, the LO address should be set to 2 for the second unit, 3 for the third unit, and up to F for the fifteenth unit. For more than fifteen units, the HI address must be changed on the sixteenth and higher numbered un its to provide a unique address for each unit. For the seventeenth unit, HI = 1 and LO = 1. For the 33rd unit, HI = 2 and LO = 1. On multiple unit applications, a Network Master Panel is required to allow communications between units. (This manual does not include information regarding networking).

D) PORT- A (PC Terminal or phone line connection).

This is an RS-232 communication port which can communicate from 300 to 9600 BAUD. Unit operation and control can be done with an IBM compatible Personal Computer with available MicroTech Monitor Program software.

The necessary communication can take place through this port via a phone line and optional Modem or local system monitoring over a limited (The network uses the RS 232 communication standard with a maximum cable lenght of 15 mt.) through low voltage shielded twisted pair cable.

See the Personal Computer specification section of this manual for specific hardware requirements.

E) PORT-B (Network connection)

Multiple units may be connected together into a network, RS-485 communication may take place between units via a cable connected between these port on the various units. This communications occurs at speed from 1200 to 9600 BAUD. Refer to MicroTech Monitor program user's Manual.

F) ANALOG/DIGITAL INPUT CONNECTION

Conditioned system variable inputs are received from the analog and digital input board through these port via a plug-in ribbon cable, and send to the control board for interpretation. These inputs are 0-5 VDC (Volt Direct Current) analog signals.

G) DIGITAL OUTPUT CONNECTION

Signal commands are used to control all compressors, condenser fans, solenoid valves and alarm annunciation, are sent to the Output board through this port via a plug-in ribbon cable.

L) AUX/OUT TERMINAL

There are several internal power supplies used by the controller and its associated circuitry. The regulated 5 VDC power on terminal N. 9 is used to support the analog inputs on the ADI board and should not be used to operate any external devices. An unregu lated 13 VDC power supply is sent to the optional Modem kit through terminals 8(+) and 7(-) of this port.

Output O is used for powering alarm light.

Contact McQuay Service to discuss your application before making any connection to these terminals.

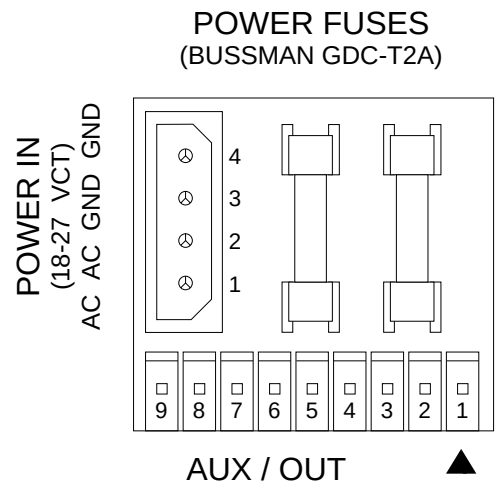


Figure 5 - Power supply

FUSES (refer to fig. 5) - There are two identical fuses located to the right of the power supply input terminal on the Micro Controller power supply circuit (13 VDC)

2. ANALOG/DIGITAL INPUT BOARD (ADI BOARD).

The ADI Board provides low voltage power for the temperature and pressure sensors. It also provides optical isolation between the Microprocessor Control Board and all 24V switch inputs. LED's are furnished on the board to give a visual indication of the status of all digital inputs. All analog and digital signals from sensors, transducers, and switches are received by the ADI Board and then sent to the Microprocessor Control Board for interpretation.

2.1 CONTROLLER ANALOG INPUT

Analog inputs are used to read the various temperatures and pressures on the chiller as well as customer supplied 4-20mA reset signals. The controller's internal regulated 5 VDC and 12 VDC supplies provide the correct operating voltage for the sensors.

Table 3 - Analog input for WHR 045÷380 and ALR 035÷360 units

input No	W.D. simb.	Function	Description & location	Range	Resolution
0	W100	Leaving evaporator water temp.	Sensor is located in the leaving chilled water nozzle. The signal is used for capacity control and freeze protection (see note 1)	-40 to 130°C	0.1°C
1	W12	Evaporator pressure transducer Circ # 1	Sensor is located in the circuit 1 suction line Used to determine suction saturated refrigerant pressure and temperature. This sensor also provides refrigerant freeze protection for Circ # 1	35 to 1015kPa	0,7 kPa
2	W22	Evaporator pressure transducer Circ # 2	Sensor is located in the circuit 1 suction line Used to determine suction saturated refrigerant pressure and temperature. This sensor also provides refrigerant freeze protection for Circ # 2		
3	W13	Condenser pressure transducer Circ #1	Sensor is located in the Circ #1 discharge line. Used to determine saturated refrigerant pressure temperature. This sensor provides software high pressure protection and head pressure control	140 to 3150kPa	3,5 kPa
4	W23	Condenser pressure transducer Circ #2	Sensor is located in the Circ #2 discharge line. Used to determine saturated refrigerant pressure temperature. This sensor provides software high pressure protection and head pressure control		
5	/	Transducer power voltage ratio signal	5 VDC power supply to transducers	/	/

input No	W.D. simb.	Function	Description & location	Range	Resolution
6	Q19	Evaporator water temp. reset or when used by McQuay "Ice" mode switch (optional)	A 4 to 20 mA DC (supplied by others) a building automation system or temperature transmitter to reset the leaving chilled water setpoint. The impedance of the ADI board is 249 ohms	4 to 20 mA DC	/
7	Q16	Demand limit or when used by McQuay Energy saving switch (optional) in the units whit double speed compressor	A 4 to 20 mA DC (supplied by others) a building automation system to determine the maximum number of cool. stages which may be energized The impedance of the ADI board is 249 ohms		
8	W108	Entering evaporator water temperature	Sensor is located in the entering chilled water nozzle. The signal is used for monitoring and for chilled water reset if selected. (see note 2)	-40 to 130°C	0.1°C
9	W109	Entering condenser water temp. (O.A. temp. for air cooled units)	Sensor is located in the common entering condenser water nozzle or located under the condenser coil as an outside air temp sensor for air cooled units ALR (see note 2)	-40 to 130°C	0.1°C
10	W110	Leaving condenser water temperature	Sensor is located in the common entering condenser water nozzle.		
11	/	Percent of total unit Amps (optional)	A current transformer and adjustable voltage dropping resistor located in the power side of the control box along with a voltage converter board sends a DC signal proportional to total motor current to the microprocessor 0 vdc = 0%, 4 vdc = 100%	0 to 4 VDC	1%
12	W112	Suction temp. Circuit # 1	Sensor located to the Circ # 1 suction line measures refrigerant temperature to calculate superheat	-40 to 130°C	0.5°C
13	W113	Suction temp. Circuit # 2	Sensor located to the Circ # 2 suction line measures refrigerant temperature to calculate superheat		
14	W114	Liquid line temp. Circuit # 1	Sensor located to the Circ # 1 suction line measures refrigerant temperature to calculate subcooling		
15	W115	Liquid line temp. Circuit # 2	Sensor located to the Circ # 2 suction line measures refrigerant temperature to calculate subcooling		

Note: the above analog input are common for Micro Control board model 250 & 280 ADI 16 & 24 equipped on the unit with two compressors both Copeland or its equipped with 3 &4 McQuay compressors.

Table 4 Analog input for WHR 225÷285 and ALR 210÷260 3 compressors unit

Analog input for WHR 210÷380 and ALR 285÷360 4 compressors unit

input No	W.D. simb.	Function	Description & location	Range	Resolution
16	W32	Evaporator pressure transducer Circ # 3	Sensor is located in the circuit 3 suction line Used to determine suction saturated refrigerant pressure and temperature. This sensor also provides refrigerant freeze protection for Circ # 3	35 to 1015kPa	0,7 kPa
17	W42	Evaporator pressure transducer Circ # 4	Sensor is located in the circuit 4 suction line Used to determine suction saturated refrigerant pressure and temperature. This sensor also provides refrigerant freeze protection for Circ # 4		

input No	W.D. simb.	Function	Description & location	Range	Resolution
18	W32	Evaporator pressure transducer Circ # 3	Sensor is located in the Circ # 3 suction line Used to determine suction saturated refrigerant pressure and temperature. This sensor also provides refrigerant freeze protection for Circ # 3	35 to 1015kPa	0,7 kPa
17	W42	Evaporator pressure transducer Circ # 4	Sensor is located in the Circ # 4 suction line Used to determine suction saturated refrigerant pressure and temperature. This sensor also provides refrigerant freeze protection for Circ # 4		
18	W33	Condenser pressure transducer Circ #3	Sensor is located in the Circ #3 discharge line. Used to determine saturated refrigerant pressure temperature. This sensor provides software high pressure protection and head pressure control	140 to 3150kPa	3,5 kPa
19	W43	Condenser pressure transducer Circ # 4	Sensor is located in the Circ #4 discharge line. Used to determine saturated refrigerant pressure temperature. This sensor provides software high pressure protection and head pressure control		
20	W116	Suction temp. Circuit # 3	Sensor located to the Circ # 3 suction line measures refrigerant temperature to calculate superheat	-40 to 130°C	0.1°C
21	W117	Suction temp. Circuit # 4	Sensor located to the Circ # 4 suction line measures refrigerant temperature to calculate superheat		
22	W118	Liquid line temp. Circuit # 3	Sensor located to the Circ # 3 suction line measures refrigerant temperature to calculate subcooling		
23	W119	Liquid line temp. Circuit # 4	Sensor located to the Circ # 4 suction line measures refrigerant temperature to calculate subcooling		

The above analog inputs are present only on the above units and are the conditions of the continuous table

Note: Sensor placement

1) In the ALR 285÷360 having 2 evaporators and not common water connection, sensor W100 W108 for entering and leaving water temperatures are left near to the outlet nozzle of the evaporator.
   Install the immersion well and the sensor bulb in the inlet and outlet chilled water common piping for the two evaporators.
   Insert heat conducting compound inside the well before installing the sensors.

2) In the WHR units sensors W109 W110 for entering & leaving condenser water temperatures have to installed as explaned in point 1.
   See figure 5 for dimension of immersion well and sensor

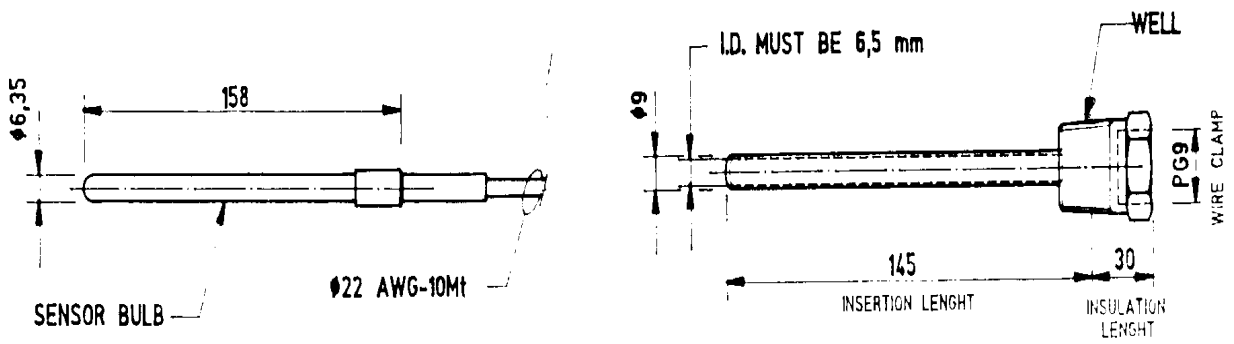


Figure 6 - Dimension of immersion well and sensor

2.2 CONTROLLER DIGITAL INPUT

All digital Inputs are 24 VAC at 7,5 VAC to 24 VAC digital Input contacts are considered closed. Below 7,5 VAC, the contacts are considered open. The 7,5 VAC threshold is the voltage at which the opto coupler conducts.

Note that each digital input has a red LED which is illuminated when the contacts are closed (24 VAC is present at board terminal).

See Table below for details and operating characteristics.

Table 5 Digital input for WHR 045÷190 & ALR 035÷180 units

Input & LED no	W.D. simbols	Description	Circuit reference	Contacts description	
				Closed	Open
0	F13	Mechanical high pressure switch	Circ # 1	Normal	High pressure
1	F11	Oil differential pressure switch	Compr # 1		Low oil pressure
2	MP1	Motor protection switch			High compressor temp.
3	/	Open	/		/
4	/	Open	/		/
5	Q12	System switch	Unit		Unit shutdown
6	F112	Phase/voltage monitor			P.V.M. alarm
7	Q13	Pump down switch	Circ # 1		Manual pumpdown
8	F23	Mechanical high pressure switch	Circ # 2		High pressure
9	F21	Oil differential pressure switch	Circ # 2		Low oil pressure
10	MP2	Motor protection switch			High compressor temp.
11	/	Open	/		/
12	/	Open	/		/
13	Q21	Remote stop switch	Unit	Run	Pumpdown & stop
14	F116	Water flow switch		Normal	No evaporator (cond) flow
15	Q14	Pump down switch	Circ # 2		Manual pumpdown

Note: These digital input are common for Micro control board model 250 ADI 16

Table 6 Digital input for WHR 210÷380 & ALR 210÷360 units

Input & LED no	W.D. simbols	Description	Circuit reference	Contacts description	
				Closed	Open
0	F13	Mechanical high pressure switch	Circ # 1	Normal	High pressure
1	F11	Oil differential pressure switch	Compr # 1		Low oil pressure
2	MP1	Motor protection switch			High compressor temp.
3	F31	Oil differential pressure switch	Compr # 3		Low oil pressure
4	MP3	Motor protection switch			High compressor temp.
5	Q12	System switch	Unit		Unit shut down
6	F112	Phase /voltage monitor			P.V.M. alarm
7	Q13	Pump down switch	Circ # 1		Manual pumpdown
8	F23	Mechanical high pressure switch	Circ # 2		High pressure
9	F21	Oil differential pressure switch	Compr # 2		Low oil pressure
10	MP2	Motor protection switch			High compressor temp.
11	F41	Oil differential pressure switch	Compr # 4		Low oil pressure
12	MP4	Motor protection switch			High compressor temp.
13	Q21	Remote stop switch	Unit	Run	Pumpdown & stop
14	F116	Water flow switch		Normal	No evap (cond) flow
15	Q14	Pump down switch	Circ # 2		Manual pump down
16	F33	Mechanical high pressure switch	Circ # 3		High pressure
17	Q33	Pump down switch			Low oil pressure
18	F43	Mechanical high pressure switch	Circ # 4		High pressure
19	Q34	Pump down switch			Manual pump down
20	F51-52	Thermal overload	Compr # 1		High power absorbed compressor
21	F53-54	Thermal overload	Compr # 2		
22	F55-56	Thermal overload	Compr # 3		
23	F57-58	Thermal overload	Compr # 4		

Note: These digital input are common for Micro control board model 250 ADI 16

3. RELAY BOARD OUTPUTS

All of the MicroTech panel outputs are controlled by solid-state relays which are driven by the model 250 or 280 controller. The controller activates a solid-state relay by sending a "trigger" signal to the output board (See fig. 6) via the attached ribbon cable. The relay responds to the trigger by lowering it's resistance which allows current to flow through it's "contacts". When the controller removes the trigger signal, the relay's resistance becomes very high, causing the current flow to stop. The outputs are individually protected by a replacable 5 amp fuse mounted on the output board adjacent to each relay. Tables 8 to 12 provide additional information about each output.

Table 7 WHR 045÷100 Relay board outputs

digital output	Output Description
0	Alarm circuit & alarm
1	Chilled water pump relay
2	Circ # 1 liquid solenoid valve
3	Circ # 2 liquid solenoid valve
4	Compr # 1 MCR
5	Compr # 2 MCR
6	Compr # 1 unloader # 1
7	Compr # 2 unloader # 1
8	Compr # 1 unloader # 2
9	Compr # 2 unloader # 2
10	Condenser water pump circ # 1
11	Open
12	Open
13	Condenser water pump circ # 2
14	Open
15	Open

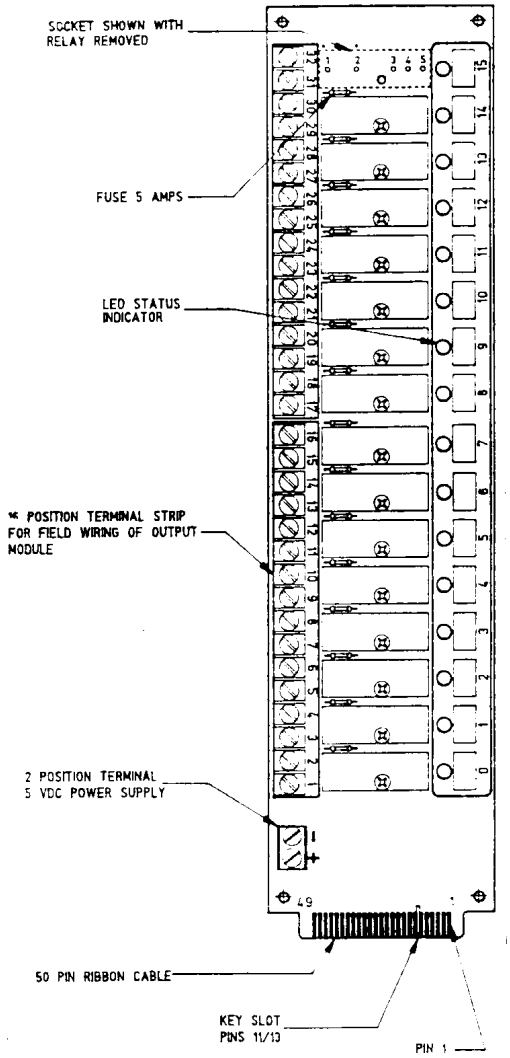


Figure 7. Output board 16 position

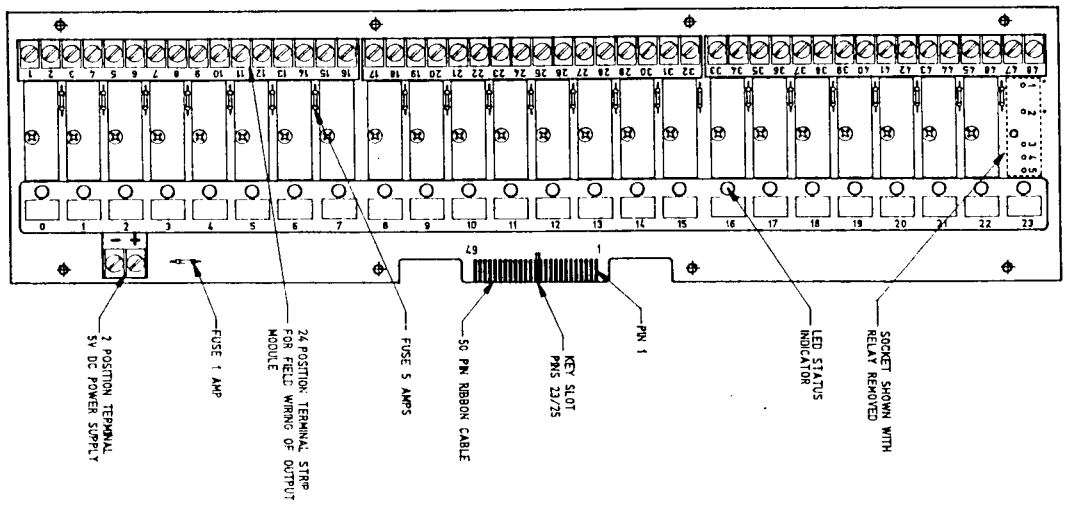


Figure 8. Output board 24 position

Table 8 ALR 035÷095 Relay board outputs

digital output	Output Description	Presence of the output relays on the board			
		035-038-045-055	060-065	070-075-085	095
0	Alarm circuit & alarm				
1	Chilled water pump relay				
2	Circ # 1 liquid solenoid valve				
3	Circ # 2 liquid solenoid valve				
4	Compr # 1 MCR				
5	Compr # 2 MCR				
6	Compr # 1 unloader # 1				
7	Compr # 2 unloader # 1				
8	Compr # 1 unloader # 2				
9	Compr # 2 unloader # 2				
10	Condenser fan stage 1 circ # 1	X	X	X	X
11	Condenser fan stage 2 circ # 1		X	X	X
12	Condenser fan stage 3 circ # 1			X	X
13	Condenser fan stage 1 circ # 2	X	X	X	X
14	Condenser fan stage 2 circ # 2		X	X	X
15	Condenser fan stage 3 circ # 2			X	X

Table 9 WHR 105÷190 & ALR 100÷180 Relay board outputs

digital output	Output Description	
	Part winding (PWS) unit	Double speed (2C) units
0	Alarm circuit & alarm contacts for remote indication	
1	Chilled water pump relay	
2	Circ # 1 liquid solenoid valve	
3	Circ # 2 liquid solenoid valve	
4	Compr # 1 MCR	Compr # 1 MCR - Low speed
5	Compr # 1 unloader # 1	Compr # 1 MCR - High speed
6	Compr # 1 unloader # 2	Compr # 1 unloader # 1
7	Compr # 2 MCR	Compr # 2 MCR - Low speed
8	Compr # 2 unloader # 1	Compr # 2 MCR - High speed
9	Compr # 2 unloader # 2	Compr # 2 unloader # 1

Note: 1 Digital output number 10 through 15 are not used on these units

2 Digital output number 6 and 9 are optional and present only when additional capacity reduction step are required

The above D.O. are common for WHR 105÷190 and ALR 100÷180 units. Following table shows the remaining outputs used on ALR units and are the continuous of the previous table

Table 10 ALR 100÷180 Relay board outputs		Presence of the output relays on the board				
10	Condenser fan stage 1 circ # 1	X	X	X	X	X
11	Condenser fan stage 2 circ # 1	X	X	X	X	X
12	Condenser fan stage 3 circ # 1			X	X	X
13	Condenser fan stage 1 circ # 2	X	X	X	X	X
14	Condenser fan stage 2 circ # 2	X	X	X	X	X
15	Condenser fan stage 3 circ # 2			X	X	X
		100	110	130	155	180

Table 11 WHR 210÷380 & ALR 210÷360 Relay board outputs

digital output	**Output Description**	
	Part winding (PWS) unit	**Double speed (2C) units**
0	Alarm circuit & alarm contacts for remote indication	
1	Chilled water pump relay	
2	Circ # 1 liquid solenoid valve	
3	Compr # 1 MCR	Compressor # 1 - MCR low speed
4	Compr # 1 - unloader	Compressor # 1 - MCR High speed
5	Circuit # 2 Liquid line solenoid valve	
6	Compr # 2 MCR	Compressor # 2 - MCR low speed
7	Compr # 2 - unloader	Compressor # 2 - MCR High speed
8	Circuit # 3 Liquid line solenoid valve	
9	Compr # 3 MCR	Compressor # 3 - MCR low speed
10	Compr # 3 - unloader	Compressor # 3 - MCR High speed
11	Circuit # 4 Liquid line solenoid valve	
12	Compr # 4 MCR	Compressor # 4 - MCR low speed
13	Compr # 4 - unloader	Compressor # 4 - MCR High speed

The above D.O. are common for WHR 210÷380 and ALR 210÷360 Following table shows the remaining outputs used on ALR units and are the continuous of the previous table

Table 12 ALR 210÷360 Relay board outputs

14	Condenser fan stage 1 circ # 1
15	Condenser fan stage 2 circ # 1
16	Condenser fan stage 3 circ # 1
17	Condenser fan stage 1 circ # 2
18	Condenser fan stage 2 circ # 2
19	Condenser fan stage 3 circ # 2
20	Condenser fan stage 1 circ # 3
21	Condenser fan stage 2 circ # 3
22	Condenser fan stage 3 circ # 3
23	Condenser fan stage 1 circ # 4
24	Condenser fan stage 2 circ # 4
25	Condenser fan stage 3 circ # 4

3.2 Diox expansion board

The model 280 controller on ALR 285÷360 units is equipped with an expansion board to accomodate additional digital outputs which are allocated on 4 position output board, required for four circuit application

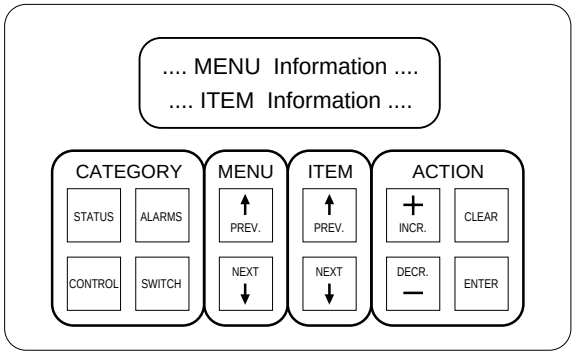
4. Keypad & Display

General description

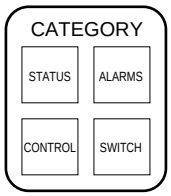
The information stored in the MicroTech controller can be viewed (one menu and one item a time) through a two line by sixteen character LCD display.
The current MENU is shown on the top line and the current MENU ITEM on the bottom line of the display.

The MicroTech keypad consist of twelwe pressure sensitive membrane switchs. This keys are used to step through, access, and manipulate the information stored in the MicroTech controller using a tree -like structure. The keypad key are divided into four groups, with two or four keys in each.

These groups of keys and their functions are described below.



First group: CATEGORY



The keys in this group provide quick access to strategic menus throughout the menu tree-structure.
This reduces the need to step through all the menus, one by one, in order to reach the designed menu.

There are three categories which make up the tree structure and are described below.

Each Category is divided into Menu and each Menu into Menu Item.

KEY 

Pressing STATUS key at any time shift the display to Menu # 1 related to Unit Status which is the first menu of the STATUS category.
This provides information on the current and chiller operating conditions.

KEY 

Pressing CONTROL key at any time shifts the display to Menu # 13 (control mode) for units with two compressors and to Menu # 19 for units with three & four compressors.

This is the first menu of the control category, which provide for the input of all the unit control parameters changeables through the keypad. These include cooling, compressor and condenser fan control parameters as well as time schedules and alarm limits.

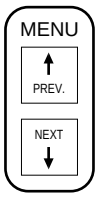
KEY 

Pressing ALARMS key at any time shifts the display to Menu # 24 (Circuit 1 current alarm) for units with two compressors and to Menu # 30 for units with three and four compressors. This is the first menu of the ALARM category and provide information regarding current and previous alarm conditions.

KEY 

Pressing SWITCH key at any time toggles the display beween the current menu (status/control) item and the related menu (control/status) item somewhere else in the tree-structure. For example, if this key is pressed in a unit equipped with two compressors, while the current menu item is Menu Item 4-A.1 (Lvg Evap = 6,2°C) the display shifts to Menu Item 14-A.1 (Lvg Evap Spts = 5,9°C). This provide for easy review of actual versus set point values.

Menu structure directory on page 47, include a listing of all the currently supported switching functions.



Second group: MENU

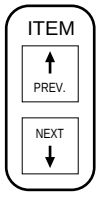
The keys in this group as for stepping from menu to menu in the menu tree-structure.

KEY Pressing PREV. shift the display to the previous menu.

Note: When Menu # 1 is currently in the display (the first menu in the menu tree-structure) pressing PREV. causes an "end of menus" message to appear in the display.
Pressing PREV. again causes the display to wrap around to the last menu in the tree-structure.

KEY Pressing NEXT shift the display to the next menu.

Note: When the last menu in the menu tree-structure is currently display, pressing NEXT causes an "end of menu" message to appear in the display. Pressing NEXT again causes the display to wrap around to Menu # 1 that is the first menu in the menu tree-structure.



Third group: ITEM

The keys in this group are for stepping

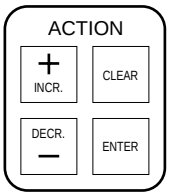
from item within a menu.

KEY Pressing PREV. shifts the display to the previous items in a menu.

Note: When the first item in a menu is currently in the display, pressing PREV. causes an "end of items" message to appear in the display pressing PREV. again causes the display to wrap around to the last item in the menu.

KEY Pressing NEXT shifts the display to the next item in a menu.

Note: when the last item in a menu is currently in the display, pressing NEXT causes an "end of items" message to appear in the display. Pressing NEXT again causes the display to wrap around to the first item in the menu



Fourth group: ITEM

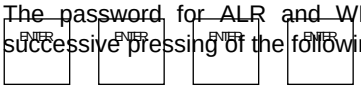
The keys in this group are for making changes to the unit control parameter or for cleaning alarm conditions.

Note: before a change to a parameter can be made or before an alarm can be cleaned, the display prompts the user with an "enter password" message.

At this point, the password must be entered before the user can continue with the action.

PASSWORD INFORMATION

The password for ALR and WHR units is always the successive pressing of the following ACTION group keys:



Once this has been done, the user can make changes to the menu item entries. After entering the correct password, the controller will allows a 5 minute time period during which the operator may make any necessary set point adjustments.

Any keypad activity will reset the timer for the full 5 minutes so the password only needs to be entered once per section.

After 5 minutes of inactivity, the password access time will expire providing protection against unauthorized users.

KEY When changing the value of a menu item entry, pressing INCR. + shifts the menu item display line to the next available selection or next higher values, continuing pressing this key cause to get to the upper limit of the value range and "high limit reached" message appear in the display.

KEY When changing the value of a menu item entry, pressing DECR. - shifts the menu item display line to the next previous available selection or the lower values, continuing pressing this key cause to get to the lower limit of the values range and "low limit reached" message

appear in the display.

KEY Once a change has been made the desired value, pressing ENTER locks in the new value.

KEY Pressing ALARMS followed by CLEAR clears the current alarm. Also when a change is made to a menu item, pressing CLEAR returns the display to the original value as long as ENTER has not yet been pressed.

Note: the cause of an alarm should always be determined and corrected before resetting the alarm through the keypad.

Example of keypad operation

A) To change a control setpoint

As an example of using keypad key fuctions, consider reprogramming the Leaving evaporator setpoint on ALR or WHR equipped with two compressors, from 7 to 6°C.

This consists of changing the Menu Item 14-A.1 entry from 7 to 6°C.

Assume Menu # 1 Unit Status is currently in the display. The following key sequence is followed:

1. Press the CATEGORY group CONTROL key one time. This switches the display to Menu # 13 (the first menu in the CONTROL category).

2. Press the MENU group NEXT key once. This shifts the display to Menu Item 14-A.

3. Press one of the ACTION group key one time. This prompts the user to enter the password.

4. Enter the 4 character authorization password (four times ENTER key). After the password verified message, press the ACTION group DECR.- key. Note that the value begins to blink. Continue pressing the DECR.- key until the desired value is shown.

5. Pressing the ACTION group ENTER key one time to set the value. This stores the new entry into the MicroTech controller memory. Note the value stops to blinking.

6. Pressing the CATEGORY group STATUS key then shifts the display back to Menu # 1.

Note: During the enter password procedure, pressing the wrong key causes an "Password Invalid" message appear in the display.

B) To view and clear a current alarm

1. Press the ALARM key Circuit # 1 Current Alarm is displayed.

2. Press the CLEAR key. The alarm is cleared and normal operation of Circuit # 1 is resumed.

3. Press NEXT MENU key. Circuit # 2 Current Alarm is displayed.

4. Repeat step 2 to CLEAR the alarm

5. Pressure transducer

Evaporator transducers are selected for a specific operating range and provide an output signal which is proportional to the sensors is 34 to 1000 kPa with a resolution of 0,1 psig. Condenser pressure sensors have a range of 138 to 3100 kPa and a resolution of 3 kPa. The pressure transducers require an external 5 VDC power supply to operate which is provided at field wiring terminal # 14. This connection should not be used to power any additional devices. The transducer output characteristics are detailed in fig 9.

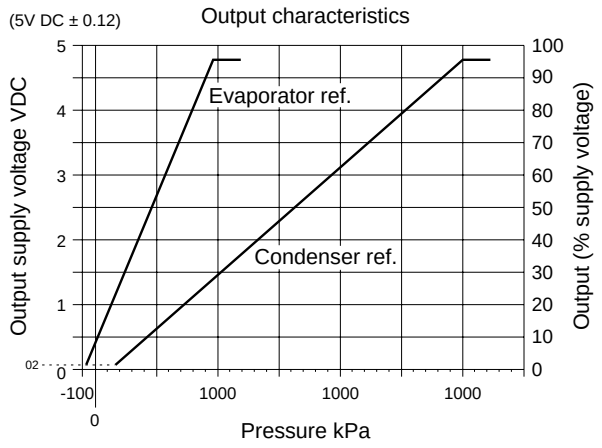


Figure 9 condenser and evaporator transducers

6. Thermistor sensor

MicroTech use a negative temperature coefficient thermistor for temperature sensing. A normal sensor will measure 3392 ohms at 22,2°C between ground and 5 VDC source from the micro control board.

The voltage between these two resistance varies as the resistances of the resistance of the sensor varies, and this voltage is converted to temperature by the controller, table13 shows the variations of thermistor resistance with temperature. Sensors are pre-mounted and connected to the MicroTech wiring strip with shielded cable.

• Entering and leaving condenser (if applicable) evaporator temperature

• Suction an liquid line temperature (provides direct display of subcooling and superheat)

• Ambient O.A. temperature.

INSTALLATION AND MAINTENANCE

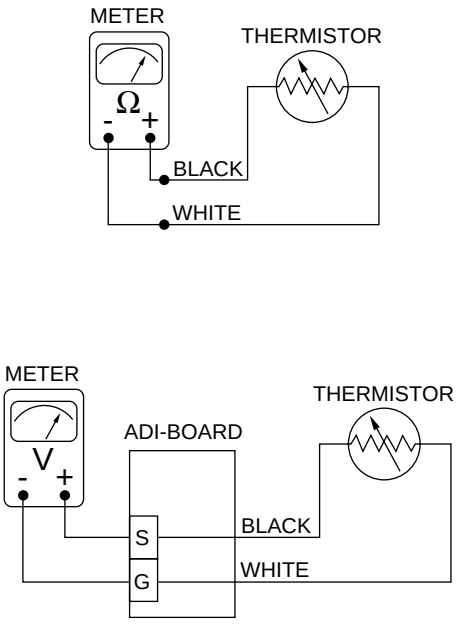
The controller is shipped factory tested and pre-configured for the type of unit to be controlled.

SENSORS AND TRANSDUCERS

Sensors and Transducers are pre-mounted and connected to the MicroTech field wiring strip with shielded cable.

Table 13 - MicroTech thermistor resistance & Testing

°C	Ω	VDC	°C	Ω	VDC	°C	Ω	VDC
-14	20563	4,30	20	3747	2,65	54	929	1,09
-12	18468	4,23	22	3425	2,54	66	863	1,03
-10	16597	4,16	24	3134	2,43	58	802	0,97
18	14986	4,09	26	2873	2,32	60	746	0,91
-6	13388	4,06	28	2631	2,21	62	694	0,86
-4	12049	3,92	30	2418	2,1	64	645	0,81
-2	10857	3,83	32	2219	2	66	63	0,77
0	9797	3,73	34	2042	1,9	68	562	0,72
2	8851	3,63	36	1879	1,81	70	525	0,68
4	8006	3,53	38	1731	1,71	72	491	0,64
6	7252	3,43	40	1596	1,62	74	459	0,6
8	6577	3,32	42	1474	1,54	76	430	0,57
10	5971	3,21	44	1362	1,45	78	402	0,54
12	5427	3,1	46	1259	1,37	80	377	0,51
14	4939	2,99	48	1166	1,3	82	353	0,48
16	4500	2,87	50	1080	1,22	84	331	0,45
18	4104	2,76	52	1001	1,16	86	310	0,42



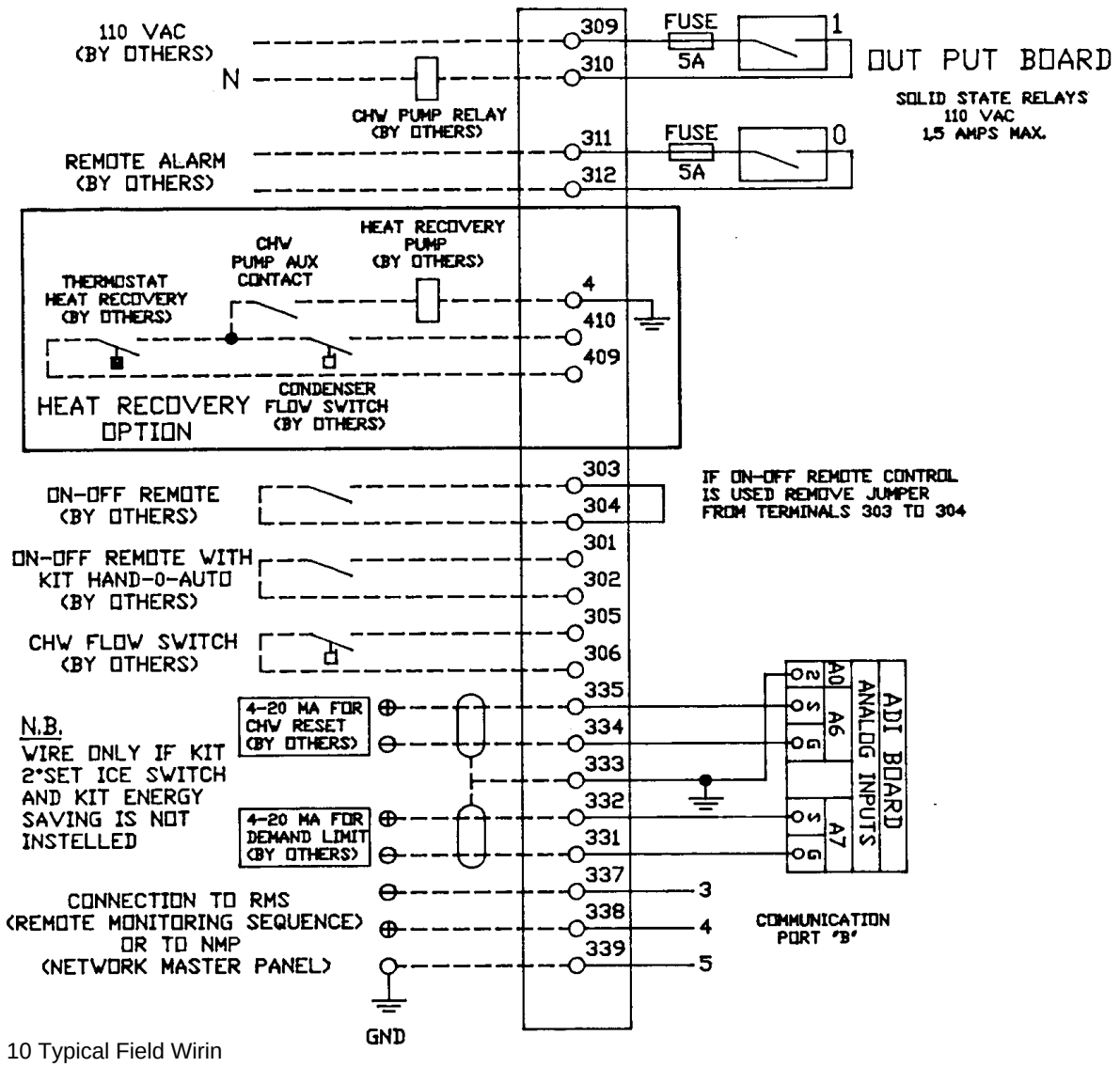


Figure 10 Typical Field Wirin

CONTROL WIRING

All low voltage control wiring is installed, labeled and tested by the factory prior to shipment.

INTERLOCK WIRING

All interlock wiring to field devices such as flow switches and pump starters is provided by the installing contractor. Refer to Figure 6 as well as the unit wiring schematics and typical application drawings at the end of this manual for details.

EXTERNAL ALARM CIRCUIT

The MicroTech panel can activate an external alarm energizing the solid state relay (output 0) When an alarm or pre-alarm condition is detected.

The terminal N. 311 e 312 are available at the field wiring terminal to energize an external alarm device such as a bell, light or relay. An alarm annunciator rated for a maximum load of 1,5 Amps at 110 VAC maximum.

The solid state relay alarm signal is de-energized during normal operation and will energize on an alarm condition. During a pre-alarm condition, the alarm output will pulse at a rate of 5 seconds on, 4 seconds off.

NOTE: The alarm signal is not active during a power failure and will not provide a "Loss of power" alarm.

REMOTE 4-20 MILLIAMP SIGNALS

Signals for chilled water reset and demand limit can be provided by the customer and should be connected to the appropriate terminals on the field wiring strip inside the control cabinet.

CALIBRATION

The control software is installed and tested by the factory prior to shipping therefore no periodic calibration of the controller is required. All control and safety setpoints will be checked and adjusted if necessary by the installing contractor prior to starting the unit. The MicroTech controller contains default setpoints which will be appropriate for most common installations. Refer to Control Menu section in this manual for a listing of the factory default settings.

MODEM KIT

An optional modem kit may be factory or field installed for remote monitoring of the chiller from an off-site PC running the McQuay Monitor software. The kit comes complete with modem, wiring harness and installation instructions.

FIELD WIRING

Interconnecting wiring for the reciprocating control panel may consist of:

- Power Winring-110 VAC
- Analog Input Signals
- Digital Input Signals
- Communications to a Personal Computer
- Telephone Line for Remote Modem Access

POWER SUPPLIES

There are several internal power supplies used by the controller and its associated circuitry.
The regulated 5 VDC power on terminal n. 14 is used to support the analog inputs on the ADI Board and should not be used to operate any external devices. An unregulated 12VDC power supply is available on field wiring terminal n. 336 and an unregulated 24VAC supply is provided at terminal n. 5.Both of these may be used for powering external devices such as low current relays and light. Contact McQuay Service to discuss your application before making any connections to these terminals.

DEMAND LIMIT, CHILLED WATER RESET SIGNALS

The optional demand limit and chilled water reset signals are 4 to 20 milliamp DC signals. The resistive load used to condition the milliamp signalsis a 249 ohm resistor factory mounted on the ADI Board.

DIGITAL INPUT SIGNALS

Remote contacts for all digital inputs such as the chilled water flow switch and the remote start/stop switch must be dry contacts suitable for the 24VAC control signals from the reciprocating control panel.

NOTE: DO NOT CONNECT 110 VAC CONTROL POWER INTO THESE OR ANY OTHER CONNECTING CIRCUITS.

DIGITAL OUTPUTS

Devices wired to the digital outputs would tipically be an optional Chilled Water Pump control relay or an Alarm Annunciator.

The MicroTech output device is a normally open solid-state relay with an on board, replaceable 5 amp fuse.The status of all outputs are shown by individual red LED's for ease of determining output status.

AUDIBLE ALARM

It is highly recommended that an audible alarm be wired to the Alarm Output of the Reciprocating control panel so that the operator is alerted to any alarm condition as soon as possible. This alarm output is de-energized during normal operation or safety shutdown of a unit controller.

COMMUNICATION PORTS

Communication ports are provided on the MicroTech controller for connection to an IBM compatible computer for local or remote system monitoring. All communication network wiring utilizes low voltage shielded twisted pair cable. The network uses the RS 232C communication standard with a maximum cable lenght of 15 mt. See the Personal Computer Specification section of this manual for specific hardware requirements.

TELEPHONE LINE

For Remote Modem Access, a voice quality, direct dial telephone line is required if remote access and monitoring of the unit controller is desired. The phone line should be terminated with a standard RJ-11 modular phone plug.

STARTUP AND SHUTDOWN

PRE STARTUP

1. With main disconnect open, check all electrical connections in control panel and starter to be sure they are tight and provide good electrical contact.
Although connections are tightened at the factory, they may have loosened enough in shipment to cause a malfunction.

2. Check and inspect all water piping. Make sure flow direction is correct and piping is made to correct connection on evaporator and condenser.

3. Open all water flow to the condenser and evaporator.

4. Start manually evaporator condenser water pump. Check all piping for leaks. Vent the air from the evaporator and condenser water circuit as well as from the entire water system. The cooler circuits should contain clean, non-corrosive water.

5. If water regulating valves are provided, connect their capillary to the manual valves provided on the condensers and open the manual valves.

6. Turn the main power Q10 switch, the F120 transformer circuit breaker, auxiliary circuits Q9 circuit breaker, and emergency stop Q11 push bottom to "ON" position.

This will energize crankcase heaters R1, R3, R4 the compressor motor protector MP1, MP2, MP3, MP4 and the R6 evaporator heater (only ALR units).

Crankcase heaters have operate at least 12 hours prior to start-up.

Crankcase should be warm.

Making sure Q12 system switch and pumpdown switches Q13-Q14 and Q33-Q34 are on "OFF" position.

The 24V T2 transformer provides power to the MicroTech controller and related components.

With 24V power applied, the controller will check the position of the front panel System Switch. If the switch is in the "stop" position the chiller will remain off and the display will indicate the operating mode to be OFF:SystemSW.

The controller will then check the PumpDown Switches. If either switch is in the "stop" position, that circuit's operating mode will be displayed as OFF:PumpDownSw. If the remote Start/Stop Switch is open, the chiller will be OFF:Remote Sw.

The chiller may also be commanded off via the communications network if a separate RMS Panel is installed. The display will show OFF:RemoteComm if this operating mode is in effect.

If an alarm condition exists which prevents normal operation of both refrigerant circuits, the chiller will be disabled and the display will indicate OFF:AllCompAlarm.

Assuming none of the above "Off" conditions are true, the controller will examine the internal time schedule to determine if the chiller should start.

The operating mode will be OFF:TimeClock if the time schedule indicates an "off" time period.

7. Check compressor oil level. Prior to startup, then oil level should cover at least one-third of the oil sightglass.

8. Check pressure drop across evaporator and condenser, and see that water flow is correct per the design flow rates and data on page 9.

9. Check the actual line voltage to the unit to make sure it is the same as called for on the compressor nameplate within + 10% and that phase voltage unbalance does not exceed 2%.
Verify that adequate power supply and capacity is available to handle load.

10. Make sure all wiring and fuses are of the proper size. Also make sure all interlock wiring is completed per McQuay diagrams.

11. Verify that all mechanical and electrical inspections by code authorities have been completed.

12. Make sure all auxiliary load and control equipment is operative and that an adeguate cooling load is available for initial startup.

STARTUP

1. Open the compressor suction and discharge shutoff valves until backseated. Always replace valve seal caps.

2. Open the manual liquid line shutoff valve.

3. Check to see that the unit F120, Q9, Q11 switches are in the "off" position.

4. Check to see that the pumpdown switches Q13-14 and Q33-34 are in the "manual pumpdown" position and the control system switch Q12 is in the "off" position.

5. Thtow the main power Q10 and control circuit disconnects to the "on" position.

6. Verify crankcase heaters have operated for at least 12 hours prior to startup. Crankcase should be warm.

7. Turn the unit main power Q10 switch to the "on" position.

8. Turn the F120, Q9, Q11 switches to the "on" position.

9. The MicroTech controller contains factory installed default setpoints which will be appropriate for most common installations. Step through all the unit's setpoints by using the keypad/displayand adjust them as required to meet the job specifications.

The chiller is shipped with "Manual unit off" as default operating mode to avoid improper operating mode by the operator. Select automatic operation in the Control Menu before to go on. Any alarms appearing on the display should be cleared at this time by pressing the CLEAR key on the keypad/display.

Watch the LED's on the input board, if no alarm is present all LED's on the ADI board unless = 1, 3, 9, 11 referred to oil pressure switch and = 7, 15, 17, 19 referred to circuits switches must be "on" and see also output board to determine the operating status of the controller's outputs while performing the following system checks.

Move the Q12 System Switch to the "on" position. LED = 5 on the ADI Board will turn on and if the internal time schedule indicates an "on" period, the chilled water pump output will be activate. The keypad/display will show the unit status as OFF: PumpDnSw's.

NOTE: The chilled water pump output will remain energized anytime the chiller is enable. The pump output is deenergized whenever the chiller is in an OFF Mode initiated by the System Down Switches or Network communicationbs. When the chiller shifts from a Cooling Mode to one of these off Modes, the chilled water pump output will remain energized for 60 seconds.

This will maintain water flow through the evaporator during pumpdown and prevent rapid cycling of the chilled water pump.

10. Move Q13, Q14, and Q33, Q34 circuit switches to the "on" position. LED's = 7, 15, 17, 19 on the ADI Board will illuminate. If none of "off" conditions are present the MicroTech Controller will initiate a start sequence and energize the chilled water pump output relay.

The chiller will remain in the Waiting For Flow mode until the field installed flow switches indicates the presence of chilled water flow. If flow is not proven within 30 seconds, the alarm output will be turned on and the chiller will continue to wait for proof of chilled water flow.

Once flow is established the controller will sample the chilled water temperature and compare it against the Leaving Chilled Water Setpoint, the Control <band and the Load Delay which have been programmed into the controller"s memory. If the leaving chilled water temperature is above the Leaving Chilled Water Setpoint plus half of the adjustable Control Band plus Start-up Delta-Temp. Setpoint.

The controller number of starts will select the refrigerant circuit with the lowest as the lead circuit and enter the first stage of the Cool Staging Mode.

The controller will open the liquid line solenoid valve of the lead refrigerant circuit (Y1, Y2, Y3, Y4) allowing refrigerant to flow through the expansion valve and into the evaporator. When the evaporator refrigerant pressure rises above the LPCutln Setpoint the controller will start the first compressor.

The first condenser fan stage will be started in conjunction with the first compressor to provide initial head pressure control. The MicroTech controller continuously monitors the lift pressure referenced to several head pressure control setpoints and will adjust the number of operating condenser fans as required to maintain proper head pressure. For WHR unit Copeland compressors, the condenser pump will be started in conjunction with the first compressor to provide head pressure control.

The unit will stage up automatically to meet system demand based on the setpoints stored in the controller's memory and the keypad/display will show the unit's current cooling stage.

Condenser fans for the lead refrigerant circuit will be cycled as required to maintain proper condenser pressure. All operating characteristics will be viewable on the keypad/display.

11. After running the unit for a short time, check the oil level in each compressor crankcase, rotation of condenser fans (if any), and check for flashing in the refrigerant sightglass.

12. After system performance has stabilized, it is necessary that the "Compressorized Equipment Waranty Form" be completed to obtain full warranty benefits. Be sure to list the pressure drop across both vessels. This form is shipped with the unit and after completion should be returned to the McQuay Service Department through your sales representative.

NOTE: Initial start-up is to be performed only by McQuay autorized Service organization. This is a must to obtain full warrants benefits.

EMERGENCY STOP

A red switch Q11 is provided on the front panel of the control box, to allow the unit emergency stop in case of malfunction, the unit must be restarted following this procedure:

1. Move switches Q13-Q14 and Q33-Q34 to the OFF position.

2. Reset emergency stop switch Q11.

3. Repeat start-up procedure from beginning.

WEEKEND OR TEMPORARY SHUTDOWN

Move the Circuit switches to the "OFF" position. Each circuit will pumpdown and the compressors will stop. In this condition, the compressors will remain off and no additional pumpdown will occur even if the evaporator pressure rises above the LPCutin setpoint.

After both circuits have been pumped down, open the Remote Stop Switch and the controller will stop the chilled water pump.

Startup After Temporary Shutdown - Move the Q13-14-33 or 34 Circuits switches to the "ON" position. If the controller is calling for cooling, the compressors will start and the unit will stage up as required. If cooling is not requested, the circuits may pump down and the compressors will stop.

EXTENDED SHUTDOWN

CAUTION!

It is the operator's responsability to provide protection against water circuit freezing on ALR units. All water must be drained from the evaporator and associated piping and power for the cooler heating cable should be applied via separate disconnect if freezing ambient conditions are expected.

1. Close the manual liquid line shutoff valves. Move the circuits switches to the "OFF" position. Each operating circuit will pumpdown and the compressors will stop. In this condition, the compressors will remain off and no additional pumpdown will occur even if the evaporator pressure rises above the LPCutln setpoint.

2. After both circuits have been pumped down, open the Remote Stop Switch and the controller will stop the chilled water pump.

3. Move the Q12 System Switch and the Q11 "Emergency Stop" position. Turn off main power to the chiller and to the chilled water pump.

4. Close the compressor suction and discharge valves and the oil equalization line valve.

5. Tag all opened electrical disconnect switches to warn against startup before opening the compressor suction, discharge and liquid valves.

6. On ALR units, drain all water from the unit evaporator and chilled water piping and leave power applied to the cooler heating cable if the unit will be exposed to freezing ambient temperatures.

LOW AMBIENT START

If the saturated condenser temperature is less than 15°C (1480 KPa) at the time of circuit startup, the low ambient start logic will cause the following changes in the normal startup sequence.

The first compressor will start when the solenoid valve is opened regardless of whether the evaporator pressure has risen above the LPCutIn setpoint. The refrigerant freeze protect setpoint will be ignored for 180 seconds to allow time for the refrigerant pressure to build. If at the conclusion of the 180 second timer the evaporator pressure is still below the LPCutIn setpoint, the circuit will shutdown and the alarm output be activiated.

The chilled water freeze alarm setpoint is enforced during low ambient starts and will shut down the chiller if a water freeze condition is detected.

If at any time during low ambient start the evaporator pressure drops to 70 kPa the chiller will shut off and a "Lo Evap Pressure" alarm will be generated.

PUMPDOWN CONTROL

Pumpdown of each refrigeration circuit will always occur when the circuit is commanded from a "Cooling" mode to an "Off: Ready" mode. The pumpdown sequence closes the solenoid valve and the lead compressor in the circuit is used to perform the pumpdown.

The compressor is fully loaded during pumpdown if unloaders are present. While in the units with double speed compressor the controllers shall pumpdown the circuit in either high speed and low speed (which ever condition the circuit was in when the pumpdown request was made). An alarm condition in the refrigerant circuit will disable the pumpdown sequence.

Pumpdown will occur if the evaporator pressure is above the LPCutIn pressure and stop when the pressure reaches the LPCutOut pressure. If the evaporator pressure has not dropped to the LPCutOut setpoint after 180 seconds, the controller will stop all compressors and activate the alarm output. Alarm will be "Can't Pump Down".

Note that pumpdown can be commanded by the operator by moving the circuit switch from "ON" to "OFF". When manual pumpdown is activated, the circuit will pump down once and then shut off. No additional compressor operation will occur even if the evaporator pressure climbs above the LPCutIn setpoint.

When the switch is moved to the "Auto" position, the first compressor will start and the unit will stage up as required if the controller is calling for cooling. If cooling is not requested , the circuits will pump down and the compressors will stop.

If the chiller is commanded Off by the Time Schedule, Remote Communications or the Remote Stop Switch, the chiller will pump down and stop when the evaporator pressure falls to the LPCutOut Setpoint.

In the event the evaporator pressure rises above the LPCutIn Setpoint, the controller will initiate another pumpdown sequence. After the second pumpdown, the controller will allow only one additional pumpdown to occur every 120 minutes if required.

AIR COOLED HEAT RECOVERY UNITS

Heat recovery operation is enabled only when condenser water flow is verified by the field installed condenser flow switch. With Q17 closed and on a call for heat, the field provided heat recovery control switch closes initiating a 5 minute time delay.

After 5 minutes the time delay will close energizing K9 relay. K9 will de-energize the condenser fans and energize solenoid valves Y11, Y12, Y31 and Y41, rerouting the compressor discharge gas to the heat recovery condensers.

Upon satisfying the heating demand, the heat recovery control switch opens which will start the condenser fans and re-route the refrigerant back to the air cooled condenser. KT16, 26, 36 and 46 will delay switch-over of Y20 for 20 seconds when entering heat recovery mode to allow time for the refrigerant charges to stablize.

MENU DESCRIPTION

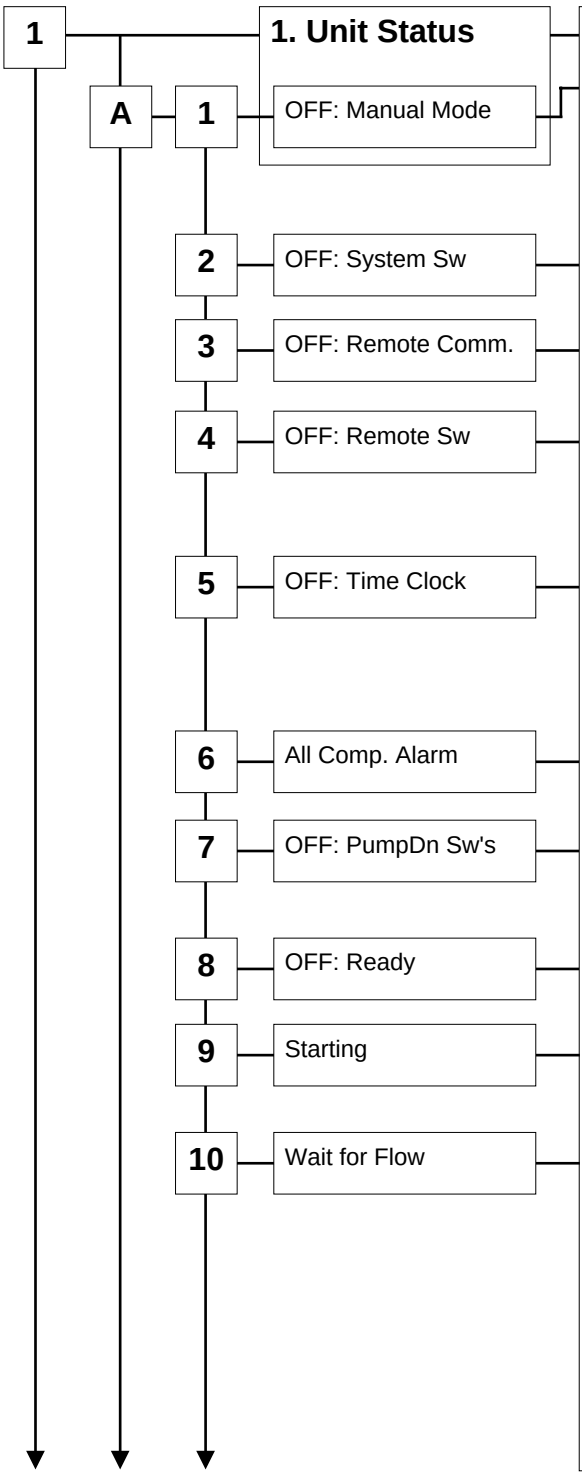
A description of each of the three structures, STATUS, CONTROL and ALRM is here given.

For each structure are explanation of each menu is also given

STATUS MENUS

Menu 's1 through 12 for ALR & WHR units equipped with 2 compressors, and 1 through 18 for ALR & WHR units equipped with 3 & 4 compressors. Provides chiller operating information and display of sensor readings. The items listed under these stautus menus are affected by the settings under the associated control menus and are not directly adjusted via keypad.

STATUS MENU DESCRIPTIONS



The chiller operating status is displayed within this Menu.

When the mode of the unit is "Manual Unit Off" (see Menu 13-A.1) note that all the outputs will be off thus no pump down will take place, and no operation of the chiller water pump. This is the default mode of operation when the unit is shipped or when new code is down loaded into a unit.

Q12 switch located in the front panel of the unit is in the OFF position.

Controller has been commanded to an off state via Remote Communications

Upon start up the panel will check the "Remote Stop Switch" digital input. Note that from the factory, the unit will ship with a mechanical jumper between 303-304 field terminals. If the switch is open, the controller will remain in the "OFF: Remote Switch" mode.

Upon closure of the remote Stop switch the unit will assure an "OFF Time Schedule" mode. Note that if a customer wishes for the unit to run whenever the remote switch is closed, the eight-day time clock must be set to start at 00:00 and stop at 23:59 for all day.

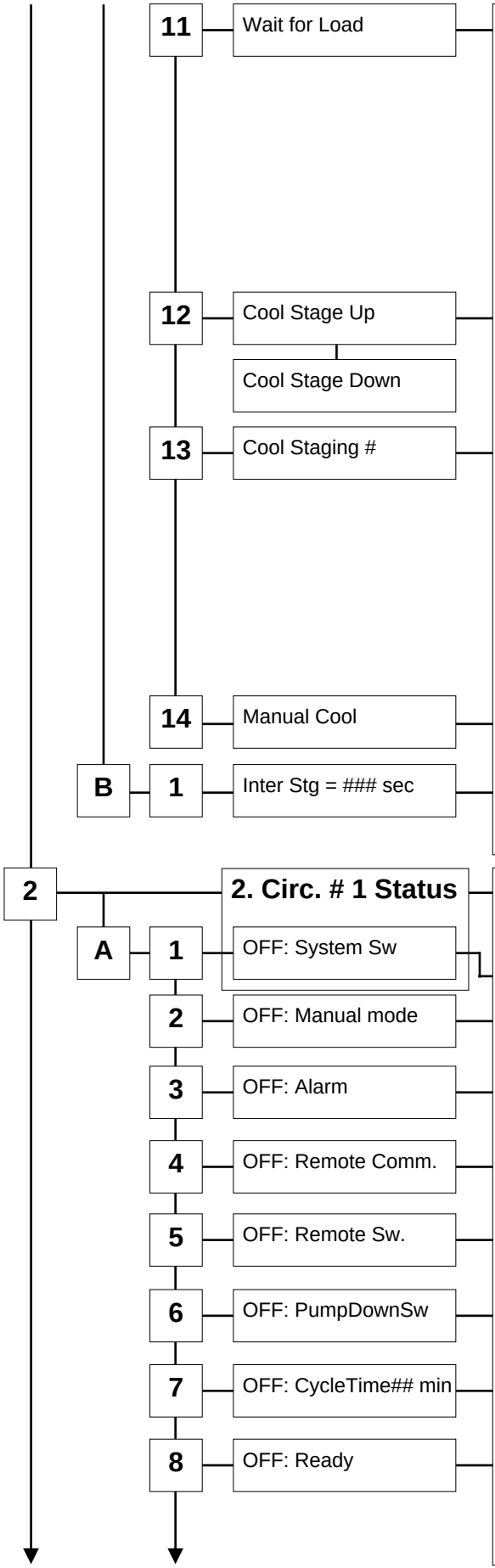
This is the mode which will be displayed when all circuits are in alarm condition which means no cooling is possible.

Q13;Q14-Q33 and Q34 pump down digital inputs for all circuits are in the "OFF" position, the mode of the chiller is "OFF: Pump Down Switch's"

OFF Ready or Standby

If none of the above "OFF" conditions are true, the unit will attempt to start, this is a transition mode to tell the operator that the controller will attempt to start the unit.

Once a start has been requested, the controller shall energize the chilled water pump and check for the presence of chilled water flow via the normally open flow switch (connected between terminals 305-306) If flow is not present, the controller will stay in the "Wait for Flow" mode until flow is established. This is considered to be a "warning" condition which will generate a pre-alarm. Loss off chilled water flow during chiller operation will cause the unit to log the alarm and return to the "Waiting for Flow" state. When chilled water flow has been re-established, the alarm will



When chilled water flow is established the controller will wait for a period of time equal to the "Load Delay" setpoint (Menu 15-D) to determine if the chilled water loop is above the current chilled water setpoint. If the leaving chilled water temperature is above the leaving chilled water setpoint (Menu 14-A) plus half of the Control band (Menu 14-C) plus Startup Delta T (Menu 14-D), the controller will enter the Cool Staging mode otherwise the controller will wait until the end of the currently scheduled run period.
Example: If the leaving chilled water setpoint is 6°C and the Control Band is 1,6°C and the StartupD-T set point is 1,4°C. The leaving chilled water temperature must be 6+0,8+1,4=8,2°C before the chiller will enablecool staging.

These are momentary operating modes indicating a stage-up or stage-down is being initiated by the controller.

This the normal mode the chiller will be in while cooling. The number of currently active cooling stages will be displayed. The stage is only an indicator of system capacity and does not indicate which compressor or circuits are on.
Note: that "Cool Stage O" means that compressors are currently not available to be energize due to anti-cycle timers. If the load drops, such that the chiller is at stage 1 and the leaving chilled water temperature is below the leaving chilled water temp. Setpoint (Menu 14-A.1), less half of the Control Band (Menu 14-C), less Shut Down Delta T (Menu 14-E) the chiller will go from the "Cooling Starting" mode to the "Wait for flow" mode.

The current operating condition of refrigerant circuit # 1 is displayed whenever this menu is selected. There is only one item contained in this menu.

See Menu 1 - Item A-2

See Menu 1 - Item A-1

Off due to Alarm condition

See Menu 1 - Item A-3

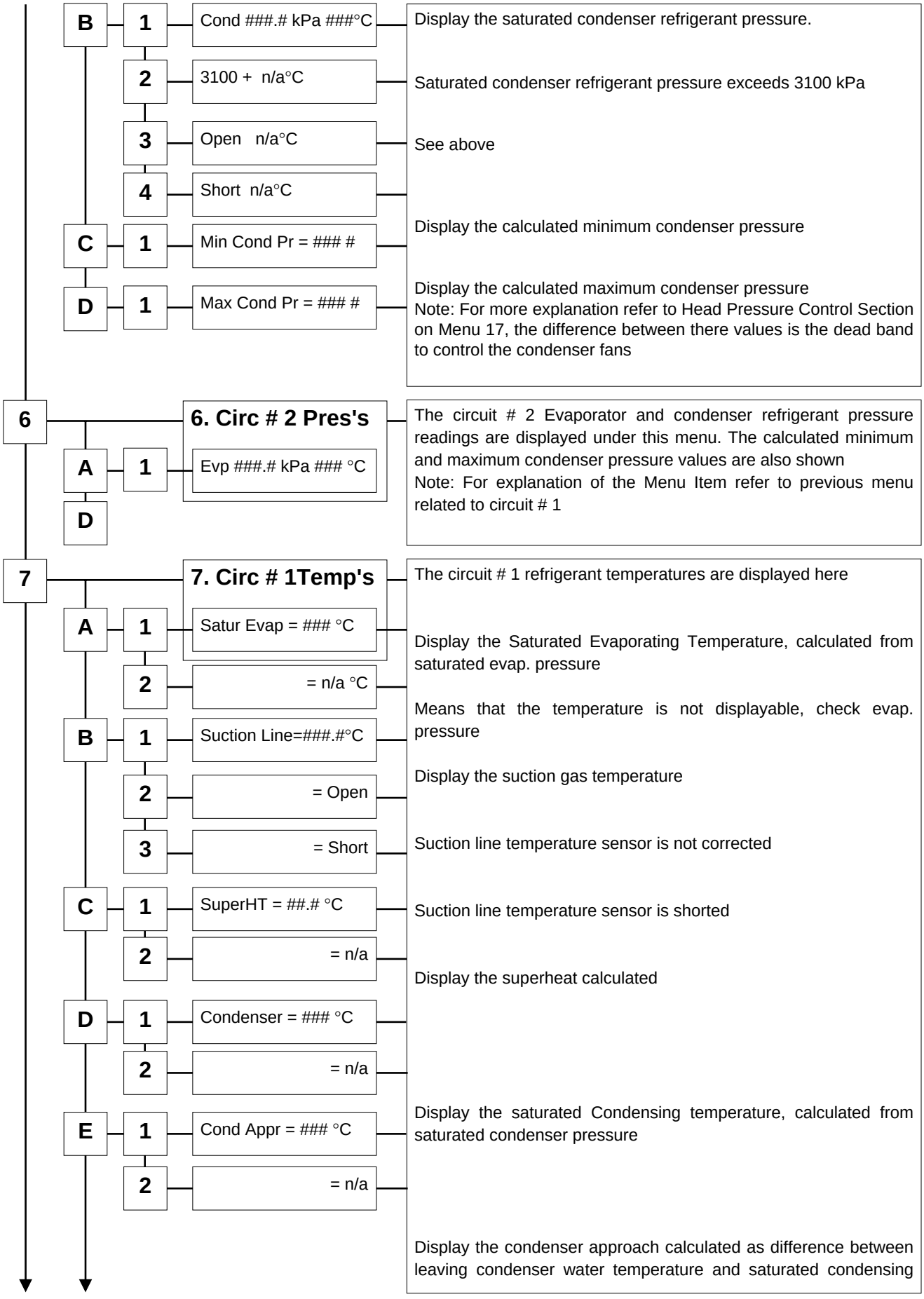
See Menu 1 Item A-4

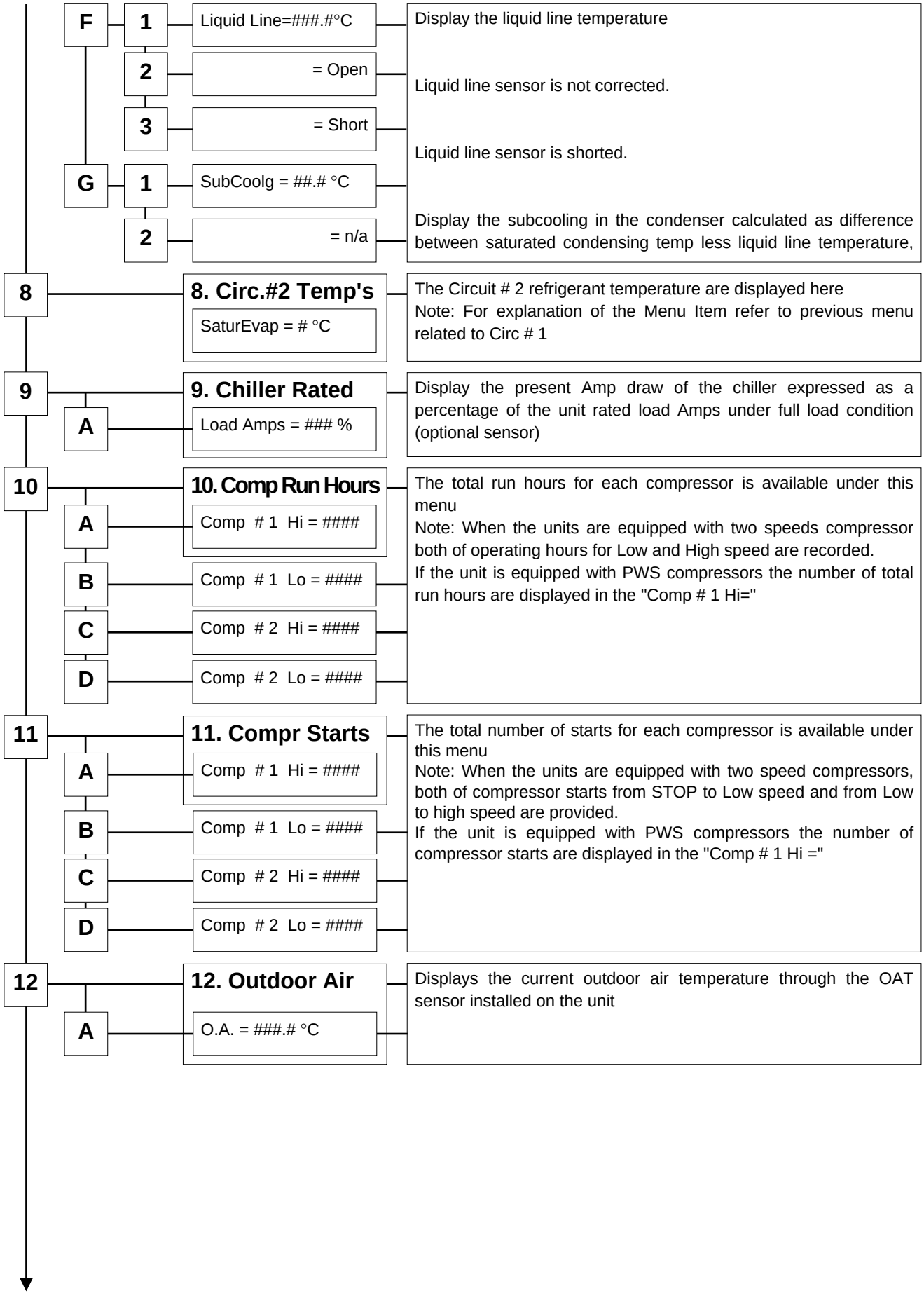
The Circuit pumpdown switch Q13 is in the "OFF" position

Off due to Anti-cycle timers (Menu 16-C/16-D)

See Menu 1 Item A-8

		9	Pumping Down	The circuit is in the process of pumping down, the solenoid valve is closed
		10	Open Solenoid	A request has been made for the circuit to be energized for cooling, the solenoid valve is open and the controller is waiting for the pressure to rise above the "LP OUT IN" Setpoint (Menu 22-A)
		11	Brine Start Cyc #	Number of cycle (Menu 16-E) remaining in the circuit during initial startup to reach normal sequence of operation
		12	Cooling % Cap = ###	Circuit is cooling, operating conditions are normal. The circuit percent capacity is displayed
3	**3. Circ. # 2 Status**			The operating staus of this refrigerant circuit displayed on the key-pad/display are the same description listed above for circuit No 1
	A		OFF: System Sw	
4	**4. Water temp's**			Display all the water temperature
	A	1	Lvg Evap = ##.# °C	Display the Evaporator Leaving Water Temperature
		2	= Open	The MicroTech controller has a built-in function which will identify a defective sensor. The two possible failure modes are as follows: "Open" = Open Sensor "Short" = Shorted Sensor
		3	= Short	
	B	1	Ent Evap = ###.# °C	Display the entering evaporator water temperature
		2	3 See above	
	C	1	Ent Cond = ###.# °C	Display the entering Condenser water temperature (for sensor location see instruction on page .....)
		2	3 See above	
	D	1	Lvg Cond = ###.# °C	
		2	3 See above	
5	**5. Circ. # 1 Pres's**			The circuit # 1 evaporator and condenser refrigerant pressure readings are displayed under this menu.
	A	1	Evp ###.# KPa ###°C	Display the saturated evaporator refrigerant pressure and the corresponding evaporating temperature.
		2	999+ n/a°C	Saturated evap. pressure exceeds 999 kPa.
		3	Open n/a°C	Display failure condition for the sensor.
		4	Short n/a°C	


B
1
Cond ###.# kPa ###°C
Display the saturated condenser refrigerant pressure.
2
3100 + n/a°C
Saturated condenser refrigerant pressure exceeds 3100 kPa
3
Open n/a°C
See above
4
Short n/a°C
C
1
Min Cond Pr = ### #
Display the calculated minimum condenser pressure
D
1
Max Cond Pr = ### #
Display the calculated maximum condenser pressure
Note: For more explanation refer to Head Pressure Control Section on Menu 17, the difference between there values is the dead band to control the condenser fans
6
6. Circ # 2 Pres's
The circuit # 2 Evaporator and condenser refrigerant pressure readings are displayed under this menu. The calculated minimum and maximum condenser pressure values are also shown
Note: For explanation of the Menu Item refer to previous menu related to circuit # 1
A
1
Evp ###.# kPa ### °C
D
7
7. Circ # 1Temp's
The circuit # 1 refrigerant temperatures are displayed here
A
1
Satur Evap = ### °C
Display the Saturated Evaporating Temperature, calculated from saturated evap. pressure
2
= n/a °C
Means that the temperature is not displayable, check evap. pressure
B
1
Suction Line=###.#°C
Display the suction gas temperature
2
= Open
3
= Short
Suction line temperature sensor is not corrected
C
1
SuperHT = ##.# °C
Suction line temperature sensor is shorted
2
= n/a
Display the superheat calculated
D
1
Condenser = ### °C
2
= n/a
E
1
Cond Appr = ### °C
Display the saturated Condensing temperature, calculated from saturated condenser pressure
2
= n/a
Display the condenser approach calculated as difference between leaving condenser water temperature and saturated condensing

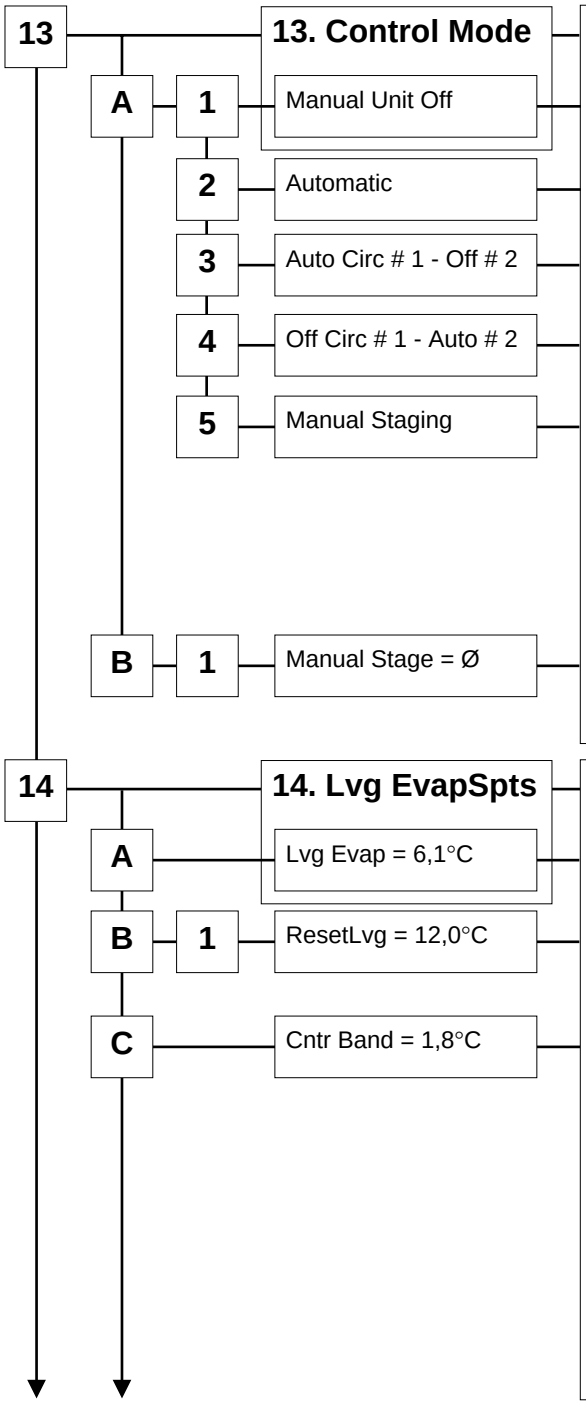

F
1
Liquid Line=###.#°C
Display the liquid line temperature
2
= Open
Liquid line sensor is not corrected.
3
= Short
Liquid line sensor is shorted.
G
1
SubCoolg = ##.# °C
2
= n/a
Display the subcooling in the condenser calculated as difference between saturated condensing temp less liquid line temperature,
8
8. Circ.#2 Temp's
SaturEvap = # °C
The Circuit # 2 refrigerant temperature are displayed here
Note: For explanation of the Menu Item refer to previous menu related to Circ # 1
9
9. Chiller Rated
A
Load Amps = ### %
Display the present Amp draw of the chiller expressed as a percentage of the unit rated load Amps under full load condition (optional sensor)
10
10. Comp Run Hours
A
Comp # 1 Hi = ####
B
Comp # 1 Lo = ####
C
Comp # 2 Hi = ####
D
Comp # 2 Lo = ####
The total run hours for each compressor is available under this menu
Note: When the units are equipped with two speeds compressor both of operating hours for Low and High speed are recorded.
If the unit is equipped with PWS compressors the number of total run hours are displayed in the "Comp # 1 Hi="
11
11. Compr Starts
A
Comp # 1 Hi = ####
B
Comp # 1 Lo = ####
C
Comp # 2 Hi = ####
D
Comp # 2 Lo = ####
The total number of starts for each compressor is available under this menu
Note: When the units are equipped with two speed compressors, both of compressor starts from STOP to Low speed and from Low to high speed are provided.
If the unit is equipped with PWS compressors the number of compressor starts are displayed in the "Comp # 1 Hi ="
12
12. Outdoor Air
A
O.A. = ###.# °C
Displays the current outdoor air temperature through the OAT sensor installed on the unit

CONTROL MENUS

Menu's 13 through 23 for ALR & WHR units equipped with 2 compressors, and Menu's 19 through 29 for ALR & WHR units equipped with 3 & 4 compressors, are the setpoint menu's. All adjustable control parameters and setpoints, time schedules, control options, and alarm conditions are accessed through these menu's.

CAUTION: Any changes to the followings parameters must be determined and implemented by qualified personnel with a through understanding of how these parameters affect the operation of the unit. Negligent or improper adjustment of these controls may result in damage to the unit or personal injury.

CONTROL MENU DESCRIPTIONS



This menu allows the operator to choose one of several operating modes for the units

The unit is manually Off. The operator must change this status to another explained below to start-up the units.

Automatic Staging control, all circuits are enabled for operation.

Selecting this option as the operating mode, refrigerant circuit 2 is locked off while allowing Circuit 1 to stage automatically.

This option allow the normal staging of refrigerant circuit 2, but circuit 1 is locked out.

Note: These manual setting are intended to aid in the troubleshooting and should not be considered to be normal operating modes. The equipment should not be left unattended during manual operation as some automatic controls are disabled. The chiller will remain in the manual mode until Automatic operation is selected. Selecting Manual staging the operator will determine manually the number of Cooling Stages. In this operating mode, the condenser fans are controlled by the MicroTech.

The chilled water setpoint, control band and maximum pull down rate are adjusted from within this menu as well as chilled water reset options and control ranges This is the chilled water temperature that will be mantained if no reset options are in effect.

Reset Chilled water setpoint, will indicate the calculated chilled water temperature to be mantained when one of the reset options (Menu # 14 G) is enabled.

The control band is a function between the water temperature drop accross the evaporator, at full load, and the maximum number of cooling stages present in the unit, and defined as non staging area of the control. Any time the sensor temperature, minimum time between stage (adjustable interstage time Menu 16 B) has elapsed, the next band limits, no staging will occur. McQuay recomends the following formula for calculating the minimum control band setpoint:

$$\frac{\text{Temperature drop across the evaporator at full load (°C)}}{\text{Maximum number of cooling stages of the unit}}$$

D — StartUp D-T = 1,6°C

E — ShutDn D-T = 0,6°C

F — MaxPull Dn = 0,2°C

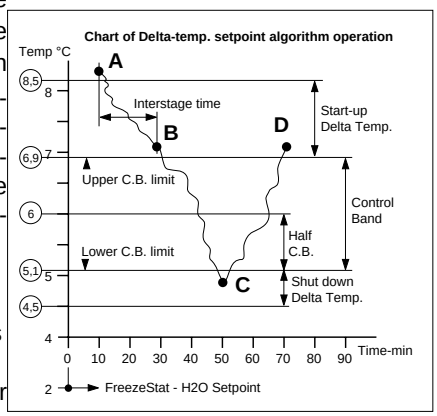
G — **1** — Reset Opt = None

2 — Reset Opt = Return

The decision to enable the first stage of cooling is controlled by Startup delta temp. setpoint. Once flow is established, the controller will sample the chilled water temperature. If the chilled water temperature is above the leaving chilled water temperature setpoint plus half of the control band setpoint plus the adjustable Startup delta T, the controller will select the refrigerant circuit with the lowest number of starts as the lead circuit and energize the first stage of cooling.

If the chiller is operating at minimum capacity (stage no 1) and the chilled water tempearture falls below the leaving chilled water setpoint plus half of the control band setpoint plus the adjustable shutdown Delta T, the controller will shut off the chiller, enter the "Waiting for load mode" Menu # 1, and monitor the chiller water temperature.

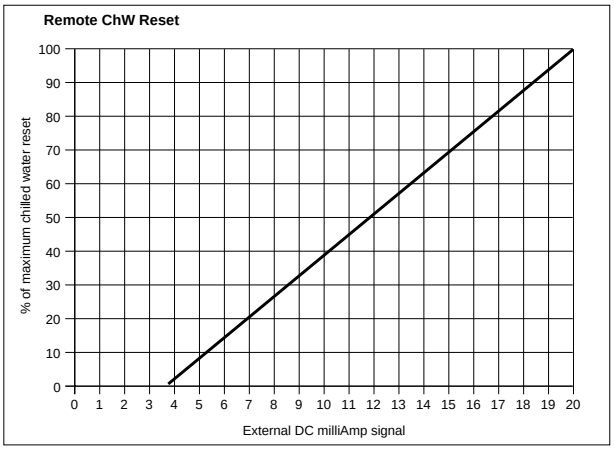
The maximum Pull down rate setpoint will prevent over shooting the chilled water setpoint during initial startup. The controller will limit the rate at which the chilled water temperature is reduced based on an adjustable setpoint (typically 0,3°C/min). Whenever the pulldown rate excedes the setpoint, the controller will delay additional stage cooling.



EXAMPLE:
Unit with two compressors
• No of cooling stage = 4
• Entering Evap water temp. = 12°C at full load
• Leaving Evap water temp. = 6°C at full load
• ΔT = 6°C at full load
C.B. setpoint = 6/4 + 0,3 = 1,8°C
Startup ΔT = 1,4°C
Shutdown ΔT = 0,6°C
The first stage of the unit during the startup, will be energized when the water temperature is above the upper C.B. limit plus the Startup ΔT setpoint, if the interstage time has elapsed (point A).
After the minimum time between stages has elapsed and the leaving water temperature is above the upper C.B. limit the next highest stage of cooling will be energized (point B). Only when the LvgEvap temp has dropped below the lower C.B. limit the unit stage down. This sequence will continue until the demand for cooling increase or decrease. Any time the evaporator leaving water temperature is above the upper C.B. limit a stage will go "ON" and any time the water temp falls below the lower C.B. limit a stage will go "OFF".
Note: The value of the sum of Lvg Evap Spt plus 1/2 Control band Setpoint plus Shutdown Delta temp Setpoint, must not be less than or equal to 4°C to avoid freezing inside the evaporator.

As part of the "Lvg Evap Spts" menu, the operator shall select the type of reset of the leaving Evaporator temperature.
No Reset will occur. This means that the water temperature Leaving the evaporator will match to the "Lvg Evap Setpoint".

By setting "Return" as the reset mode, the leaving chilled water



3 Reset Opt = 4÷20mA

The controller resets the chilled water setpoint based on an external 4 to 20 mA At 4 mA or less, no reset will occur. At 20 mA, the chilled water setpoint will be reset by an amount equal to the value stored in the "Maximum reset setpoint" Menu # 14-I. The reset schedule is linear and may be calculated using the above figure.
Note: When the unit is to be used for Ice storage, the chilled water reset analog input is used by McQuay, installing Q19 switch.

4 Reset Opt = Network

The controller can also receive a reset signal from a MicroTech RMS Panel via communication port. Signal received shall be percentage of maximum reset. Thus a 0% signal results in no reset and a 100% signal results in maximum reset.

5 Reset Opt = Ice

If the signal is to be used for Ice storage, the following step are taken:
1) Select "Ice" Option in this Menu
2) Set the chilled water setpoint Menu # 14-A to the desired (night) ice morning setpoint i.e. T night = -7°C
3) Establish the value of leaving chilled water setpoint during non-ice building mode (day operation) i.e. T day = +6°C
4) Set the "Maximum chilled water reset " Menu # 14-I equal to the amount of the absolute values of above setpoint
Max ChWRst = 7 + 6 = 13°C
Note: During the Ice building mode, compressor are fully loaded (high speed in that units where double speed compreessors are used), to guarantee compressor loading.
This means the number of cooling stages will be divided into two.

H Reset Sig = 15,2 mA

Display the Remote reset signal

I Max Chw Reset = °C

J Return Spt = ##.# °C

The maximum chilled water reset setpoint is set to reflect the

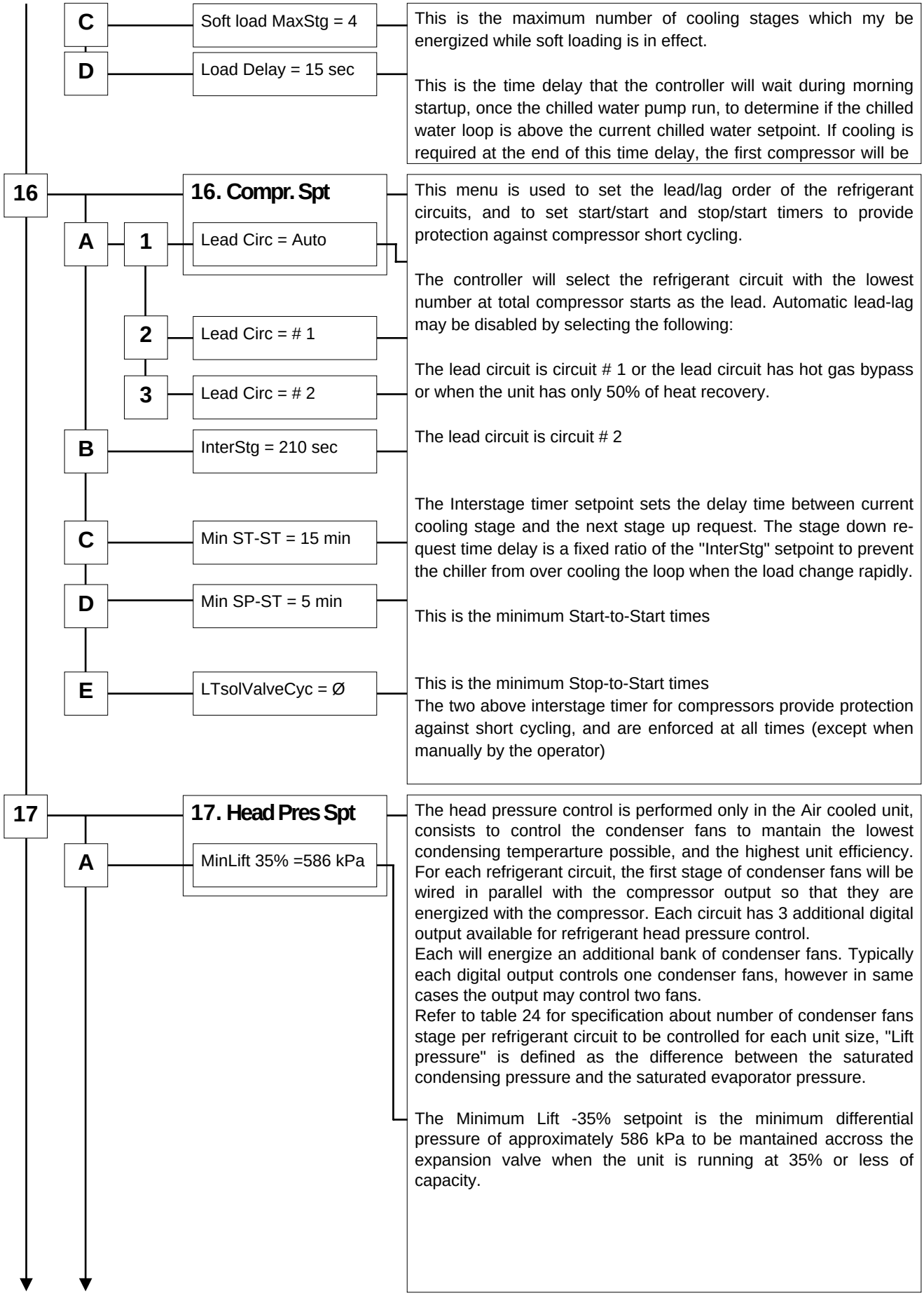
15 **15. Soft Load Spts**

The soft loading feature limits the number of coding stages which may be energized by the controller to prevent unnecessary electrical demand and possible overshoot of the desired leaving chilled water tempearture. Soft loading is typically used during morning startup.
When the controller enters the "Cool staging" mode of operation the controller will start a count down timer and "time left" indicates how long the unit has been in the cool staging mode.

A Time left = 20 min

B Soft load = 20 min

This is the lenght of time soft loading will be in effect after the



This is the maximum number of cooling stages which my be energized while soft loading is in effect.

This is the time delay that the controller will wait during morning startup, once the chilled water pump run, to determine if the chilled water loop is above the current chilled water setpoint. If cooling is required at the end of this time delay, the first compressor will be

This menu is used to set the lead/lag order of the refrigerant circuits, and to set start/start and stop/start timers to provide protection against compressor short cycling.

The controller will select the refrigerant circuit with the lowest number at total compressor starts as the lead. Automatic lead-lag may be disabled by selecting the following:

The lead circuit is circuit # 1 or the lead circuit has hot gas bypass or when the unit has only 50% of heat recovery.

The lead circuit is circuit # 2

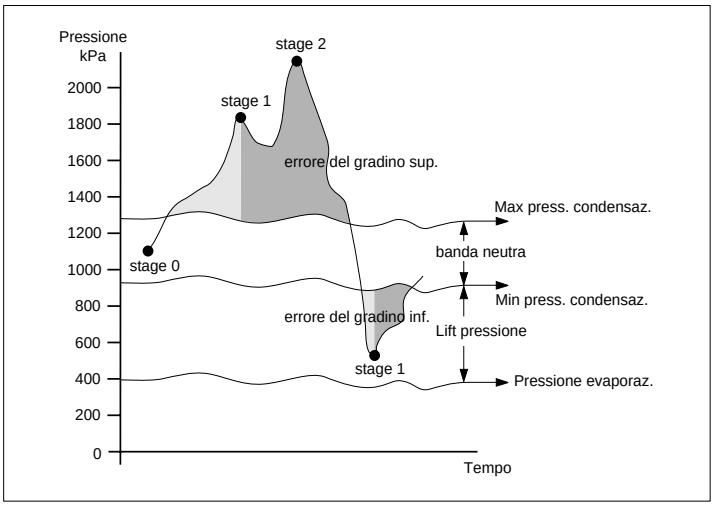
The Interstage timer setpoint sets the delay time between current cooling stage and the next stage up request. The stage down request time delay is a fixed ratio of the "InterStg" setpoint to prevent the chiller from over cooling the loop when the load change rapidly.

This is the minimum Start-to-Start times

This is the minimum Stop-to-Start times
The two above interstage timer for compressors provide protection against short cycling, and are enforced at all times (except when manually by the operator)

The head pressure control is performed only in the Air cooled unit, consists to control the condenser fans to mantain the lowest condensing temperarture possible, and the highest unit efficiency. For each refrigerant circuit, the first stage of condenser fans will be wired in parallel with the compressor output so that they are energized with the compressor. Each circuit has 3 additional digital output available for refrigerant head pressure control.
Each will energize an additional bank of condenser fans. Typically each digital output controls one condenser fans, however in same cases the output may control two fans.
Refer to table 24 for specification about number of condenser fans stage per refrigerant circuit to be controlled for each unit size, "Lift pressure" is defined as the difference between the saturated condensing pressure and the saturated evaporator pressure.

The Minimum Lift -35% setpoint is the minimum differential pressure of approximately 586 kPa to be mantained accross the expansion valve when the unit is running at 35% or less of capacity.



B — MinLift 100%=966 kPa

The Minimum Lift-100% setpoint is the minimum differential pressure to be maintained to accomodate the increased flow through the expansion valve when the unit is running at 100% capacity. Between 35% and 100% circuit
capacity, the controller will calculate the proper Lift pressure by Lineary interpolating between these two end points.

C — DeadBandMult = 1,0

The Lift Pressure dead band is a band of pressure differential range above the Minimum Lift pressure setpoint where the controller will attempt to stabilize the lift pressure and within which no condenser fan staging will occur. This Dead band value is based on the current unit capacity and the current number of condenser fans in operation. "Dead Band Multiplier" is a variable that provide to adjust all dead bad's up or down in 10% increments. In general, increasing the Dead band multiplier will slow down the response of the condenser fans when a change in condenser pressure is defected. Decreasing the Dead band multiplier setpoint will speed up the condenser fan response to a change in condenser pressure.

D — StageUpErr = 2760

When the head pressure moves outside of upper limit of the Dead band the controller will integrate the pressure error over time. When the integrated error exceeds the Stage Up Error Setpoint the controller will adjust the condenser the fan stage up to bring the head pressure back within the Dead Band.

E — StageDnErr = 690

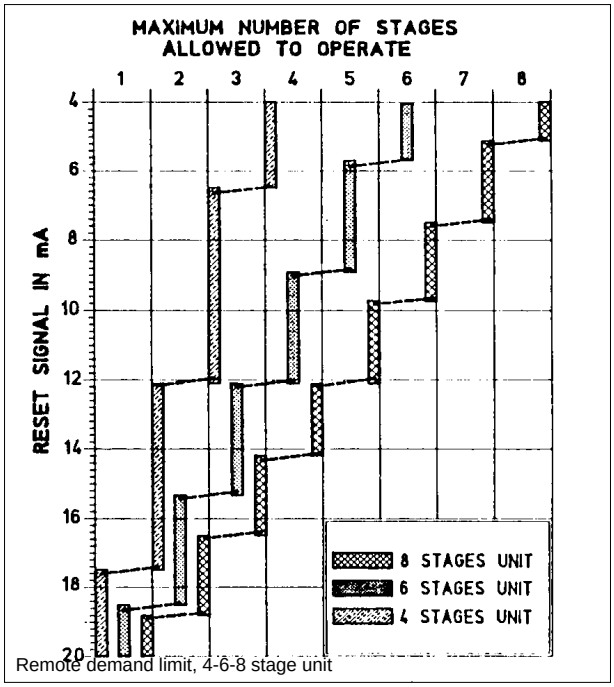
When the head pressure moves outside of the Lower Circuit of the Dead Band, the controller will integrate the pressure error over time. When the integrated error exceds the stage down error setpoint the controller will stage down the condenser fan.

18 — **18. Demand Limits**

A — DemandLim = 2 Stg

The controller will limit the total number of stages based on external 4 to 20 mA signal regardless of the amount of cooling actually required. Signal between 0 and 4 mA will enable all stages to operate, while between 4 to 20 mA the maximum number of active stage, as shown in fig. 9.

Demand limit setpoint defines the maximum number of cooling stages allows by an external 4÷20 mA signal



Remote demand limit, 4-6-8 stage unit

B — Demand Sg = 20,0 mA

Display the actual demand limit signal level in milliamps.
Figure next to, detail the effect that the remote demand limit signal will have on the chiller capacity.

Note: When the unit is equipped with the optional "Energy Saving"

19 — **19. Clock Setting**

The MicroTech controller uses an internal calendar and clock to provide automatic operation for each day of the year

A — Time = 10 : 25

TIME

Current minutes
Current hour

To change the time once the "Clock Setting" Menu is displayed press the Next Item Keys.
Values of current hour blink, press INCR, DECR Key to change to the desired value than press ENTER key to confirm.

After pressing the ENTER key to set hour, the cursor will advance to the minutes position on the display. Use the INCR, DECR, and ENTER key to set the correct values.

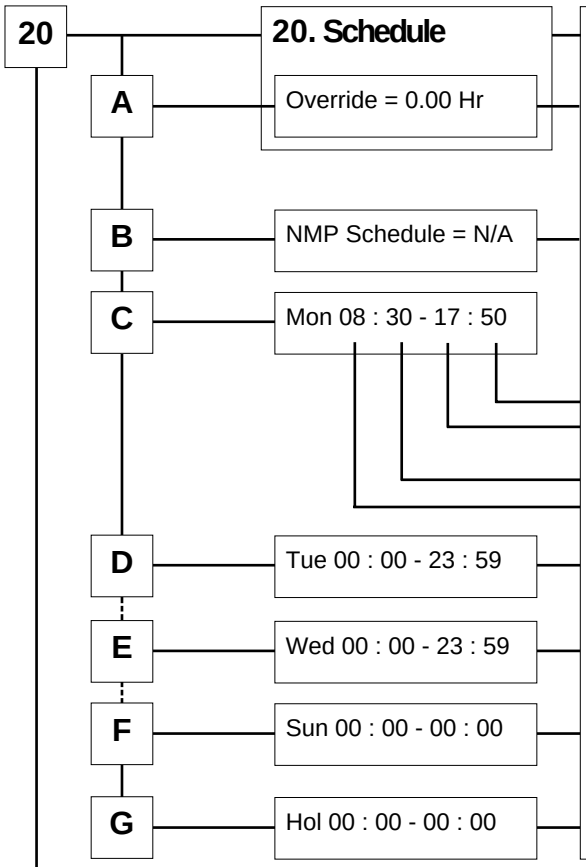
B — Date = 10 / 07 / 92

DATE

Current year
Current month
Current day

Press the NEXT ITEM key. The display show the current Day/Month/Year.

If this information needs to be changed, follow the same procedure used to set the TIME.



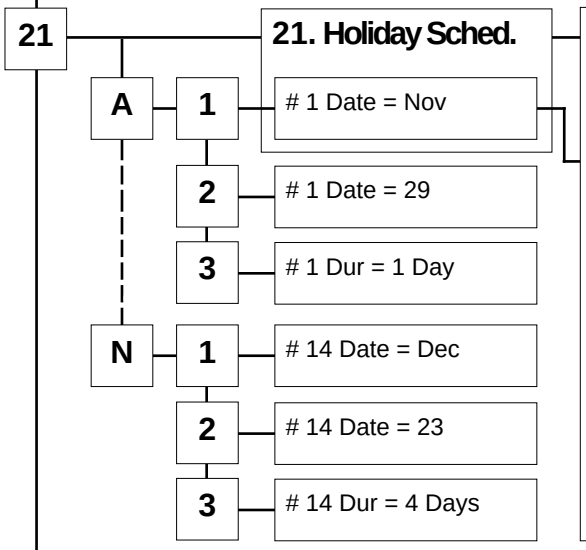
This section will help you to set the Dayli START/STOP time for automatic operation of the chiller.

The controller shall allow a timed OVERIDE function which will place the unit into an occuped time period for a programmable duration. Time units for override shall be in 15 minutes increments, up to 63,5 hours of override shall be available.

If the chiller is a part of a MicroTech Network (i.e. centralized time scheduling from a Remote monitoring system), the controller shall ignore the internal time schedule and start and stop according RMS time schedules (up to time schedules allowed). Default shall be N/A and changeable up to 32.

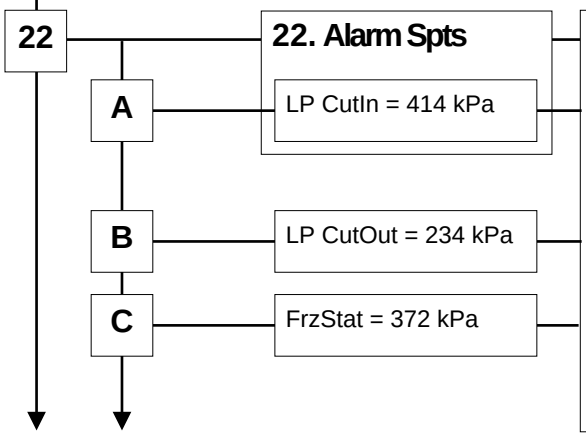
Pressing the NEXT MENU key and the NEXT ITEM key will advance the display to the Daily TIME SCHEDULE. This is where the start and stop times for each day of the week will be set using the 24 hour format. Begining with Monday use the INCR and DECR keys to set the desired start and stop time and press the ENTER key to store the information in the controller.

Press the NEXT ITEM key to advance through the remaining week days and Holidays Start/Stop timer.



Up to 14 holiday dates may be entered. When the MicroTech controllers surrent date maches a date set in the holiday schedule, the normal daily start/stop times are replaced by the holiday start/stop times which were set in the previous section.

At the date prompt, use the INCR and DECR keys to set the first holiday month and press ENTER to advance to the day position of the holiday.
Press NEXT ITEM to advance to Holiday 1 Duration. If the scheduled holiday spans more than one day use the INCR and DECR keys to set the Holiday duration and press ENTER key to store the information in the controller.
Use NEXT ITEM key to set additional holiday dates and duration for the entire year.



These are safety parameters factory setted according to unit specification used to prevent damage to the unit.

Low Pressure Cut In Setpoint is the value that determines starting of compressor. On a call for cooling the controller will open liquid line solenoid valve. When the evaporator pressure rises above the "LP CutIn" setpoint the first compressor will be started.

The low Pressure CutOut setpoint determines the point at which the compressor will shut off during a pumpdown sequence.

The Freezestat setpoint is a refrigerant freeze protection.

D — Frze H2O = 1.1 °C

The Freeze H2O setpoint is a chilled water freeze protection.
Note: We suggest to set this value 2,5÷3°C less than the resultant of the "Lvg Evap" (Menu 14-A) less half "Control Band" (Menu 14-C) less "Shut Dn D-T" (Menu 14-E)

E — FreezeTim = 80 sec

The FreezeTime is a time delay setpoint to prevent nuisance tripout on momentary low suction pressure

F — HiPres = 2428 kPa

This high pressure setpoint is the high condenser pressure controlled by software. If the condenser HiPres setpoint is exceded, the controller will shut off the chiller. Usually this setpoint should be set a minimum 1 bar less the Mechanical high Pressure switches.

23 — **23. Misc Setup**

Several general operating characteristics are defined here. There are set at the factory prior to unit delivery and should not require adjustment. The control software version number is displayed in this menu.

A — Type = Air Cooled

Type of unit

ALR	= Air Cooled
WHR	= Water Cooled

B — Comp = Part Winding

Specifics which kind of compressor motor is installed on the unit to generate the proper operating logic

Compr. type:	Part Winding
	Two Speed

C — Unit Size = 130 - 150

Specifics the unit size to determine the right cooling capacity and staging logic

Unit size:	ALR	WHR
	100	105
	110	125
	130	150
	155	175
	180	190

D — No. Stage = 4

Number of capacity stages present in the unit.
Note: Two additional step of capacity are available only on the unit equipped with two compressors.

E — No. Fan Stages = 3

Number of condenser fans to be controlled by MicroTech

F — IDENT = CR2EM15B

Controller software is factory installed and tested in each panel, prior to shipment.
The software is identified by a program code which is printed on a small label attached to the controller.

McQuay 01/06/92	Date of shipment
P/N 131090002	Part number
S/N 1942	Serial number
EOS 20.21	Operating system version
VER CR2EM15A	Software Version

Typical software identification is a shown in the label below:

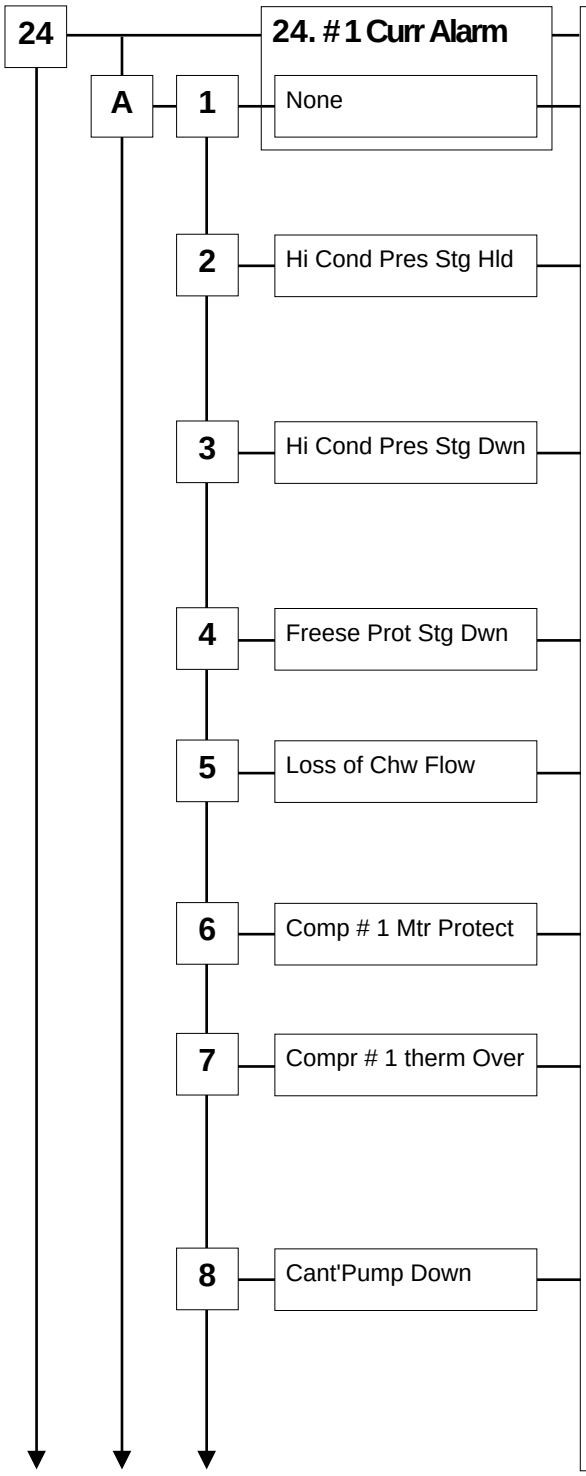
X X X X X XX X

Type of Unit
C - Air or Water cooled chiller
H - Air to water or water to water heat pump
Type of compressors
R - Reciprocating compressor
Number &/or type of compressor
1 - 2 Copeland compressors
2 - 2 McQuay compressors
4 - 3 or 4 McQuay compressors
Languages
I - Italian
E - English
F - French
D - German
P - Spanish
S - Swedish
Unit of Measures
M - Metric System
I - English System
Version of software (0,1,2,3,.....)
Revision (O,A,B,C,D,.....)

ALARM MENUS

Menu's 24 through 27 for ALR & WHR units equipped with 2 compressors and 30 through 37 for ALR & WHR units equipped with 3 & 4 compressors, are used to display any alarm conditions which may be present in the unit. All alarm messages are accompained by the date and time when the alarm occured. Important operating conditions at the time of the alarm are stored in the controller's memory and may be viewed within the following alarm menus.

ALARM MENU DESCRIPTIONS



If refrigerant circuit # 1 is in an alarm condition the appropriate alarm message will be displayed here.

No alarm conditions.
The following alarms are "AUTOCLEAR" alarm, that means AUTOMATIC RESET, in this condition the red light on the front panel and the alarm output Ø will blink up to the operating condition are restored.

"High Condenser Pressure Stage Hold" is displayed when condenser pressure rise to within 210 kPa of "Hi Cond Pres" setpoint (Menu 22-F), the controller will override any request to increase current capacity staging. This the controller will hold at the current capacity stage until the pressure decrease below the a/m differential value.

"High Condenser Pressure Stage Down" is displayed when condenser pressure increase more than the above value getting to within 140 kPa of "Hi Cond Pres" setpoint (Menu 22-F), the controller will automatically stage down every 10 sec. until the condenser pressure fails below the 140 kPa band below the "Hi Cond Pres" setpoint.

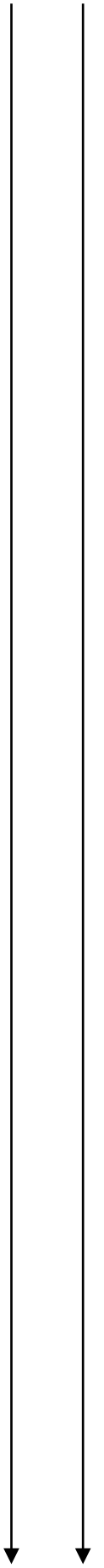
"Freeze Protection Stage Down" displayed when the standard evaporator refrigerant pressure falls below the "FrzStat" setpoint (Menu 22-C), and this condition has been mantained for at least 30 seconds.

"Loss of Chilled Water Flow" displayed when there is no flow trough the evaporator due to the digital input signal from flow switch. A time delay is combined to accomodate momentary loss of flow due to air bubbles, pressure fluctuations in the chilled water piping.

This motor protect indicates a high motor temperature condition in the units equipped with 3 & 4 compressors, and in the units with 2 compressors indicates also motor overload. The entire circuit shall remain locked out the contacts remake.

Thermal Overload alarm condition. This available as separate alarm, only on the 3 & 4 compressors unit.
Note: When thermal overload trips, reset must be done on the devices.

The following alarm are MANUAL reset, that means a shutdown of



9	Freeze Stat Prot	"Freeze Stat Protection" is displayed when the saturated evaporator refrigerant pressure falls below " FrStat" setpoint (Menu 22-C) for a time period equal to "Freeze Time" setpoint (Menu 22-E).
10	Low Evap Pressure	"Low Evaporator Pressure" is displayed when the saturated evaporator refrigerant pressure is below the "LPCutOut" setpoint (Menu 22-B). This alarm will also occur if the evaporator pressure drops to 70 kPa during low ambient start.
11	Comp # 1 LowOil / Pwr	Each compressor is equipped with an oil differential pressure switch which closes when the differential between oil pressure at the discharge of the compressor oil pump and the suction pressure, reaches 0,9 bar in units equipped with Copeland compressor and 2,1 bar in units equipped with McQuay compressor. The controller will initiate a shutdown of all compressors in a circuit should one of these compressors in that circuit loose adequate oil pressure. Loss of oil pressure is detected when the oil pressure differential switch opens at 0,7 bar (Copeland) and 1,8 bar (McQuay) and this condition remains the true for more than 30 consecutive seconds. If the switch recloses before 30 seconds has elapsed, the timer is reset.
12	Hi Cond Pressure	This high pressure cut out alarm condition is in responce to the signal sent by the pressure transducer, this is a a software controlled setpoint and alarm locks out the respective circuit until cleared.
13	Mech Hi Pressure	This is an alarm due to "Mechanical High Pressure switches". This device is required to satisfy, safety requirements. In all cases the high pressure condition will be detected first by the MicroTech "Hi Cond Pres" alarm. Setting are in accordance to unit installation and country rules.
14	Bad Evap Pres Sen	This alarm appear when Evaporator Pressure Transducer signal is shorted to ground or open.
15	Bad Cond Pres Sen	As above but reffered to condenser Pressure transducer.
	System Alarm Condition	The following alarm are "System Alarm Condition" and are those alarm which are common to all refrigerant circuits present in the unit, and requires all compressors to be locked out. The following alarm condition are checked continuosly during all modes of operation by the controller. If one of the following alarm conditions is detected, the mode of the controller will switch to "All Comp Alarm" (Menu 1-A.6). The controller disable all compressors operating by turning off all compressor Enable Outputs. Alarm Output # 0 will be turned on to notify the operator of the alarm condition. The chiller must have the following system alarm conditions cleared before normal operation can resume.
16	Bad Phase/Voltage	Upon detecting an opening of the normally closed "Phase Voltage Monitor" contacts, compressors are immediately de-energized by the P.V.M. device (OPTIONAL), the controller shall also immediately open compressor enabled outputs and show proper diagnostics.
17	Water Freeze Prot	If the leaving chilled water temperature falls below the "Frze H2O" setpoint (Menu 22-D), the chiller is shut down and alarm conditions logged. Note: These is no time delay, just one sampling of water at this low temperature will shut the unit down.

18 Bad Volt Ratio Sen

The controller monitors the output of both internal 5VD power supply and calculate their ratio. If the microprocessor is not receiving a acceptable Volts ratio signal, the unit will be shut down.

19 Bad Lvg Water Sen

Defective Leaving temperature water sensor. Check both possible failure modes. A shorth or Open o this sensor.

Note: The MicroTech controller will shut down the chiller, logging one of the above alarm condition, if one of the primary temperature or pressure sensors provide information to the display but are not critical to chiller operation. The microprocessor will not activate the external alarm contacts or the OutPut or the red light alarm in the front panel, or shut down the unit if one of the "Monitor only" sensors fails. The display will simply indicate "Short or Open on the keypad/display for defective sensor.
The monitoring only sensors include:
- Compressor Suction Temperature
- Evaporator Water Temperature reset Signal
- Demand Limit Signal
- Entering Evap Water Temperature
- Entering Condenser water Temperature
- Leaving Condenser water Temperature
- Liquid Line Temperature

Monitor Only Sensor

B @ 20 : 52 10/06/92

All alarm messages are accompained by the date and time when the alarm occured. Important operating conditions at the time of the alarm are stored in the controller's memory and may be viewed within the following alarm menus.

C Evp 215 kPa

Evaporating pressure

D Cnd 1830 kPa

E Suction Line = 15°C

F Liquid Ln = 38°C

Condensing pressure

25 **25. # 2 Curr Alarm**

In this menu are used to display any alarm condition which may be present in refrigerant circuit # 2. The temperature and pressure readings at the time of the alarm will be stored in the controllers memory and may be displayed for analisys from this menu.
For an explanation of the alarm message displayed here refer to the previous menu.

A None

F LiquidLn = ##.# °C

26 **26. # 1 Prev Alarm**

The alarm message for the last recorded Circuit 1 alarm may be displayed from this menu. This information will be replaced when a current alarm condition is cleared

A None

27 **27. # 2 Prev Alarm**

See above

A None

Table 24

ALR unit size	Compressors		Number of fans "ON"																
			# 1				# 2				# 3				# 4				
	No	Type	D	1	2	3	D	1	2	3	D	1	2	3	D	1	2	3	total
035÷055	2	Copeland Discus	2	1	/	/	2	1											4
060-065			3	1	1		3	1	1										6
070÷085			4	1	1	1	4	1	1	1									8
095			5	1	1	2	5	1	1	2									10
100	2	McQuay semihermetic • PWS • Double speed	3	1	1		3	1	1										6
110			3	1	1		4	1	1	1									7
130			4	1	1	1	4	1	1	1									8
155			4	1	1	1	5	1	1	2									9
180			5	1	1	2	5	1	1	2									10
210	3		4	1	1	1	4	1	1	1	4	1	1	1					12
220			4	1	1	1	4	1	1	1	6	2	1	2					14
240			4	1	1	1	5	1	1	2	6	2	1	2					15
260			5	1	1	2	5	1	1	2	6	2	1	2					16
285	4		4	1	1	1	5	1	1	2	4	1	1	1	4	1	1	1	17
310			5	1	1	2	5	1	1	2	4	1	1	1	4	1	1	1	18
335			5	1	1	2	5	1	1	2	4	1	1	2	5	1	1	2	19
360			5	1	1	2	5	1	1	2	5	1	1	2	5	1	1	2	20

fan stage 3
fan stage 2
fan stage 1
Condenser fan wired with the compressor

Note: When Speedtrol is to be used, Speedtrol is applied to the fan which is energized when the compressor is turned on

TEST PROCEDURE - TROUBLE ANALYSIS

All of the following procedures assume that power is applied to the MicroTech control panel and the circuit breaker is on. Some of the following procedures require the removal or replacement of fuses, connectors, terminals or jumpers. Always shut off the power before making the required changes.

MICROPROCESSOR CONTROL BOARD

The MicroTech controller three LEDs which can be used to diagnose some controller problems. Table 10 details to operating condition indicated by these LEDs.

If the microprocessor status LEDs do not follow the normal sequence as shown in Table 10, there is a problem with

the controller.

Likely problems include loss of controller power, corrupted software or the controller itself may be defective.

RED LED Remains On - This indicates that the Microprocessor Control Board has failed the self-check and must be replaced or the power supply voltage is abnormally low.

RED LED Does Not Turn On - Check for 18 VAC between Control Board power supply input terminals 1 and 2. If 18 VAC is present, check the fuses mounted adjacent to the power connector. If this fuse is blown, it should be replaced with a fuse of the same rating. If this fuse is not blown, it is likely that the controller is itself defective and must be replaced.

If 18 VAC is not present at the power connector, check for 24 VAC at terminals 25 and 27. If 24 VAC is present here,

Table 25 Controller status LED's

Green led	Red led	Indication
Off	Off	No power to controller
Off	On	Self- test failure
On	Off	Microprocessor operating normally

transformer T-4 is probably defective.

ADI BOARD

All digital and analog input signals are conditioned by the ADI Board. Power for the board is derived from the Microprocessor Control Board via the interconnecting ribbon cables. If the ADI Board appears inoperative, make sure these ribbon cables are fully seated in their sockets and the locking tabs are engaged.

The digital unputs indicate the presence of 24 VAC by illuminating its corresponding LED. At 7.5 VAC to 24 VAC the digital input contacts are considered closed and the LED will be on. Below 7.5 VAC the contacts are considered open and the LED will be off. Individual digital inputs may be tested by momentarily installing a jumper between terminal 25 and the ADI Board terminal to be tested. If the input is operating properly, the LED will illuminate when 24 VAC from terminal 25 is applied. Refer to drawing 716358D-01.

Temperature sensors receive operating power from then ADI Board which relies on the Microprocessor Control Board's regulated 5 VDC power supply. If all temperature sensors appear to have failed, check the 5 VDC supply on the controller.

KEYPAD/DISPLAY

Operating power for the keypad/display is provided by the Microprocessor Control Board via the interconnecting ribbon cable. An inoperative keypad/display can be caused by a loose or damaged ribbon cable or the loss of the controller's power supply.

Some production versions of the display are equipped with a contrast adjustment potentiometer which will blank the display if set incorrectly. The optimum contrast setting may change slightly based on ambient temperature. Adjust this control with a small screwdriver to achieve the best displaycontrast.

OPEN OR SHORTED TEMPERATURE SENSORS

The MicroTech Controller has a built-in function which will identify a defective sensor. The two possible failure modes are indicated through the corresponding keypad menu item as follow:

"Open" = Open Sensor

"Short" = Shorted Sensor

ERRONEOUS PRESSURE READINGS

If the evaporator or condenser pressure readings, as read through the keypad, appear erroneous or unrealistic, the following procedure is followed to check the pressure transducers:

1. Check for proper ribbon cable and other connections.

2. Measure the voltage (0 to 5 VDC) across the suspected pressure transducer (evaporator transducer 1 for example) at ADI Board terminal A1.

3. Compare this reading with what the value should be according to that shown in Figure 4. NOTE: The actual pressure to the transducer must be known. If that transducer is not defective, then it is likely that ADI Board itself is defective and must be replaced.

OUTPUT BOARD

Solid-state relays on the MicroTech Ccontroller Output Board all have contacts open when de-energized. However, because these relay are "solid-state", the contacts are not "open" in the sense that electromechanical relays open their contacts. Instead, the relay switches from low to high resistance.

When checking the voltage in a circuit where these relays have been incorporated, it is possible to be confused by the presence of voltage on the load side of the relay. If there is a load on the relay, the circuit will behave like a traditional relay circuit.

That is, if the relay switches to "off", the voltage will drop to zero at the output of the relay. But, should the circuit be "open" between the relay output and the load, and the output relay is "off", the high resistance of the relay and the voltmeter form a series circuit.

McQuay monitor software personal computer specification

IBM PC or 100% compatible 386 minimum including:

- 31/2" 1,44 MB floppy diskette drive
  Utilized for loading the MicroTech monitor program into the hard disk of the computer. Also provides capability of archiving historical data and system back-up.
- 2 MB RAM (Random Access Memory)
  The computer must have in order to run the MicroTech Monitor Program. Any memory resident programs that run in the background must be disabled.
- Asyncronous Serial communications adapter
  A direct communications interface connection between the PC and the MicroTch controller. Connection should be 25 Pin Male or 9 Pin Male with a 9 to 25 conversion cable.
- VGA Video Graphics Adapter
  For high resolution graphics and data display.
- Parallel Printer Adapter
  For hard copy custom reports of all accumulated data.
- Hard Disk Drive (20 MB min.)
  A mass data storage area for the operator interface, custom report software and essential data collection.
- 101 Enhanced Keyboard
  Required for more advanced functions of the operator interface and custom report software.
- The computer shall include a DOS 5.0 and manual along with other manuals provided with the computer.
- The computer shall have internal timeclock that is battery backed to mantain system time and date.
- The computer shall come with the screen saver option, to extend the life of the display monitor.

a Multisync or compatible VGA Color Monitor
  For use with the video graphics adapter for high resolution data display.

b Printer 192 CPS (Characteres per Second) Dot Matrix
  Type Must have the ability of supporting IBM extended character graphics.

c Printer cable, 6 Ft. Parallel
  For communications connection between the PC and the printer.

The computer is used for changing setpoints, monitoring data, trend logging, diagnostics, and remotely clearing alarms within the system.

The computer is normally a dedicated personal computer, however, the operator may choose to exit the Monitor program from time to time to perform other functions such as word processing or data manipulation using a spreadsheet program.

It should be noted, however, that for maximum convenience and functionality, the computer should be considered a dedicated computer for the MicroTech system.

The communications from the unit control panel to the Personal computer is shielded, twisted pair wire.

The communications adheres to the industry standards of RS - 232C and the rate of communications is 9600 baud.

The recommended maximum distance from the personal computer to the control panel is 15 mt. If the required distance is in excess of 15 mt, an optional RS - 232 extension kit is required (contact McQuay).

Telephone line for remote modem access

A voice quality, direct dial telephone line is required if remote access and monitoring of the unit controller is desired.

The phone line should be terminated with a standard RJ-11 modular phone plug.

Terms and definitions

ASCII
(American Standard Code for Information Interchange) Method with which all alphanumeric characters are assigned a unique number between 1 and 127.

Baud
Normally ranges from 300 to 9600 and indicates the speed of computer communication, the higher the BAUD, the faster the data transfer. The BAUD rate is changeable for each communications port.

Checksum
The operating system of the microprocessor, upon power up or a reset, sweeps through the application program memory space and adds the values of all memory locations together. The resultant number is referred to as the checksum and is used to insure that the application program space has not been corrupted.

CPU
(Central Processing Unit) The main component of the computer system. It interprets and executes program instructions, contains computational circuits, and input/output ports. Each MicroTech has its own CPU which allows it to operate independently.

Download
The act of sending information from a terminal to an MicroTech Controller: can be either individual setpoints or an entire new logic program.

EEPROM
(Electronically Erasable Programmable Read Only Memory) Enables the MicroTech Controller to retain its memory even during power outages yet allow changing og values from a remote location.

Hexadecimal
Refer to the base 16 number system in which the basic digits are represented by 0-9 and A-F:

Decimal	Hexadecimal	Decimal	Hexadecimal
0-9	0-9	13	D
10	A	14	E
11	B	15	F
12	C	16	10

Computers operate in base 2 but since that quickly becomes complicated and it doesn't convert easily to decimal, hexadecimal is commonly used for computer applications.

Inputs
The MicroTech Controller allos up to 16 inputs from sensors that return a voltage of 0 TO 5 volts. Each reading is converted to a number between 0 and 255. EXAMPLES: Temperature sensor, pressure transducer, potentiometer, etc.

Modem
Device that allows communication with a controller network over a telephone line. Two modems are required, one at the terminal end of the phone line and one wired to a controller in the network.

Output
The MicroTech Controller allows up to 16 outputs capable of turning a device on or off.

Parity Check
A check of whether the total number of 1's in a data byte is even or odd. Used in data transmission to insure error-free communication, data bytes are covered to either even or odd parity before transmission by setting their eighth bit.

Port
A communications channel on a controller for talking either to other controllers or to a terminal. Each unit has 2 ports for various network connections. Each port must be pre-set for specific communications purposes.

Pressure Transducer
Device used to convert a reading of static pressure into a voltage for input into the MicroTech Controller.

RAM
(Random Access Memory) Computer memory that will NOT hold its contents through a power outage. The MicroTech Controller also contains some RAM for storage of temporary variables. RAM memory values may be changed an infinite number of times without any problem, whereas EEPROM's may only be overwritten approximately 10,000 times before they begin to fail.

RS232C
Refers to a hardware configuration standard used for communiations between computers and computer equipment. Many personal computers are equipped with RS232C connections and this is required for linking a PC with the controller network.

RS422/485
Another hardware configuration that is very common for linking of computer equipment int network because of its resistance to transmission errors at high BAUD rates. It involves the use of a twisted pair of wires to connect components and requires one controller to coordinate the communications between all other units.

Setpoint
A desired value for some measured quantity. The MicroTech Controller operates to maintain comfort based upon the values of specific setpoints. Example: Leaving chilled water temperature, discharge air temperature, rom temperature, minimum and maximum CFM.

Terminal
Normally refers to a personal computer but could be any computer equipment capable of RS232C communications and ASCII protocol. An IBM compatible personal computer is preferred.

Temperature Sensor
The room temperature is measured as output from a thermistor which the controller reads as a number between 0 and 1024 and then calculates a Fahrenheit temperature.

Timing Constants
Refer to adjustable time values that the controller uses to manage its inputs and outputs. The time between room temperature readings or the amount of time to turn on an actuator are two examples. They may range from a tanth of a second to 62 hours or they may also indicate ALWAYS and NEVER.

UART
(Universal Asynchronous Receiver-Transmitter) Tipically, a single computer chip that converts serial data transmissions into parallel information. The fact that the MicroTech Controller contains a UART means that it can transmit and receive at different Baud rate. It also maintains automatic parity error checking and speeds the entire communications process.

Notes

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