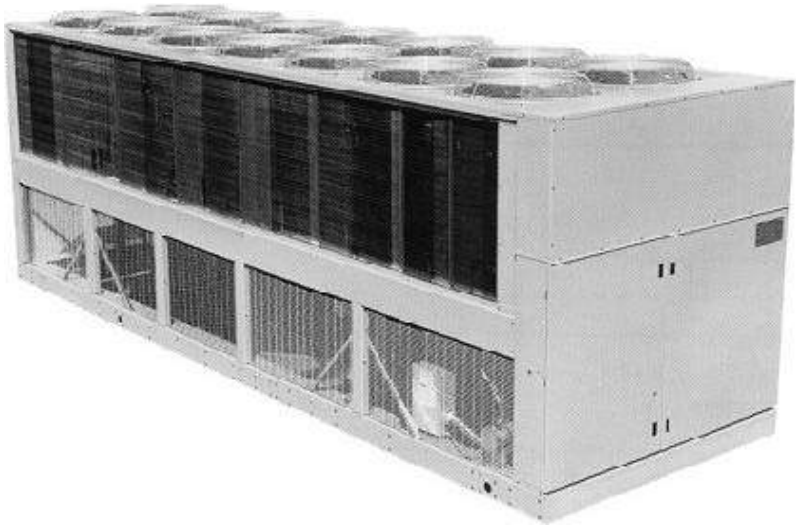
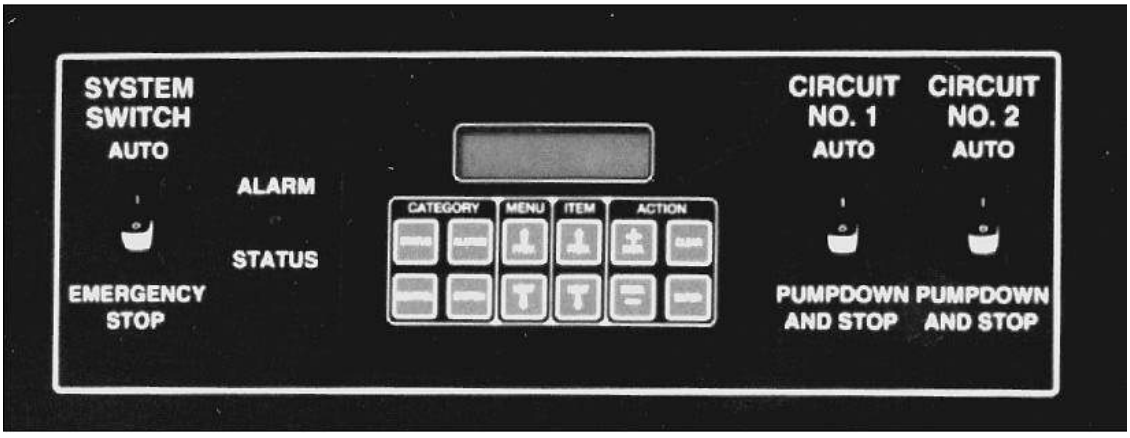
Operating Manual	OM ALSMICRO
	Group: **Chiller**
	Part Number: **573865Y**
	Effective: **March 2000**
	Supersedes: **IM 549-1**

MicroTech Control System for Air-Cooled Screw Compressors

Models: ALS 125B through 425B





McQuay Air Conditioning

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Introduction

This manual provides installation, setup and troubleshooting information for the MicroTech controller provided on McQuay air-cooled screw compressor chillers. Please refer to the current version of installation manual IOMM ALS for unit application information as well as water and refrigerant piping details. All operating descriptions contained in this manual are based on the current MicroTech controller software version at time of publication. Contact McQuay Technical Response Center at 1-877-349-7782 for information on specific code versions. Chiller operating characteristics and menu selections may vary depending on the actual software version installed.

CAUTION

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions 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 of 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. McQuay International disclaims any liability resulting from any interference or for the correction thereof.

CAUTION

The McQuay MicroTech control panel contains static sensitive components. A static discharge while handling electronic circuit boards may 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.

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 devices and MicroTech components housed in the main control panel must be protected.

The MicroTech controller is designed to operate within an ambient temperature range of minus 40 to plus 185°F and a maximum relative humidity of 95% (non-condensing).

General Description

The MicroTech Unit Control Panel, available on all McQuay ALS products, contains a Model 250 or 280 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 panel's 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 contacts if an alarm condition develops.

Important operating conditions at the time an alarm occurs are retained in the controller's memory to aid in troubleshooting and fault analysis. The system is protected by a password scheme, which only allows access, by authorized personnel. The operator must enter a valid password into the panel keypad before any setpoints may be altered.

Table 1, Unit Identification

Unit Identification	
ALS	Air-Cooled Chiller with Screw Compressors

Control Panel Features

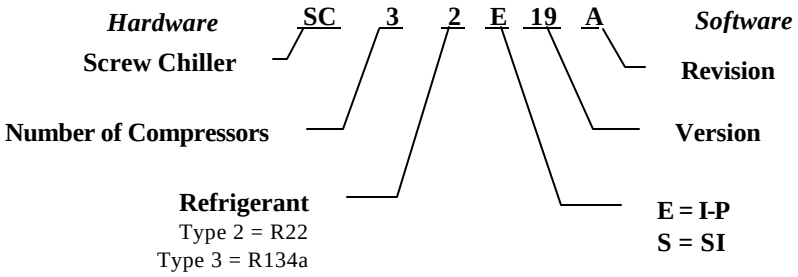
- Flexible control of leaving chilled water with convenient reset capability.
- Enhanced head pressure control on air-cooled units resulting in increased total unit SEER.
- Convenient, easy to read 2 line by 16-character display for plain English readout of operating temperatures and pressures, operating modes or alarm messages.
- Keypad adjustment of unit safeties such as 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.
- Security password protection against unauthorized changing of setpoints and other control parameters.
- Complete plain English diagnostics to inform the operator of system warnings and alarms. All alarms are time and date stamped so there is no guessing of when the alarm condition occurred. In addition, the 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 chilled water loop pulldown.
- Easy integration into building automation systems via separate 4-20 milliamp signals for chilled water reset and demand limiting. McQuay's Open Protocol feature is fully supported.
- Flexible 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 McQuay Monitor software.
- Special service modes may be used to override automatic unit staging during system checkout and service.

Software Identification

Controller software is factory installed and tested in each panel prior to shipment. The software is identified by a program code that is printed on a small label attached to the controller. The software version may also be displayed on the keypad/display by viewing the last menu item in the Misc. Setup menu.

The software "version" is the 6th & 7th location of the software number. In the example, the version is "19" and the revision to the software is "A".

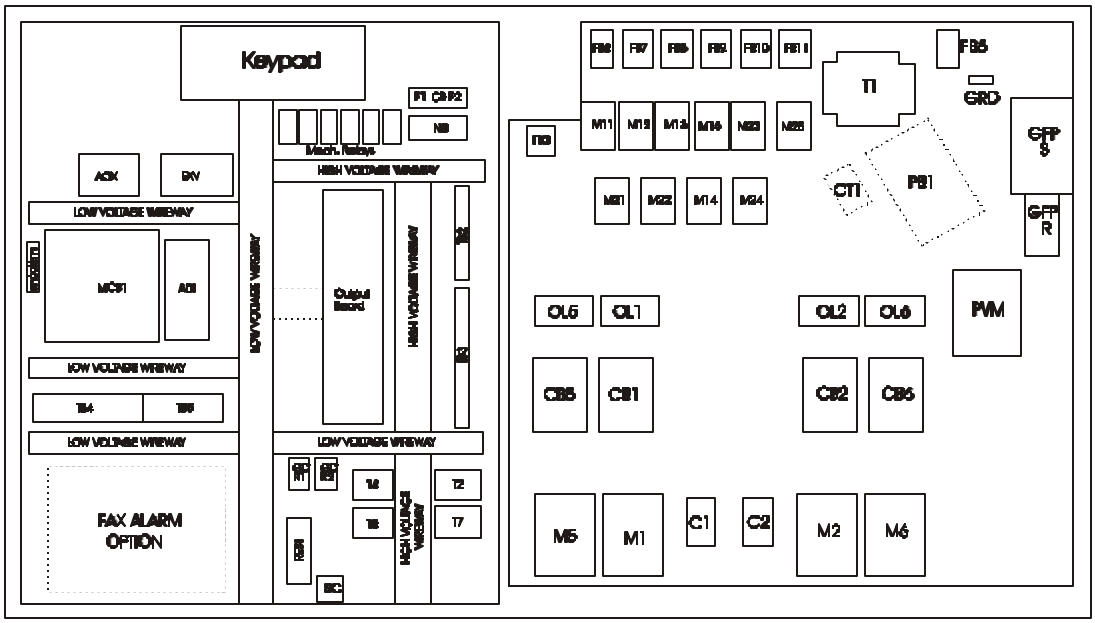
Revisions are released in alphabetical order.



Controller Layout

All major MicroTech components are mounted inside the control section side of the unit's control cabinet. The individual components are interconnected by ribbon cables, shielded multi-conductor cables, or discrete wiring. Transformers T-2 and T-4 provide power for the system. All field wiring must enter the control cabinet through the knockouts provided and be terminated on field wiring terminal strips. The standard ALS keypad/display is located inside the control cabinet for protection from the weather. See Figure 1 for typical control cabinet layout.

Figure 1, Typical control cabinet layout

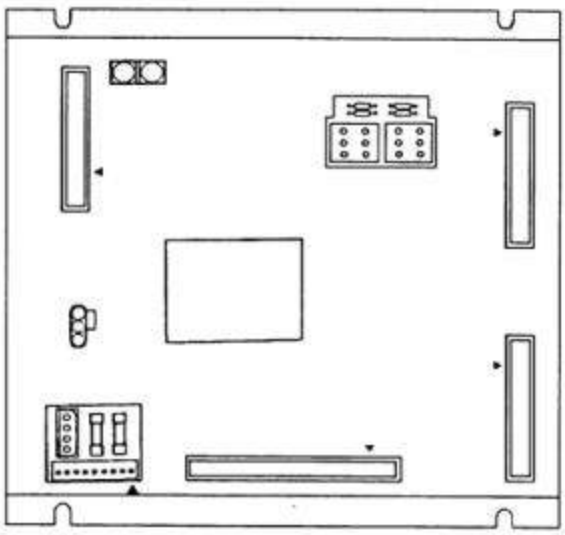


Component Data

Microprocessor Control Board (MCB1)

The Model 250 or 280 Microprocessor Control Board contains the electronic hardware and software required to monitor and control the unit. It receives input from the ADI Board and sends commands to the Output Board to maintain the unit's optimum operating mode for the current conditions. Status lights are mounted on the control board to indicate the operating condition of the microprocessor.

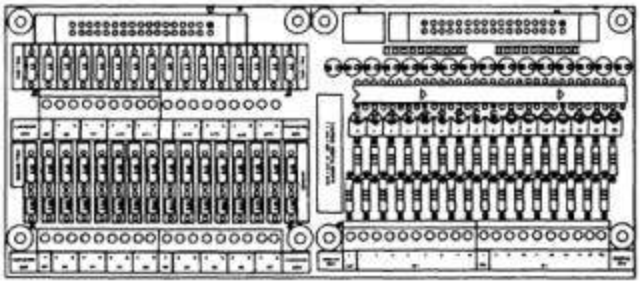
Figure 2, MCB1



Analog/Digital Input Board (ADI Board)

The ADI Board provides low voltage power for the temperature and pressure sensors. It also provides electrical isolation between the Microprocessor Control Board and all 24V switch inputs. LEDs 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.

Figure 3, ADI

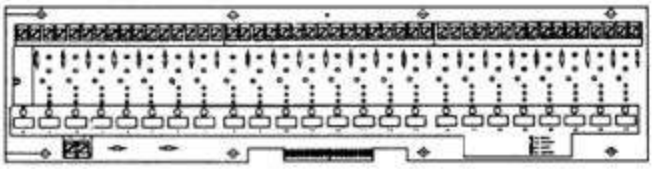


Output Board

The Output Board contains up to 24 solid state relays, which are used to control all compressors, condenser fans, solenoid valves and alarm annunciation.

It receives control signals from the Microprocessor Control Board through a 50-conductor ribbon cable.

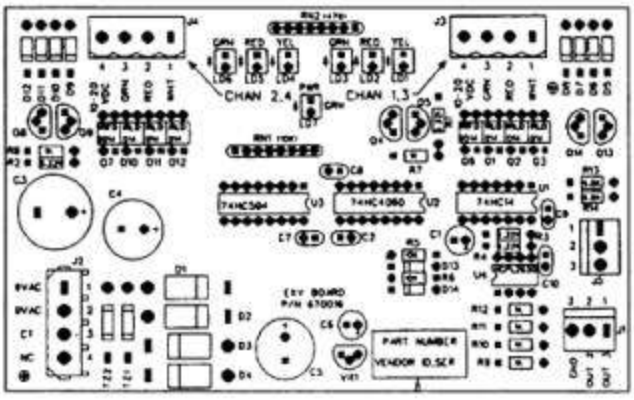
Figure 4, Output board



Electric Expansion Valve Board (EXV Board)

Each EXV Board will directly control up to two electronic expansion valves. The boards may be cascaded together for units with more than two EXV's. Control instructions for the boards are generated by the M250 controller.

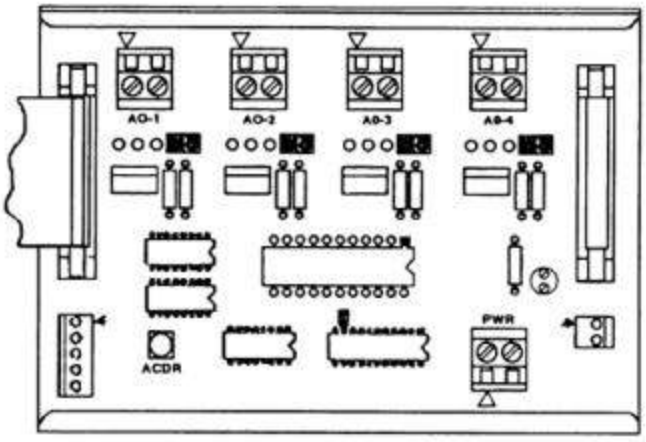
Figure 5, EXV board



Analog Output Board (AOX Board) (With Optional SpeedTrol)

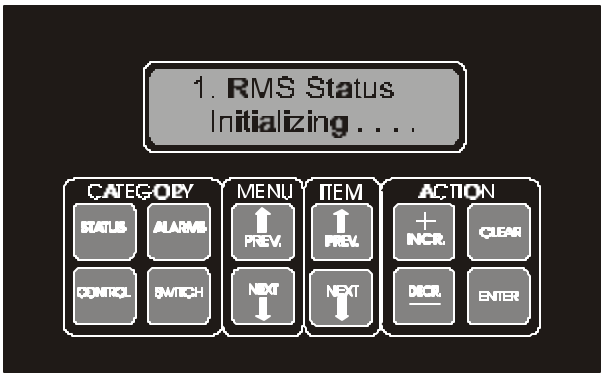
The AOX Board converts control instructions from the M250's expansion bus into an analog control signal suitable for driving a variable speed condenser fan. Each AOX Board is factory set via jumper to provide an output signal of 0 - 10 VDC.

Figure 6, AOX board



The Keypad/Display is the primary operator interface to the unit. All operating conditions, system alarms and setpoints can be monitored from this display and all adjustable setpoints can be modified from this keyboard if the operator has entered a valid operator password.

Figure 7, Keypad display



Sensors and Transducers

Standard Sensors

Evaporator Leaving Water Temperature

Evaporator Refrigerant Pressure, Circuit #1, 2, 3 & 4

Condenser Refrigerant Pressure, Circuit #1, 2, 3 & 4

Suction Temperature, Circuit #1, 2, 3 & 4

Liquid Line Temperature, Circuit #1, 2, 3 & 4 (Provides direct display of subcooling and superheat)

Entering Evaporator Water Temperature

Outside Ambient Air Temperature

Optional Sensor Packages

Percent Unit Amps on 2 Compressor Units (Percent total unit amperage including compressors and condenser fans. Does not include externally powered equipment such as water pumps.)

Percent Compressor Amps on 3 Compressor Units and Percent Circuit Amps (1 & 3, 2 & 4) on 4 Compressor Units.

Thermistor Sensors

MicroTech panels use a negative temperature coefficient thermistor for temperature sensing. A normal sensor will measure 3000 ohms at 77°F.

Figure 8, Thermistor sensor

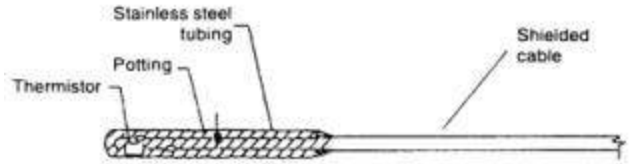


Table 2, MicroTech Thermistors

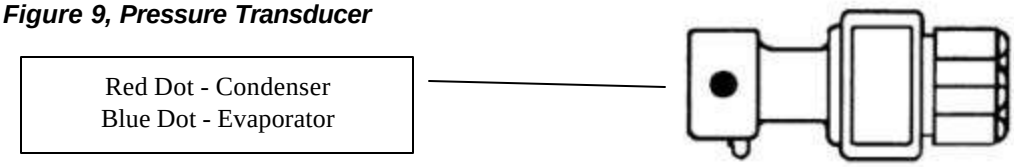
℉	Ohms	Volts	℉	Ohms	Volts	℉	Ohms	Volts
15	16,104	4.145	77	3,000	2.373	139	761	0.932
16	15,627	4.124	78	2,927	2.343	140	746	0.917
17	15,166	4.102	79	8,357	2.313	141	731	0.902
18	14,720	4.080	80	2,789	2.283	142	717	0.888
19	14,288	4.057	81	2,723	2.253	143	703	0.874
20	13,871	4.034	82	2,658	2.223	144	689	0.859
21	13,469	4.011	83	2,595	2.194	145	676	0.846
22	13,076	3.988	84	2,534	2.164	146	662	0.831
23	12,698	3.964	85	2,474	2.135	147	649	0.818
24	12,333	3.940	86	2,416	2.106	148	637	0.805
25	11,979	3.915	87	2,360	2.077	149	625	0.792
26	11,636	3.890	88	2,305	2.049	150	613	0.779
27	11,304	3.865	89	2,251	2.020	151	601	0.766
28	10,983	3.839	90	2,199	1.992	152	589	0.753
29	10,672	3.814	91	2,149	1.965	153	578	0.741
30	10,371	3.788	92	2,099	1.937	154	567	0.729
31	10,079	3.761	93	2,051	1.909	155	556	0.717
32	9,797	3.734	94	2,004	1.882	156	546	0.706
33	9,523	3.707	95	1,959	1.855	157	535	0.694
34	9,258	3.608	96	1,914	1.828	158	525	0.683
35	9,002	3.653	97	1,871	1.802	159	516	0.673
36	8,753	3.625	98	1,829	1.775	160	506	0.661
37	8,512	3.597	99	1,788	1.750	161	496	0.650
38	8,278	3.569	100	1,747	1.724	162	487	0.640
39	8,052	3.540	101	1,708	1.698	163	478	0.629
40	7,832	3.511	102	1,670	1.673	164	469	0.619
41	7,619	3.482	103	1,633	1.648	165	461	0.610
42	7,413	3.453	104	1,597	1.624	166	452	0.599
43	7,213	3.424	105	1,562	1.600	167	444	0.590
44	7,019	3.394	106	1,528	1.576	168	436	0.580
45	6,831	3.365	107	1,494	1.552	169	428	0.571
46	6,648	3.335	108	1,461	1.528	170	420	0.561
47	6,471	3.305	109	1,430	1.505	171	413	0.553
48	6,299	3.274	110	1,398	1.482	172	405	0.544
49	6,133	3.244	111	1,368	1.459	173	398	0.535
50	5,971	3.213	112	1,339	1.437	174	391	0.527
51	5,814	3.183	113	1,310	1.415	175	384	0.518
52	5,662	3.152	114	1,282	1.393	176	377	0.510
53	5,514	3.121	115	1,254	1.371	177	370	0.501
54	5,371	3.078	116	1,228	1.350	178	364	0.494
55	5,231	3.059	117	1,201	1.328	179	357	0.485
56	5,096	3.028	118	1,176	1.308	180	351	0.478
57	4,965	2.996	119	1,151	1.287	181	345	0.471
59	4,714	2.934	121	1,103	1.247	183	333	0.456
60	4,594	2.902	122	1,080	1.227	184	327	0.448
61	4,477	2.871	123	1,058	1.208	185	321	0.441
62	4,363	2.839	124	1,036	1.189	186	316	0.435
63	4,253	2.808	125	1,014	1.170	187	310	0.427
64	4,146	2.777	126	993	1.151	188	305	0.421
65	4,042	2.745	127	973	1.133	189	299	0.413
66	3,941	2.714	128	953	1.115	190	294	0.407
67	3,842	2.682	129	933	1.076	191	289	0.400
68	3,748	2.651	130	914	1.079	192	284	0.394
69	3,655	2.620	131	895	1.062	193	280	0.389
70	3,565	2.589	132	877	1.045	194	275	0.382
71	3,477	2.558	133	859	1.028	195	270	0.376

72	3,392	2.527	134	842	1.012	196	266	0.371
73	3,309	2.496	135	825	0.995	197	261	0.364
74	3,328	2.465	136	809	0.980	198	257	0.359
75	3,150	2.434	137	792	0.963	199	252	0.353
76	3,074	2.404	138	777	0.948	200	248	0.348

Pressure Transducers

These transducers are selected for a specific operating range and provide an output signal, which is proportional to the sensed pressure. The typical range for evaporator sensors is 0 to 150 psig with a resolution of 0.1 psi. Condenser pressure sensors have a range of 0 to 450 psi and a resolution of 0.5 psi. The pressure transducers require an external 5 VDC power supply to operate that is provided by the MicroTech controller. This connection should not be used to power any additional devices.

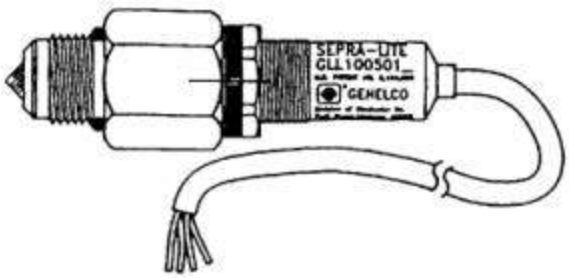
Figure 9, Pressure Transducer



Liquid Presence Sensor

A liquid level sensor mounted at the liquid injection port in the compressor casting determines the presence of liquid refrigerant. Whenever the glass prism sensor tip is in contact with liquid, the sensor output signal will be high (>7 VDC). If no liquid is detected, the output will be low (O VDC).

Figure 10, Liquid Presence Sensor



Sensor Data

Sensor Locations

Analog Inputs

Analog inputs are used to read the various temperature and pressure sensors installed on the chiller as well as any 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.

Figure 11, Sensor Locations, Two Compressor Units

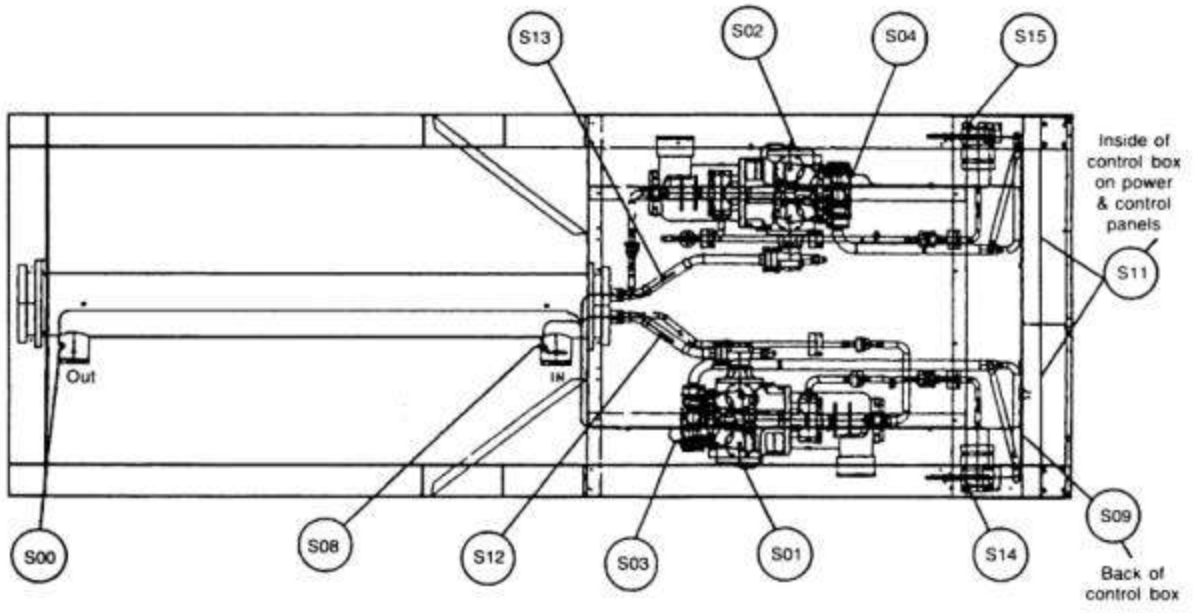


Table 3, Analog Inputs - 2 Compressor Units

Sensor Number	Description	Sensor Location
S00	Evaporator Leaving Water Temperature	Leaving Chilled Water Nozzle
S01	Evaporator Pressure Transducer Circuit #1	Common Circuit #1 Suction Line
S02	Evaporator Pressure Transducer Circuit #2	Common Circuit #2 Suction Line
S03	Condenser Pressure Transducer Circuit #1	Compressor #1 Discharge Cover
S04	Condenser Pressure Transducer Circuit #2	Compressor #2 Discharge Cover
Input05	Transducer Power Voltage Ratio	(Internal)
Input06	Reset-Evaporator Water Temperature	External 4-20 mA Signal
Input07	Demand Limit	External 4-20 mA Signal
S08	Entering Evaporator Water Temperature	Entering Chilled Water Nozzle
S09	O.A.T	Back of the Control Box
S11	Percent Unit Amps	CT1 and Signal Converter Board
S12	Suction Temperature Circuit #1	Well Brazed to the Circuit #1 Suction Line
S13	Suction Temperature Circuit #2	Well Brazed to the Circuit #2 Suction Line
S14	Liquid Line Temperature Circuit #1	Well Brazed to the Circuit #1 Liquid Line
S15	Liquid Line Temperature Circuit #2	Well Brazed to the Circuit #2 Liquid Line

Figure 12, Sensor Locations - 3 Compressor Unit

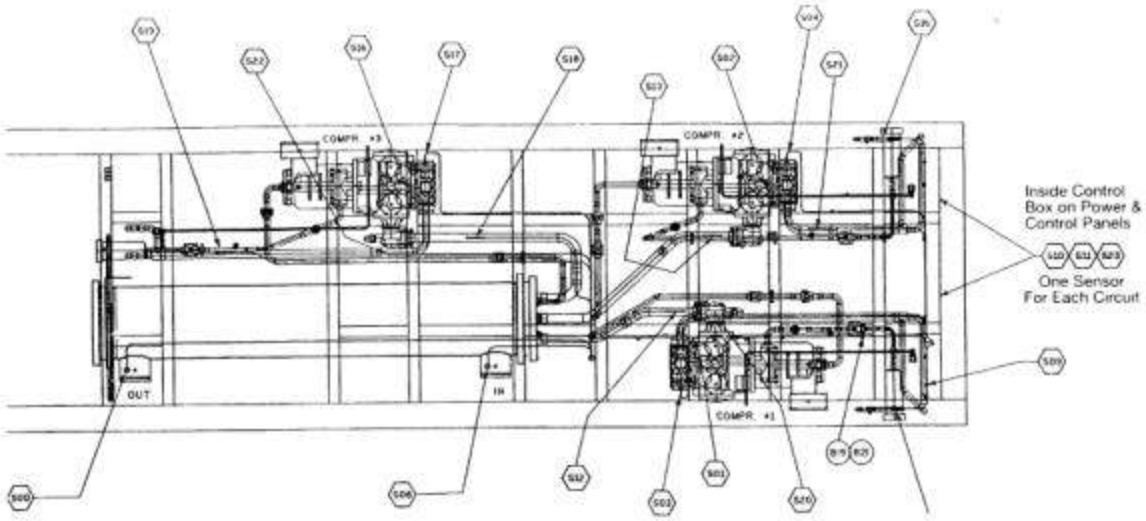


Table 4, Analog Inputs - 3 Compressor Units

Sensor Number	Description
S00	Evaporator Leaving Water Temperature
S01	Low Pressure Transducer Circuit #1
S02	Low Pressure Transducer Circuit #2
S03	High Pressure Transducer Circuit #1
S04	High Pressure Transducer Circuit #2
S06	Evaporator Water Temperature Reset (Field Supplied)
S07	Demand Limit (Field Supplied)
S08	Evaporator Entering Water Temperature
S09	Outside Air Temperature
S10	Percent Circuit Amps Circuit #1 (CT1)
S11	Percent Circuit Amps Circuit #2 (CT2)
S12	Suction Temperature Circuit #1
S13	Suction Temperature Circuit #2
S14	Liquid Line Temperature Circuit #1
S15	Liquid Line Temperature Circuit #2
S16	Low Pressure Transducer Circuit #3
S17	High Pressure Transducer Circuit #3
S18	Suction Temperature Circuit #3
S19	Liquid Line Temperature Circuit #3
S20	Discharge Temperature Circuit #1
S21	Discharge Temperature Circuit #2
S22	Discharge Temperature Circuit #3
S23	Percent Circuit Amps Circuit #3 (CT3)

Figure 13, Sensor Locations - 4 Compressor Unit

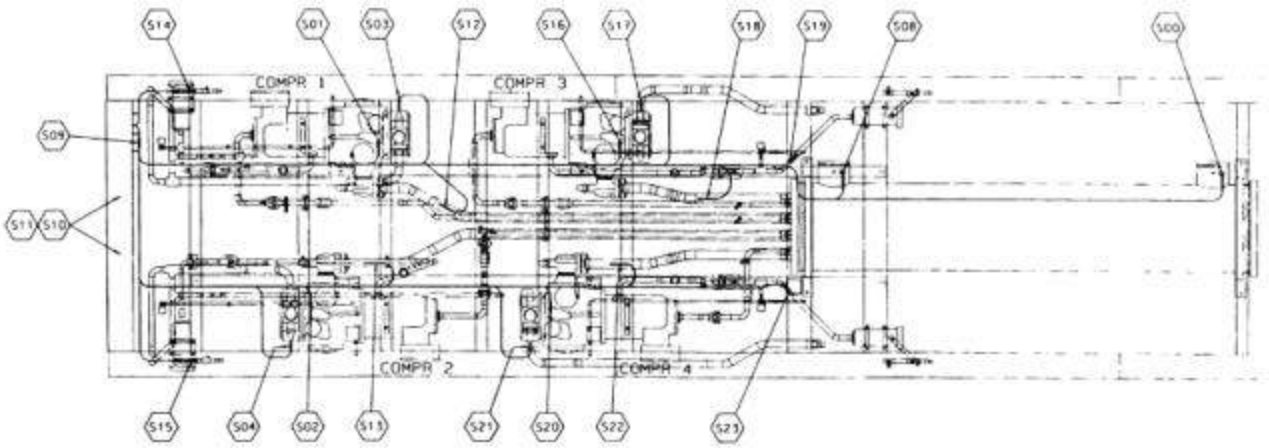


Table 5, Analog Inputs - 4 Compressor Units

Sensor Number	Description
S00	Evaporator Leaving Water Temperature
S01	Low Pressure Transducer Circuit #1
S02	Low Pressure Transducer Circuit #2
S03	High Pressure Transducer Circuit #1
S04	High Pressure Transducer Circuit #2
S06	Evaporator Water Temperature Reset (Field Supplied)
S07	Demand Limit (Field Supplied)
S08	Evaporator Entering Water Temperature
S09	Outside Air Temperature
S10	Percent Circuit Amps Circuit #1 & 3 (CT1)
S11	Percent Circuit Amps Circuit #2 & 4 (CT2)
S12	Suction Temperature Circuit #1
S13	Suction Temperature Circuit #2
S14	Liquid Line Temperature Circuit #1
S15	Liquid Line Temperature Circuit #2
S16	Low Pressure Transducer Circuit #3
S17	High Pressure Transducer Circuit #3
S18	Suction Temperature Circuit #3
S19	Liquid Line Temperature Circuit #3
S20	Low Pressure Transducer Circuit #4
S21	High Pressure Transducer Circuit #4
S22	Suction Temperature Circuit #4
S23	Liquid Line Temperature Circuit #4

Digital Inputs

Note: All digital inputs are 24 VAC.

At 7.5 VAC to 24 VAC nominal the digital input contacts are considered closed, and the signal level is high. Below 7.5 VAC nominal, the contacts are considered open, and the signal level is low.

Table 6, Digital Inputs - 2 Compressor Unit

Number	Description	Low Signal	High Signal
0	Mechanical High Pressure Switch, Circuit #1	Alarm	Normal
1	Liquid Presence Switch, Compressor #1	Alarm	Normal
2	Motor Protect, Compressor #1	Alarm	Normal
3	High Liquid Pressure Drop, #1	Alarm	Normal
4	(Reserved)	-	-
5	System Switch (S1)	Stop	Run
6	Phase Voltage Monitor	Alarm	Normal
7	Pump Down Switch, Circuit #1	Normal	Pumpdown
8	Mechanical High Pressure Switch, Circuit #2	Alarm	Normal
9	Liquid Presence Switch, Compressor #2	Alarm	Normal
10	Motor Protect, Compressor #2	Alarm	Normal
11	High Liquid Pressure Drop, # 2	Alarm	Normal
12	(Reserved)	-	-
13	Unit Remote Stop Switch	Stop	Run
14	Evap Water Flow Switch	Alarm	Normal
15	Pump Down Switch, Circuit #2	Normal	Pumpdown

Table 7, Digital Inputs - 3 Compressor Unit

Number	Description	Led On	Led Off
0	Mechanical High Pressure Switch, Circuit #1	Alarm	Normal
1	Liquid Presence Sensor Compressor #1	No Liquid	Liquid
2	Motor Protect, Compressor #1	Alarm	Normal
3	High Liquid Pressure Drop, #1	Alarm	Normal
4	Not Used	-	-
5	System On/Off Switch	Off	On
6	Phase Voltage Monitor Compressor #1	Alarm	Normal
7	PumpDown Switch Compressor #1	Normal	Pumpdown
8	Mechanical High Pressure Switch, Circuit #2	Alarm	Normal
9	Liquid Presence Sensor Compressor #2	No Liquid	Liquid
10	Motor Protect, Compressor #2	Alarm	Normal
11	High Liquid Pressure Drop, #2	Alarm	Normal
12	Not Used	-	-
13	Remote Start Stop Switch	Stop	Start
14	Evap Water Flow Switch	No Flow	Flow
15	PumpDown Switch, Circuit #2	Normal	Pumpdown
16	Mechanical High Pressure Switch Circuit #3	Alarm	Normal
17	Liquid Presence Sensor Compressor #3	No Liquid	Liquid
18	Motor Prot Compressor #3	Alarm	Normal
19	High Liquid Pressure Drop, #3	Alarm	Normal
20	Not Used	-	-
21	Phase Volt Monitor Compressor #2	Alarm	Normal
22	Phase Volt Monitor Compressor #3	Alarm	Normal
23	PumpDown Switch Compressor #3	Alarm	Normal

Table 8, Digital Inputs - 4 Compressor Unit

Number	Description	Led On	Led Off
0	Mechanical High Pressure Switch, Circuit #1	Alarm	Normal
1	Liquid Presence Sensor Compressor #1	No Liquid	Liquid
2	Motor Protect, Compressor #1	Alarm	Normal
3	High Liquid Pressure Drop, #1	Alarm	Normal
4	Not Used	-	-
5	System On/Off Switch	Off	On
6	Phase Voltage Monitor Compressor #1	Alarm	Normal
7	PumpDown Switch Compressor #1	Normal	Pumpdown
8	Mechanical High Pressure Switch, Circuit #2	Alarm	Normal
9	Liquid Presence Sensor Compressor #2	No Liquid	Liquid
10	Motor Protect, Compressor #2	Alarm	Normal
11	High Liquid Pressure Drop, #2	Alarm	Normal
12	Not Used	-	-
13	Remote Start Stop Switch	Stop	Start
14	Evap Water Flow Switch	No Flow	Flow
15	PumpDown Switch, Circuit #2	Normal	Pumpdown
16	Mechanical High Pressure Switch Circuit #3	Alarm	Normal
17	Liquid Presence Sensor Compressor #3	No Liquid	Liquid
18	Motor Prot Compressor #3	Alarm	Normal
19	High Liquid Pressure Drop, #3	Alarm	Normal
20	Not Used	-	-
21	Phase Volt Monitor Multi Point	Alarm	Normal
22	Not Used	-	-
23	Pumpdown Switch compressor #3	Normal	Pumpdown
0	Mechanical High Pressure Switch Circuit #4	Alarm	Normal
1	Liquid Presence Sensor Compressor #4	No Liquid	Liquid
2	Motor Prot Compressor #4	Alarm	Normal
3	High Liquid Pressure Drop, #4	Alarm	Normal
4	Not Used	-	-
5	Not Used	-	-
6	Not Used	-	-
7	Pumpdown Switch Compressor #4	Normal	Pumpdown

Optional Analog Outputs

Table 9, Analog Outputs

Number	Description	Signal Range
0	SpeedTrol, Circuit #1	0-10 VDC
1	SpeedTrol, Circuit #2	0-10 VDC
2	SpeedTrol, Circuit #3	0-10 VDC
3	SpeedTrol, Circuit #4	0-10 VDC

Digital Outputs

Table 10, Digital Outputs - 2 Compressor Unit

Relay	Description	Off	On
0	Alarm LED and Contact	(Programmable)	(Programmable)
1	Chilled Water Pump	Stop	Run
2	EXV Serial Data 1		
3	EXV Serial Data 2		
4	MCR Relay. Compressor#1	Stop	Run
5	Top Solenoid, Compressor #1	Hold	Load
6	Bottom Right Solenoid, Compressor #1	Hold	Load
7	Bottom Left Solenoid, Compressor #1	Hold	Load
8	MCR Relay, Compressor #2	Stop	Run
9	Top Solenoid, Compressor #2	Hold	Load
10	Bottom Right Solenoid, Compressor #2	Hold	Unload
11	Bottom Left Solenoid, Compressor #2	Hold	Load
12	Condenser Fan #1, Circuit #1 (M12)	Off	On
13	Condenser Fan #2, Circuit #1 (M13)	Off	On
14	Condenser Fan #3, Circuit #1 (M14)	Off	On
15	Condenser Fan #4, Circuit #1 (M15)	Off	On
16	Condenser Fan #1, Circuit #2 (M22)	Off	On
17	Condenser Fan #2, Circuit #2 (M23)	Off	On
18	Condenser Fan #3, Circuit #2 (M24)	Off	On
19	Condenser Fan #4, Circuit #2 (M25)	Off	On
20	Liquid Solenoid Valve, Circuit #1	Close	Open
21	Liquid Solenoid Valve, Circuit #2	Close	Open
22	(Spare)		
23	(Spare)		

Table 11, Digital Outputs - 3 Compressor Unit

Relay	Description
0	Alarm Circuit
1	Chilled Water Pump Relay
2	EXV Control
3	EXV Control
4	Compressor #1 Contactor
5	Compressor #1 Top Solenoid Valve
6	Compressor #1 Bottom Right Solenoid Valve (feed)
7	Compressor #1 Bottom Left Solenoid Valve (vent)
8	Compressor #2 Contactor
9	Compressor #2 Top Solenoid Valve (feed)
10	Compressor #2 Bottom Right Solenoid Valve (feed)
11	Compressor #2 Bottom Left Solenoid Valve (vent)
12	Condenser Fan Contactor M-12
13	Condenser Fan Contactor M-13
14	Condenser Fan Contactor M-14
15	Condenser Fan Contactor M-15
16	Condenser Fan Contactor M-22
17	Condenser Fan Contactor M-23
18	Condenser Fan Contactor M-24
19	Condenser Fan Contactor M-25
20	Compressor #3 Contactor
21	Compressor #3 Top Solenoid Valve (feed)
22	Compressor #3 Bottom Right Solenoid Valve (feed)
23	Compressor #3 Bottom Left Solenoid Valve (vent)
24	Condenser Fan Contactor M-32
25	Condenser Fan Contactor M-33

26	Condenser Fan Contactor M-34
27	Condenser Fan Contactor M-34
28	Optional Hot Gas Bypass - SV5
29	Optional Hot Gas Bypass - SV6

Table 12, Digital Outputs - 4 Compressor Unit

Relay	Description
0	Alarm Circuit
1	Chilled Water Pump Relay
2	EXV Control
3	EXV Control
4	Compressor #1 Contactor
5	Compressor #1 Top Solenoid Valve
6	Compressor #1 Bottom Right Solenoid Valve (feed)
7	Compressor #1 Bottom Left Solenoid Valve (vent)
8	Compressor #2 Contactor
9	Compressor #2 Top Solenoid Valve (feed)
10	Compressor #2 Bottom Right Solenoid Valve (feed)
11	Compressor #2 Bottom Left Solenoid Valve (vent)
12	Condenser Fan Contactor M-12
13	Condenser Fan Contactor M-13
14	Condenser Fan Contactor M-14
15	Condenser Fan Contactor M-15
16	Condenser Fan Contactor M-22
17	Condenser Fan Contactor M-23
18	Condenser Fan Contactor M-24
19	Condenser Fan Contactor M-25
20	Compressor #3 Contactor
21	Compressor #3 Top Solenoid Valve (feed)
22	Compressor #3 Bottom Right Solenoid Valve (feed)
23	Compressor #3 Bottom Left Solenoid Valve (vent)
24	Condenser Fan Contactor M-32
25	Condenser Fan Contactor M-33
26	Condenser Fan Contactor M-34
27	Condenser Fan Contactor M-35
28	Optional Hot Gas Bypass - SV5
29	Optional Hot Gas Bypass - SV6
30	Not Used
31	Compressor #4 Contactor
32	Compressor #4 Top Solenoid Valve (feed)
33	Compressor #4 Bottom Right Solenoid Valve (feed)
34	Compressor #4 Bottom Left Solenoid Valve (vent)
35	Condenser Fan Contactor M-42
36	Condenser Fan Contactor M-43
37	Condenser Fan Contactor M-44
38	Condenser Fan Contactor M-45

Controller 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 McQuayService start-up technician prior to starting the unit. The MicroTech controller contains default setpoints that will be appropriate for most common installations.

Field Wiring

Analog sensors and transducers

All sensors and transducers required for normal chiller operation are installed and wired by the factory. Any optional analog signals provided by the installing contractor require twisted, shielded pair wire (Belden #8760 or equal).

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 24 VAC control signals produced by the screw chiller panel.

Digital outputs

Devices wired to the digital outputs typically are 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 model 250 controller activates a solid state relay by sending a "trigger" signal to the output board via the attached ribbon cable. The relay responds to the trigger by lowering its resistance that allows current to flow through its "contacts". When the controller removes the trigger signal, the relay's resistance becomes very high, causing the current flow to stop. The status of all outputs is shown by individual red LEDs for ease of determining output status.

Interlock wiring

The installing contractor provides all interlock wiring to field devices such as flow switches and pump starters. Refer to the Field Wiring Drawing 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 circuit when an alarm or pre-alarm condition is detected. A 24 VAC voltage source is available at field wiring terminals #102 through #107 to power an external alarm device such as a bell, light or relay. An alarm annunciator rated for a maximum load of 1.8 Amps at 24 VAC is to be provided and wired by the installing contractor. The normal and alarm states for the 24 VAC alarm signal are programmable by the operator. Available settings are:

- Pre-alarm annunciation: Close-or-Open-or-Blink
- Alarm annunciation: Close-or-Open

Power wiring

115 VAC power for the control transformer is derived from the 3-phase power connection provided by the electrical contractor.

A separate disconnect for the cooler heating tape and control circuit transformer may be supplied as options on some installations. Wiring for these circuits is to be provided by the installing contractor and should conform to the National Electrical Code and all applicable local building codes.

Power supplies

There are several internal power supplies used by the controller and its associated circuitry. The regulated 5 VDC power on terminal #42 is used to support the analog inputs on the ADI Board and

should not be used to operate any external devices. An unregulated 12 VDC power supply is available on field wiring terminal #56 and an unregulated 24 VAC supply is provided at terminal #81. Both of these may be used for powering external devices such as low current relays and lights.

Demand limit and chilled water reset signals

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

Communication ports

Communication port "A" is provided on the MicroTech controller for connection to an IBM compatible computer for local or remote system monitoring (Belden 8762 or equivalent). The network uses the RS232 communication standard with a maximum cable length of 50 feet. All communication network wiring utilizes low voltage shielded twisted pair cable. See the Personal Computer Specification section of this manual for specific hardware requirements.

Communication port "B" is used to link the unit controller into a MicroTech network using the RS485 communication standard. Refer to the field wiring in this manual for details.

Modem Kit

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

Remote monitoring of the MicroTech controller requires a dedicated telephone line supplied by the equipment owner. The McQuay Monitor software package used to establish a remote connection to the modem kit must be purchased separately.

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.

Unit Sequence of Operation

The following sequence of operation is typical for McQuay ALS air-cooled chillers. The sequence may vary depending on various options that may be installed on the chiller.

Off Conditions

With power supplied to the unit, 115 VAC power is applied through the control fuse F1 to the compressor casing heaters, the compressor motor protector circuits, the primary of the 24V control circuit transformer and optionally, the evaporator heater (HTR5). The 24V 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 (S 1). 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 any switch is in the "stop" position, that circuit's operating mode will be displayed as 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.

The MicroTech controller allows the operator to manually set the chiller to an off mode via the keypad. The display indicates this operating mode with the message OFF:ManualMode.

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.

Start-up

If none of the above "Off" conditions are true, the MicroTech controller will initiate a start sequence and energize the chilled water pump output relay. The display will indicate Starting as the operating mode. The chiller will remain in the Waiting For Flow mode until the field installed flow switch indicates the presence of chilled water flow. If flow is not proven within 30 seconds, the alarm output will be activated and the chiller will continue to wait for proof of chilled water flow. When chilled water flow is re-established, the alarm will be automatically cleared.

Waiting for Load

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 ½the adjustable Control Band plus the Start-up Delta Temperature Setpoint, the controller will start the lead compressor.

Start Requested

In the Start Requested Mode, the electronic expansion valve is fully closed. The MicroTech controller will read the evaporator pressure to ensure that at least 4 psi of refrigerant pressure is present. If the evaporator pressure is less than 4 psi the compressor will not be enabled and the display will read "NoStart-LoEvap".

Prepurge

In order to purge the compressor of any liquid refrigerant that may be present, the starting compressor is operated at 50% capacity while the electronic expansion valve is held fully closed. The refrigerant circuit will continue to run in this mode until either the evaporator refrigerant pressure drops to less than 40 psi or 60 seconds has elapsed. If the evaporator pressure does not drop to 40 psi within the 60 seconds, the compressor will continue to run and the display will read "Failed Prepurge". The alarm is logged in the alarm buffer.

Opened EXV

With the evaporator pressure less than 40 psi and the compressor still running, the electronic expansion valve will be driven open to 300 steps. If the evaporator pressure rises above the freeze-stat setpoint, the chiller will advance to Cool Staging Mode. If the circuit is in Cool Staging Mode and after 20 seconds, the evaporator pressure remains below the freeze state setpoint but is greater than 2 psi, the controller will transition to Low Ambient Start Mode.

Low Ambient Start

If the difference between the freeze stat setpoint and the evaporator refrigerant pressure is greater than 12 psi, the low ambient start timer will be set to l80 seconds. The compressor will continue to run for 180 seconds from the moment the expansion valve is opened in an attempt to build up the evaporator pressure. If the difference between the freeze stat setpoint and the evaporator refrigerant pressure is greater than 12 psi, the following calculation will be used to set the low ambient start timer:

Low Ambient timer = 360 - (Pressure Difference X 15)

If the calculated low ambient timer value is greater than 360, the compressor will be stopped, the alarm output will be activated and the display will indicate "FailLowAmbStart".

Cool Stage

Circuit capacity at initial start will be 50%. Once the chiller has started, the MicroTech controller will add or subtract cooling capacity to maintain the chilled water setpoint. The current cooling stage will be displayed on the keypad/display. Automatic chiller staging may be overridden by selecting "Manual Cooling" as the operating mode and then choosing the desired cooling stage.

CAUTION

"Manual Cooling" will by-pass all interstage timers. This will result in rapid compressor stage up and possible chilled water temperature overshoot. The unit will not unload as the chillers water temperature reaches the setpoint.

Compressor Control

Normal Compressor Staging Logic

The Compressor Staging Logic uses an adjustable control band and interstage timers to determine the correct number of cooling stages to activate. A project-ahead temperature calculation provides stable operation. The total number of cooling stages for each circuit is dependent upon the "number of cooling stages" setpoint.

Operation at 25% is not allowed on compressors #3 and #4.

For compressors #1 and 2, 25% is selectable by setting MinStage = 1. Then 30 minutes is the maximum timer setting allowed at 25%. If the evaporator Delta-T is less than 1 degree F. then 5 minutes at 25% load is allowed.

Operation at 25% load is not allowed if the outside ambient air temperature is below the minimum setpoint of 60°F.

Compressor Staging Control Sequence

Four Compressor Unit

Stage	Staging Up					Staging Down				
	Lead Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.	Unit Capacity	Lead Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.	Unit Capacity
1	-	-	-	-	0.0%	25%	0%	0%	0%	6.3%
2	50%	0%	0%	0%	12.5%	50%	0%	0%	0%	12.5%
3	75%	0%	0%	0%	18.8%	75%	0%	0%	0%	18.8%
4	50%	50%	0%	0%	25.0%	50%	50%	0%	0%	25.0%
5	75%	50%	0%	0%	31.3%	75%	50%	0%	0%	31.3%
6	75%	75%	0%	0%	37.5%	50%	50%	50%	0%	37.5%
7	75%	50%	50%	0%	43.8%	75%	50%	50%	0%	43.8%
8	75%	75%	50%	0%	50.0%	50%	50%	50%	50%	50.0%
9	75%	75%	75%	0%	56.3%	75%	75%	50%	50%	56.3%
10	75%	75%	50%	50%	62.5%	75%	75%	50%	50%	62.5%
11	75%	75%	75%	50%	68.8%	75%	75%	75%	50%	68.8%
12	75%	75%	75%	75%	75.0%	75%	75%	75%	75%	75.0%
13	100%	75%	75%	75%	81.3%	100%	75%	75%	75%	81.3%
14	100%	100%	75%	75%	87.5%	100%	100%	75%	75%	87.5%
15	100%	100%	100%	75%	93.8%	100%	100%	100%	75%	93.8%
16	100%	100%	100%	100%	100.0%	100%	100%	100%	100%	100.0%

Three Compressors Unit

Stage	Staging Up				Staging Down			
	Lead Comp.	Lag 1 Comp.	Lag 2 Comp.	Unit Capacity	Lead Comp.	Lag 1 Comp.	Lag 2 Comp.	Unit Capacity
1	-	-	-	0.0	25%	0%	0%	8.3
2	50%	0%	0%	16.7	50%	0%	0%	16.7
3	75%	0%	0%	25.0	75%	0%	0%	25.0
4	50%	50%	0%	33.3	50%	50%	0%	33.3
5	75%	50%	0%	41.7	75%	50%	0%	41.7
6	75%	75%	0%	50.0	50%	50%	50%	50.0
7	75%	50%	50%	58.3	75%	50%	50%	58.3
8	75%	75%	50%	66.6	75%	75%	50%	66.6
9	75%	75%	75%	75.0	75%	75%	75%	75.0
10	100%	75%	75%	83.3	100%	75%	75%	83.3
11	100%	100%	75%	91.7	100%	100%	75%	91.7
12	100%	100%	100%	100.0	100%	100%	100%	100.0

Two Compressors Unit

Stage	Staging Up			Staging Down		
	Lead Comp.	Lag 1 Comp.	Unit Capacity	Lead Comp.	Lag 1 Comp.	Unit Capacity
1	-	-	0.0	25%	0%	12.5
2	50%	0%	25.0	50%	0%	25.0
3	75%	0%	37.5	75%	0%	37.5
4	50%	50%	50.0	50%	50%	50.0
5	75%	50%	62.5	75%	50%	62.5
6	75%	75%	75.0	75%	75%	75.0

7	100%	75%	87.5	100%	75%	87.5
8	100%	100%	100.0	100%	100%	100.0

Project-Ahead Calculation

The Project-Ahead Calculation provides protection against an overshoot condition when the chilled water temperature is outside the control band. During cooling mode, if the Chilled Water Temperature is above the control band and the rate of temperature reduction is so great that in 120 seconds the chilled water temperature will be below the control band, the controller will stage down. The Project-Ahead Calculation also moderates the controller's response to a rapid increase in leaving water temperature.

Interstage Timer

The minimum time delay between stage up commands is set by the interstage timer setpoint (default=120 sec). The interstage timer for stage down commands is 1/5 of the stage up timer.

Anti-Cycle Timer

Anti-cycle timers are used to protect the compressors from excessive starts and high motor winding temperature. The anti-cycle timers are 5 minutes stop-to-start and 15 minutes start-to-start.

Lead-Lag of Refrigerant Circuits

The following compressor control rules are enforced in the control software.

- The MicroTech controller will never turn on the lag compressor until the lead compressor is at 75% capacity or greater and additional cooling capacity is required.
- The MicroTech controller will not turn off the lag compressor until the lead compressor is running at 50% capacity, the lag compressor is running at 25% capacity and a reduction in cooling capacity is required. Three and four compressor units lag at 50% before pumpdown.

Automatic Lead-Lag

The controller provides automatic lead-lag of refrigeration circuits based on compressor operating hours and the number of starts. The circuit with the fewest number of starts will be started first. If circuits are operating and a stage down is required, the circuit with the most operating hours will cycle off first.

Manual Lead-Lag

The operator may override automatic circuit selection by manually selecting the lead circuit via the keypad or monitor.

When the setpoint equals "auto", the lead compressor is selected by the MicroTech controller based upon which circuit has the least operating hours. Regardless of the mode selected, if the lead circuit cannot operate due to an alarm condition or if off on cycle timers, the controller will switch to the lag circuit.

Electronic Expansion Valve

Overview

McQuay screw compressor chillers are supplied with Sporlan SE-series electronic expansion valves. The MicroTech controller generates valve positioning signals to maintain refrigerant circuit superheat to within 1.5°F of the superheat setpoint. Valve positioning signals are converted to actuator step pulses by the EXV board which in turn drives the valve's 3-phase DC stepper motor open or closed as required. A control range of 0 steps (full closed) to 760 steps (full open) is available to provide precise control of the valve position.

EXV Superheat Control

The electronic expansion valve position will be adjusted to maintain the refrigerant circuit's superheat setpoint. Superheat setpoints are based on refrigerant circuit capacity. For circuit capacity of 25% to 50%, the superheat setpoint will be 8.0°F. For circuit capacity of 75% to 100%, the superheat setpoint will be 10.0°F.

When the chiller control panel is powered up, the expansion valve will be driven closed 800 steps. This ensures that the valve is fully closed prior to a call for cooling. When all refrigerant circuit safeties are satisfied, the controller will initiate a start sequence. When the start sequence reaches "open solenoid", the expansion valve will be driven open to the First Open setpoint (default=300 steps). The current suction line temperature is compared against the Suction Line Temperature setpoint (evaporator temp plus superheat spt) to calculate superheat error (Err). The current suction line temperature is also compared with the previous reading to calculate delta superheat error (Derr). These two error values are used to determine the magnitude and direction of the expansion valve positioning signal. A new valve positioning signal is calculated every 10 seconds, however, the

interval at which these signals are issued to the EXV board is dependent on the magnitude of the required positional change. If no change is required, the internal will be 60 seconds.

Forced EXV Position Change

With an increase in circuit capacity, the electronic expansion valve position will be opened by a fixed percentage of its current position. This change will not occur if the superheat is less than 4°F below the superheat setpoint.

With a decrease in circuit capacity, the electronic expansion valve position will be closed by a fixed percentage of its current position.

Table 13, Staging Up

When Staging Up		
From	**To**	**Open**
25%	50%	65%
50%	75%	50%
75%	100%	25%

Table 14, Staging Down

When Staging Down		
From	**To**	**Close**
100%	75%	18%
75%	50%	40%
50%	25%	60%

EXV Evaporator Pressure Control

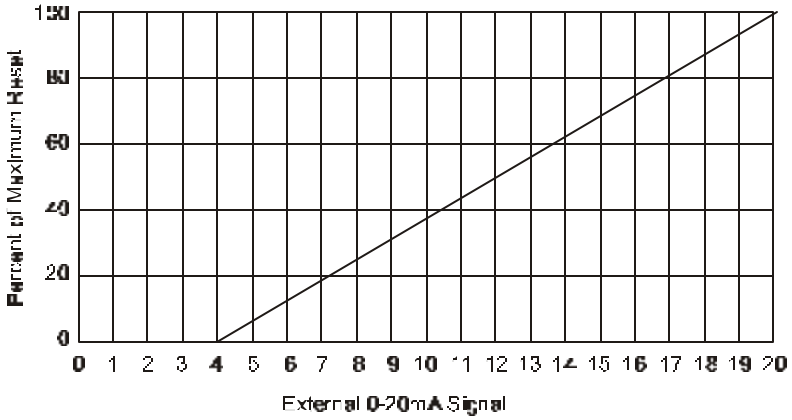
The electronic expansion valve control will maintain a constant superheat for suction line temperature up to 60°F. For suction line temperatures greater than 61°F, the expansion valve control logic will maintain a constant evaporator temperature to avoid overloading the compressor motor. The control point will be the Evap Temp setpoint (default=50°F) and the control method will be the standard MicroTech Step and Wait algorithm. When the suction line temperature drops below 57°F, the MicroTech logic will resume normal superheat control.

Chilled Water Reset Options

Chilled Water Reset (Remote 4-20mA)

The controller resets the chilled water setpoint based on an external 4 to 20mA signal. At 4mA or less, no reset will occur. At 20mA, the chilled water setpoint will be reset by an amount equal to the value stored in the Maximum Reset setpoint. The reset schedule is linear and may be calculated using Figure 14.

Figure 14, Chilled Water Reset Schedule



Ice Mode

The MicroTech controller has dual chilled water setpoints when ice mode is selected. With an external reset signal of 4mA or less, the chilled water reset will be zero. If the external reset signal is greater than 4mA, maximum reset will be in effect. The following set points should be adjusted to accommodate the reduced ice mode system temperature and pressure.

Table 15

Setpoint	Monitors	Default	Ice Mode
FreezeStat	Low Evap Pressure	54 psig	A pressure value equivalent to the leaving solution temperature minus 10°F
FreezeH20	Leaving Solution	36°F	A temperature value equal to the leaving solution temperature minus 4°F
StpPumpDn	Final Pumpdown	34 psig	A pressure value equal to the FreezeStat setpoint minus 10 psi

Note: Once the load is satisfied in Ice Mode, restart of chiller can not occur for 12 hours.

Network Reset

The reset mode can be set to "network" if chilled water reset via communications network is desired. The chiller controller receives a signal from the network master panel in the range of 0% to 100% of maximum reset.

Return Water Reset

When return water is selected as the reset mode, the MicroTech controller will adjust the leaving chilled water setpoint to maintain a constant return water temperature equal to the return water setpoint. The return water temperature is sampled every 5 minutes and a proportional correction is made to the leaving chilled water setpoint. The corrected leaving water setpoint is never set to a

value greater than the return water setpoint and is never set to a value less than the actual leaving chilled water setpoint.

Remote Demand Limit

The controller will limit the total number of stages based on an external 4 to 20mA signal regardless of the amount of cooling actually required. A 4mA or less signal will enable all stages while a 20mA signal will allow only 1 stage to operate. The effect of the reset signal may be calculated by using Figure 15.

Network Demand Limit

Unit demand limit via network communication may be selected if desired. The chiller controller receives a demand limit signal from the network master panel in the range of 0% to 100% with 0 equaling no limit.

Keypad Selectable Demand Limit

In the menu Demand Limit, set Manual Demand = Stage, which is below the maximum available for the unit.

Soft Loading

The soft loading feature limits the number of cooling stages which may be energized by the controller to prevent unnecessary electrical demand and possible over-shoot of the desired leaving water temperature. Soft loading is typically used during morning start-up. When the controller enters the "Cool Staging" mode of operation, the controller will start a count down timer to indicate how long the unit has been in the cool staging mode. The maximum number of cooling stages will be limited to the soft load setpoint until the soft load count down timer equals zero.

Max Pull Down

The controller can limit the rate at which the chilled water loop temperature is reduced. Whenever the rate of temperature decrease exceeds the maximum pull down setpoint, no additional cooling stages will be activated.

Condenser Fan Control

Condenser Fan Staging

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.

Head Pressure Control

For each circuit, the first stage of condenser fans will be wired in parallel with the compressor output so that they are energized with the compressor. For chillers with optional SpeedTrol, the first condenser fan stage will receive a control signal from the AOX board that in turn modulates the Johnson Controls S66DC-1 to provide variable speed fan operation. Each circuit has 3 additional digital outputs available for refrigerant head pressure control. Each output will energize an additional bank of condenser fans with each bank consisting of 1 or 2 fans depending on the size of the unit. Each output energizes additional heat rejection due to increased airflow across the air-cooled condenser regardless of the number of fans. If the outdoor ambient temperature is greater than 60°F when the unit is started, one additional condenser fan stage will be energized. If the outdoor ambient temperature is greater than 80°F, two additional fan stages will be energized.

ALS unit EERs are maximized by not allowing the last condenser fan stage to operate when the unit capacity is 25% and the condenser pressure is below 200 psi. The last fan stage will operate if the condenser pressure is above 220 psi at 25% unit capacity.

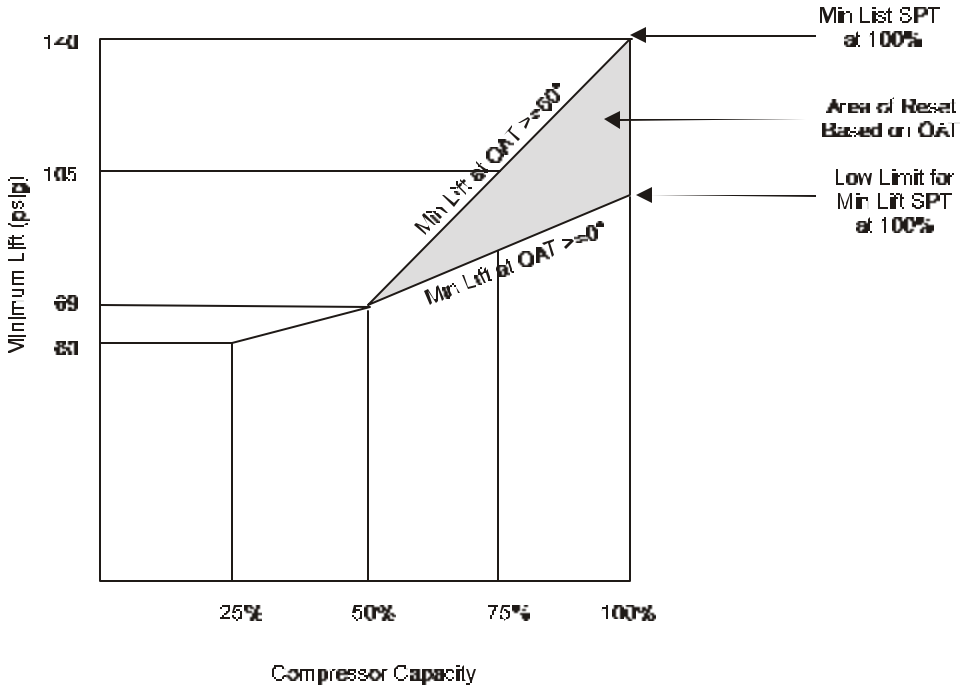
Lift Pressure Calculation

The expansion valve determines the minimum acceptable lift pressure. At low tonnage capacities, a minimum lift pressure of approximately 60 psid must be maintained. At high tonnage capacities, a higher lift pressure must be maintained to provide proper refrigerant flow through the expansion valve. Refer to the following table for the lift pressure values maintained at various unit capacities. Individual head pressure setpoints are provided at 25%, 50%, and 100% circuit capacity to optimize chiller operation. For operation at 75% capacity and greater with outdoor air temperatures less than 60°F, the minimum lift will automatically be reset downward. The maximum available reset at 100% capacity is 40 psid while the maximum reset at 75% capacity is 20 psid.

Table 16, Lift Pressure Values

Capacity	Setpoint	Adjustment Range
25%	90 psig	80 - 120
50%	100 psig	50 - 130
75%	110 psig	Fixed
100%	140 psig	110 - 160

Figure 15



Lift Pressure Dead Band

The MicroTech controller establishes a dead band above the minimum lift pressure that varies with circuit capacity. If the lift pressure is within the dead band, no fan staging will occur. Condenser fan staging will occur as follows for lift pressures above or below the dead band.

Table 17, Condenser Fan Staging With No SpeedTrol

Dead Band Table - No SpeedTrol							
Unit Capacity	**Stage 0**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**
100%	120	100	60	40	30	25	20
75%	120	70	50	30	25	20	20
50%	60	50	30	20	15	15	15
25%	50	30	20	10	10	10	10

Table 18, Condenser Fan Staging With SpeedTrol

Dead Band Table - With SpeedTrol							
Unit Capacity	**Stage 0**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**
100%	40	40	40	40	30	25	20
75%	40	40	40	30	25	20	20
50%	70	30	30	20	15	15	15
25%	80	30	20	10	10	10	10

Condenser Fan Stage Up

Every four seconds, the controller records the difference between the maximum condenser pressure (as defined by the minimum lift plus the dead band) and the actual condenser refrigerant pressure. This value is added to the previously recorded values and when the accumulated total is equal to or greater than the stage up setpoint, the controller starts an additional fan stage. The accumulated total

is set to zero whenever a fan stage change occurs or the condenser pressure falls inside the dead band. Fan stages 5 or 6 will not be enabled unless the circuit capacity is greater than 50%.

High Pressure Stage Up

The controller logic will bring on multiple condenser fan stages if a rapid rise in pressure is detected.

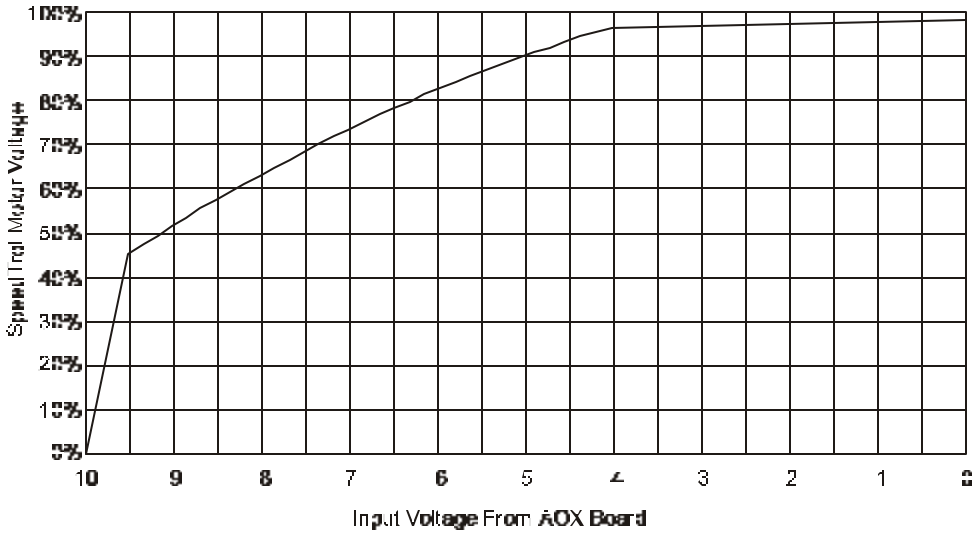
Condenser Fan Stage Down

Every four seconds, the controller records the difference between the minimum condenser pressure and the actual condenser refrigerant pressure. This value is added to the previously recorded values and when the accumulated total is equal to or greater than the stage down setpoint, the controller decrements a fan stage. The accumulated total is set to zero whenever a fan stage change occurs or the condenser pressure rises inside the dead band. Fan stages 5 or 6 will automatically be disabled whenever the circuit capacity falls to 50% or less.

SpeedTrol Logic

When the SpeedTrol option is installed, the MicroTech controller will generate an analog signal via the AOX board to directly control the S66DC-I variable speed fan motor control. The control signal is proportional to the condenser pressure's relative position within the lift pressure dead band. Minimum and maximum fan speed is defined by the minimum and maximum lift pressure setpoints. When the condenser pressure is below the dead band, the fan speed will be set to 0% and when the condenser pressure is above the dead band, the fan motor speed will be set to 100%.

Figure 16



Pumpdown

Automatic Pumpdown

As the system chilled water requirements diminish, the compressors will be unloaded. As the system load continues to drop, the electronic expansion valve will be driven to 0 steps, (closed) and the refrigerant circuit will go through a PumpDown sequence. As the evaporator pressure falls below the StopPumpDownPres setpoint while pumping down, the compressors and condenser fans will stop. If the evaporator pressure is greater than the StopPumpDownPres setpoint after 180 seconds have elapsed, the compressor will stop and the display will read "Can'tPumpDown". The alarm output will be activated.

Manual Pumpdown

When the compressor is running and the circuit pumpdown switch is moved from the Auto position to the Stop position, the circuit will pumpdown and stop when the evaporator pressure falls below the "StopPumpDownPres" setpoint.

When the compressor is not running and the circuit pumpdown switch is moved from the Auto position to the Stop position, the controller will initiate a pumpdown only if the evaporator pressure is above the "Begin Pumpdown Pressure" setpoint. The compressor will stop when the evaporator pressure falls below the "Stop Pumpdown Pressure" setpoint.

An additional pumpdown sequence can be performed by moving the pumpdown switch to the Auto position for approximately 3 seconds and then back to the Stop position. If the evaporator pressure is above the "Begin Pumpdown Pressure" setpoint, the controller will initiate a pumpdown sequence and the compressor will stop when the evaporator pressure falls below the "StopPumpdownPressure" setpoint.

Service Pumpdown

The normal pumpdown sequence will stop when the evaporator pressure equals the Stop Pumpdown setpoint pressure. A control setpoint called FullPumpDown has been provided which will allow an extended pumpdown for service purposes.

The default value for the FullPumpDown setpoint is "No". By changing this setting to "Yes", the circuit will attempt to pump down to 10 psi during the next pumpdown cycle. If 10 psi cannot be obtained, the compressor will stop after 300 seconds have elapsed. The setpoint will be set to "No" automatically at the end of the cycle.

Note: All pumpdown modes are disabled if the system switch (SI) is in the Stop position.

Note: Compressor capacity during a pumpdown sequence will be 50%.

CAUTION

Do not close any liquid line service valves for a service pumpdown. The compressor must have liquid injection available whenever it is running. Failure to provide liquid injection could cause compressor damage.

ALS Unit – MicroTech Control Alarms

Note: Those alarms which are Automatically reset will log an occurrence in the alarm buffer

Unit Alarms - Common to all Unit Refrigerant Circuits

No.	Alarm Display	Reset	Pump Down	Adjustable Setpoints	Alarm Description and Reason for Alarm
1	"BadPhase Volts"	Auto	No	Hardware Voltage Range Setting	Incoming power phasing incorrect or not within voltage limits. * To prevent operation with reverse rotation, or improper or unbalanced voltage.
2	"LossofChW Flow"	Auto (Auto)Upon flow switch closure	Yes	No Setpoints	Chiller Flow Switch open for more than 3 sec. In Cooling Status * To Prevent chiller freeze-up due to loss of water flow to chiller
3	"LvgWater Freeze"	Manual	Yes	Monitor and keypad	Chiller leaving water falls below the adjustable Freeze Water Trip setpoint(36F default) Logic will not allow this alarm to occur in Auto Control. LWT setpoint will default to 4 degrees F above the Water Freeze Trip setpoint. * To prevent chiller freeze-up
4	"BadLvgWtr Sen"	Manual		None	Controller detects an open or shorted leaving water sensor. * To prevent unit damage due to operation with defective sensor.
5	"No 5VDC @AI#5"	Manual		None	Voltage at Controller Analog Input not between 4.15 & 4.94 VDC. * To prevent operation with improper voltage to transducers and controller
Circuit Alarms					
6	"NoStart-LoEvap"	Manual	No	Memory location	Evaporator pressure below 4 psi when compressor start is requested. Circuit will not start. * To prevent start-up with no refrigerant in the unit.
7	"NoEvapPres Drop"	Manual	No	Memory locations	Evaporator pressure fails to drop a preset amount during start-up. 6 psig in 16 seconds * To shutdown circuit and liquid injection if compressor fails to start due to a possible open contactor.
8	"FailEXV/ LoChrg"	Manual			Evap. Pressure fails to rise after Exv is opened. * To prevent operation with bad EXV or severe undercharge.
9	"FailedPre Purge"	Auto	No	40psig is a memory location, 60sec timer is adjustable on Monitor and Keypad	During startup the EXV will not open until the suction pressure falls to 40 psig within a default 60 seconds. If these two settings are not met a **non-shutdown alarm will occur**. * To alert service tech that circuit is not pumping normally.
10	"FailLow Ambient"	Manual	No	Memory location	Evaporator Pressure fails to rise above the Freeze stat setpoint after 180seconds. * To prevent operation with evaporator pressure too low during start-up.

No.	Alarm Display	Reset	Pump Down	Adjustable Setpoints	Alarm Description and Reason for Alarm
11	"No Liquid Start"	Auto/ Manual	No	Memory location	20 seconds with no liquid at liquid presence sensor or 29 seconds with 9 occurrences of liquid The first occurrence is auto reset while the second is a manual reset. * To prevent overheating of the screw due to lack of liquid feed.
12	"No Liquid Run"	Manual	No	Memory locations for time w/out liquid	12 seconds without liquid at 100 and 75% load, 30 seconds w/out liquid at 50 and 25% * To prevent overheating of the screw due to lack of liquid feed during running
13	"FreezeStage Dwn"	Auto	No	Keypad and Monitor	The evaporator pressure must remain below the Freeze Stat setpoint for a period of time to calculate an error(see DD pg 55) Algorithm: Timer = 113-13 x press diff. Press diff = Freezestat setpoint - Evap press. Timer determines when the stage down will occur. * To prevent evaporator tube freeze due to low pressure operation
14	"Freezstat Prot" Awaiting new logic	Manual	No	Keypad and Monitor	Evaporator pressure falls and stays below Frz Stat setpoint for a timer longer than freezestagedown. The first freezestat protect is auto clearing. The second is a manual reset if it occurs within 60 minutes of the first occurrence. * To prevent evaporator tube freeze due to low pressure operation
15	"Hi Cond Pres"	Manual	No	Trip adjustable on key, Mon	Condenser pressure exceeds set max. value(380default) * To prevent excessive condenser pressure operation.
16	"HiPresStag Dwn"	Auto	No	Trip adjustable on key, Mon	When cond. pressure falls within 20psig of the HP trip setpoint (default of 380psig) the compressor will stage down. 30 min. must pass from time of stage down **and** the OAT must fall 3F below temperature of stage down before a stage up occurs.
17	"HiPresStage Hld	Auto	No	Trip adjustable on key, Mon	When condenser pressure falls within 40psig of HP trip setpoint. The compressor will not stage up.
18	"Hi Mech Pres"	Manual	No	Hardware(switch)	Condenser pressure exceeds Mech. Hi Press switch value(380psig) * To prevent excessive condenser pressure per Safety agency requirements
19	"Motor Protect"	Manual (reset overload)	No	Hardware(overload)/ Gardistor	Motor Protection opened due to high amps or high motor temp. * To protect compressor motor from excessive amps or high motor temp operation
20	"Can'tPump Down"	Auto	No	Press. setpoint on Mon, Key 120Sec timer Memory Address	Circuit failed to reach Stop pumpdown Setpoint default of 34psig in 90Sec during any pumpdown shutdown * To alert Service Tech. That circuit may not be pumping properly.
21	"Below Min Lift"	Manual	No	Memory addresses	When Condenser pressure - Evaporator pressure= < **Setpoint** for 254 seconds this alarm occurs. Setpoint at 25 and 50% load is: 30psig for R22 and 134A, 24psig for 407C. Setpoint at 75 and 100% load is:50psig for R22 and 134A. * To shutdown the circuit if compressor power is lost during operation. PreCursor alarm for low press differential conditions.
22	"BadEvapPres Sen"	Manual	No	None	Evaporator Pressure Transducer is failed open or shorted.

					* To prevent operation with bad pressure transducer

No.	Alarm Display	Reset	Pump Down	Adjustable Setpoints	Alarm Description and Reason for Alarm
23	"BadCondPres Sen"	Manual	No	None	Cond Pressure Transducer is failed open or shorted. * To prevent operation with bad condenser press transducer.
24	"BadSuctTemp Sen"	Manual	No	None	Suct Temperature Sensor is failed open or shorted. * To prevent operation with bad suction line temp sensor (used for Exp. Valve control)
25	"LowSubCool Temp"	Manual	Yes	5F is adjustable on the monitor, 5min is a memory address	Alarm for detecting a unit that is low on charge. Valid only at 75 and 100% load operation. Liquid Line subcooling monitored and if below a default of 5F for 5 minutes then this alarm will occur. Both the 5F and 5 minute timers are adjustable from the * To prevent operation with abnormal low charge quantity
26	"HighLiqPress Drop" *awaiting hardware	Manual	Yes	Hardware setpoint	Hardware addition to send an open signal to Digital Inputs #3(sys1) and #11(sys2) when a pressure differential (charging valve psig - LI psig) exceeds 35 psig(or what pressure is set on the switch). Open condition must remain for 15 seconds before alarm i *To prevent conditions where the filter dryer is clogged, a liq inj solenoid fails, or the liquid line shutoff valve is closed.
27	"Repower a/loss"	Auto	No	None	If power is lost on running circuit then this alarm appears and logs into buffer upon re-power. A 15min Off:Cycle timer is activated. Off:Ready circuits are free to start at repower. *To help identify jobs with poor power supply
28	"LoEvapPress"	Manual	No	Memory Address	Protect in case of bad pressure transducer. When the circuit is running and the evaporator pressure falls below 10 psig. Pressure must remain below 10 psig for 30 Seconds. Often 2 freezestagedowns will occur just prior to alarm.
29	"Hi Dschrg Temp"	Manual	No	Memory Address	Applies to 3 compressor units only. Alarm occurs when the discharge temperature is above 160F.

System Alarms

Alarm conditions that are common to both refrigerant circuits are considered to be system alarms. On a system alarm, the MicroTech controller will shut down both compressors and energize the alarm output.

Freeze protect stage down and freeze stat protect

The controller records the amount of time the evaporator refrigerant pressure is below the freeze stat setpoint (default=54 psi). The magnitude of the error will determine the time delay before a circuit stage down or alarm shutdown occurs.

Table 19

Error	S.D. Delay	Alarm Delay
2 psi	100 seconds	160°
4 psi	87 seconds	140°
6 psi	74 seconds	100°
8 psi	60 seconds	100°
10 psi	48 seconds	80°
12 psi	35 seconds	40°
14 psi	22 seconds	40°

Once the time delay is satisfied, the controller will stage down once every 20 seconds. If the controller stages down to cooling stage 0, the circuit will pump down and the compressor will stop. The circuit will restart automatically when the anti-cycle timer expires.

MicroTech Controller Test Procedures

CAUTION

Service test mode should only be used by McQuayService personnel or other factory trained technicians. The following test procedures will disable all normal chiller controls and safeties. All compressors MUST be disabled by opening circuit breakers or by disconnecting the 3-phase power before beginning tests. Failure to do so can result in severe compressor damage.

Service Test (Digital Outputs)

Select control mode, Menu 13 (Two Screw Compressor), Control mode, and set the chiller's control mode to Service Testing. Select Menu 24 (Two Screw Compressor), Service test, and with the Prev or Next item keys, select the digital output you wish to test. Enter the service password when prompted by the display. Pressing the Inc key will turn the selected output on, pressing the Decr key will turn it off. All outputs except 1, 2, 4 and 8 will remain in their last commanded state until the Service Testing mode is turned off. Manually operating outputs 1 and 2 will drive the electronic expansion valve open or closed. Compressor MCR outputs 4 and 8 will only remain in the on state for 15 seconds.

Exit the Service Testing mode by selecting the desired chiller operating mode from Menu 13 (Two Screw Compressor), Control mode.

Service Test (Digital Inputs)

Select control mode, Menu 13 (Two Screw Compressor), Control mode, and set the chiller's control mode to Service Testing. Select Menu 24 (Two Screw Compressor), Service test, and the Prev or Next item keys, select test # 16, DHI. The current state of the first 8 digits inputs (0-7) will be represented on the keypad/display as a row of ones or zeroes where 1 equals "on" and O equals "off'. By manipulating field wired devices (system switch, motor project, etc.) and watching the keypad/display, the status of the first eight digital inputs can be verified.

Press the Next item key to select test #17, DH2. The current state of the second 8 digits inputs (8-15) will be represented on the keypad/display as a row of ones or zeros where 1 equals "on" and 0 equals "off'. By manipulating field wired devices (flow switch, remote stop switch, etc.) and watching the keypad/display, the status of the second eight digital inputs can be verified.

Exit the Service Testing mode by selecting the desired chiller operating mode from Menu 13 (Two Screw Compressor), Control mode.

Keypad/Display

Overview

The information stored in the MicroTech controller can be accessed through the keypad using a tree like structure. This tree structure is divided into Categories, Menus and Menu items. There are three categories that make up the tree structure: STATUS, CONTROL, and ALARM. Each category is divided into Menus and each menu into Menu Items. The three categories are described below.

Status Category

Menus and menu items in this category provide information on the MicroTech operating conditions and the chiller operating conditions. The entries under each menu item in this category provide information only and are not changeable through the MicroTech keypad.

Control Category

Menus and menu items in this category provide for the input of all the unit parameters.

These include cooling control, compressor control and condenser fan control parameters as well as time schedules and alarm limits. The entries under these menu items are changeable through the MicroTech keypad.

Alarm Category

Menus and menu items in this category provide information regarding current and previous alarm condition.

Display Format

The current MENU is shown on the top line and the current MENU ITEM is shown on the bottom line of the display. The operator cannot select either English (Inch-Pounds) or metric (SI) units via the keypad. The units must either be ordered English or Metric or alternatively have revised software downloaded into the unit in the field.

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Inch-Pound Units:

Temperature =	°F	(Fahrenheit)
Pressure =	Psi	(Pounds per square inch)
	Psig	(Pounds per square inch, gauge)
	Psid	(Pounds per square inch, differential)

SI Units:

Temperature =	°C	(Celsius)
Pressure =	kPa	(kilo Pascal)
	kPag	(kilo Pascal, gauge)
	kPad	(kilo Pascal, differential)

MicroTech Component Test Procedures

Status LED diagnostics

The MCB status LED indications can aid in controller diagnostics. If the status LEDs do not operate normally as described in the "Component Date" section of this handout (see Table 1 and Table 2), there is a problem with the MCB. Following are troubleshooting procedures for the various symptoms.

Red LED remains on

If the red LED remains on after the 5-second self-test period, it is likely that the MCB is defective. However, this can also occur in some instances if there is a power supply problem. Refer to "Troubleshooting Power Problems" below.

Red and green LEDs off

If the red and green LEDs do not turn on after power is applied to the controller, there is likely a defective component or a problem in the controller's power distribution circuits. Refer to "Troubleshooting Power Problems" below.

Troubleshooting Power Problems

The MCB status receives 18 VAC, center-tapped power from a transformer. It then distributes both 5 VDC and 13 VDC power to various MicroTech components. A problem that exists in any of these components can affect the MCB and thus the entire control system. Power problems can be caused by an external short, which can blow a fuse, or a defective component, which can either blow a fuse or create an excessive load on the power supply. An excessive load can lower the power supply voltages to unacceptable levels. Use the following procedure to isolate the problem.

Note: This procedure may require two or three spare MCB fuses.

1. Verify that circuit breaker CB1 is closed.
2. Remove the MCB Power In connector and check for 9 VAC between the terminals on the plug corresponding to terminals 2 and 3 on the board (Figure 2, MCB1). Then check for 9 VAC between the terminals on the plug corresponding to terminals 1 and 3 on the board. (Readings of 9-12 VAC are acceptable.)

   If 9 VAC is present between both sets of terminals, go to step 3.

   If 9 VAC is not present between both sets of terminals, check both transformers and all wiring between the 115 VAC source and the Power In plug.
3. Remove power from the controller by opening circuit breaker CB1. Check the MCB power supply input fuses (Fl and F2) with an ohmmeter. See Figure 3, ADI. A good fuse will have negligible resistance through it (less than 2 ohms).

   If either or both fuses are blown, replace them. Go to step 4.

   If the fuses are intact, the MCB is defective.
4. Reconnect the Power In connector and disconnect all other connectors on the MCB. Cycle power to the controller (close and then open CB1) and check the power fuses.

   If both fuses are intact, go to step 5.
5. If either fuse blows, the MCB is defective. Reconnect the keypad/display ribbon cable (if equipped with keypad/display door). Cycle power to the controller and check the power fuses.

   If both fuses are intact, go to step 6.

   If either fuse blows, check the keypad/display and the connecting ribbon cable for shorts. Either one may be defective.

6. Reconnect the analog input ribbon cable. Cycle power to the controller and check the power fuses.

   If both fuses are intact, go to step 7.

   If either fuse blows, check the ADI board, the connecting ribbon cable, and the field wiring for shorts. Any of these may be defective. Try repeating this step after removing or swapping the ADI board.

7. Reconnect the digital input ribbon cable. Cycle power to the controller and check the power fuses.

   If both fuses are intact, go to step 8.

   If either fuse blows, check the ADI board, the connecting ribbon cable, and the field wiring for shorts. Any of these may be defective.

8. Reconnect the digital output ribbon cable to the MCB. Cycle power to the controller and check the power fuses.

   If both fuses are intact, go to step 9.

   If either fuse blows, check Output Board and the connecting ribbon cable. Either of these may be defective.

9. If there are any AOX-4 boards, reconnect the expansion bus ribbon cable to the MCB: otherwise, go to stop 10. Cycle power to the controller and check the power fuses.

   If both fuses are intact, go to step 10.

   If either fuse blows, check the analog output expansion modules (if any), the connecting ribbon cables, and the field wiring for shorts. Any of these may be defective.

10. With circuit breaker CB1 open, measure the resistance between field terminals "DC-GAD" and "5 VDC". It should be greater than 20 ohms.

    If the resistance is greater than 20 ohms, go to step 11 if the controller is equipped with at least one AOX-4 board or a modem. Otherwise, the problem is indeterminate. Obtain factory service.

    If the resistance is less than 20 ohms, it is likely that the keypad/display, the Output Board, or an external (field supplied) load is excessively loading the MCB's 5 VDC power supply. Isolate the problem by taking resistance measurements on each of these devices with the wiring disconnected. The resistance across the power input terminals on the keypad/display (G and 5V) should be close to infinite. The resistance across the power input terminals on the Output Board (+ and -) should not be less than 3000 ohms. If the component resistances are proper, check the resistance of the field supplied loads (if any) and check the wiring and connections throughout the 5 VDC power supply circuit.

11. Disconnect the connector plugs from the modem and the power plug from all AOX-4 boards (as applicable). With circuit breaker CB1 open, measure the resistance between field terminals "DC-GAD" and " 13 VDC". It should be infinite.

    If the resistance is infinite, go to step 12.

    If the resistance is not infinite, a short exists somewhere in the 13 VDC power supply wiring.

12. Reconnect the Aux/Out connector plug to the MCB. If there's a modem, reconnect its AMP plug to port A. With circuit breaker CB1 open, measure the resistance between field terminals "DC-GAD" and "13 VDC". It should steadily rise to a value greater than 5000 ohms (within approximately 30 seconds).

    If the resistance rises above 5000 ohms, go to step 13.

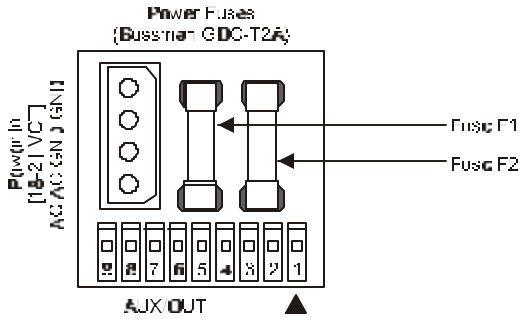
    If the resistance does not rise above 5000 ohms, the MCB is defective.

13. One at a time, reconnect the modem and each AOX-4 board (as applicable). Each time a component is reconnected, measure the resistance between field terminals "DC-GAD" and " 13 VDC". It should steadily rise to a value greater than 5000 ohms.

    If the resistance rises above 5000 ohms, repeat this step until the modem and all AOX-4 boards (as applicable) have been checked out. If the problem persists, it is indeterminate. Obtain factory service.

If the resistance does not rise above 5000 ohms, the modem or the AOX-4 board just connected is defective. (With the power plug disconnected, the resistance across an AOX-4 board's "DC" and "G" terminals should not be less than 3 meg ohms.)

Figure 17, MCB Power Supply Terminals



Troubleshooting Communications Problems

If a communications problem occurs, check the following items:

- Check the port B voltages
- Check the port B fuses
- Check the network integrity
- Check the network addressing

The best way to accomplish these checks is to perform the start-up procedures as specified in the "Network Commissioning" section of the appropriate IM manual. If these procedures have been performed and the problem persists, obtain factory service.

Troubleshooting the Keypad/Display Interface

The Keypad/Display Interface is connected to the MCB via a ribbon cable and discrete wiring for the back light. The MCB provides operating voltages, control signal outputs for the display, and input conditioning for the keypad inputs.

Display is hard to read

The clarity of the LCD display can be affected by ambient temperature. Typically, less contrast will result with cooler temperature. If the display is difficult to read, adjust the contrast trim pot, which is located on the back of the keypad/display assembly.

Back light not lit

The Keypad/Display Interfaces supplied with the MicroTech control panel is equipped with a back light. If the light does not come on, check for 5 VDC at terminal 9 on the IDC connector on the KDI and for 5 VDC on the field wiring terminal strip.

Check for 5 VDC on the IDC connector on the MCB aux/out. To check for the 5 VDC on the IDC connector, pull back the plug about one-eighth of an inch and place the test leads against the exposed pins. If there is no voltage the MCB is probably defective.

Display is blank or garbled

If the MCB appears to be functioning properly and the display is completely blank or garbled, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1.
2. Try adjusting the contrast trim pot, which is located on the back of the keypad/display assembly. If the contrast trim pot has no effect, it is likely that either the keypad/display or its ribbon cable is defective.

3. After removing power from the controller, check the ribbon cable and connections between the keypad/display and the MCB. Look for bent pins. Restore power after reconnecting the ribbon cable.

4. Try swapping a known good ribbon cable and keypad/display. Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Analog Inputs

An analog input, such as a temperature sensor, is connected to the Analog Input terminal strip on the ADI board. The ADI board then conditions the analog input. The conditioned input is transferred to the MCB via a ribbon cable.

Analog input not read by the MCB

If the MCB appears to be functioning properly and the analog input is not being read by the MCB, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1.

2. Check the ribbon cable, power wiring connector, and the field wiring connections from the analog input device. Look for bent pins, cable on backwards, or miswires. Restore power after reconnecting all cables and wires.

3. If the problem persists, try swapping a known good ribbon cable, an ADI board, or analog input device. Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Digital Inputs

A digital input device is connected to the Digital Input terminal strip on the Input Conditioning Module Terminal Board. 24 VAC, supplied by the CSC, is sent to the digital input device via a supply wire. (CSC is a Chiller System Controller that is a separate MicroTech Network panel). When a contact in the digital device makes, a return signal is sent back to the Digital Input terminal strip. The Input Conditioning Module (ICM) then conditions the signal. The conditioned digital input is then sent to the MCB via a ribbon cable.

Digital input not read by the MCB

If the MCB appears to be functioning properly and the digital input is not being read by the MCB, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1.

2. Check the ribbon cable, power wiring connector, and the field wiring connections from the digital input device. Look for bent pins, cable on backward, or miswiring. Restore power after reconnecting all cables and wires.

3. If the problem persists, try swapping a known good ribbon cable, an ADI board, or a digital input device. Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Analog Outputs

Variable voltage or current control signals are sent to analog outputs by the MCB through the Analog Output Expansion Module (AOX-4) (This can be on the ALS units as the optional fan speed control). The MCB sends a voltage or current signal to the AOX-4 via a ribbon cable. Jumpers on the AOX-4 determine what type of output will be sent to the analog output device. The analog output signals are

sent from the AOX-4 by connecting a two-pin Phoenix connector to the Analog Output Ports on the AOX-4.

Analog output device is not operating correctly

If the MCB appears to be functioning properly and the analog output device is not operating correctly, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1.
2. Check the ribbon cable(s), power wiring from the transformer to the AOX-4, field wiring connections from the AOX-4 to the analog output device, and the power wiring from the external power supply to the output device. Look for bent pins, cable on backwards, or miswiring. Restore power after reconnecting all cables and wires.

   Note: If the analog output signal supplied by the MCB is a voltage signal (0-5, 0-10 VDC), the external power supply ground must be grounded to the MCB chassis ground.

3. If the problem persists, try swapping a known good AOX-4, ribbon cable(s), analog output device, or external power supply. Swap these components separately to isolate the problem. Remove power from the controller and analog output device before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Troubleshooting Output Boards

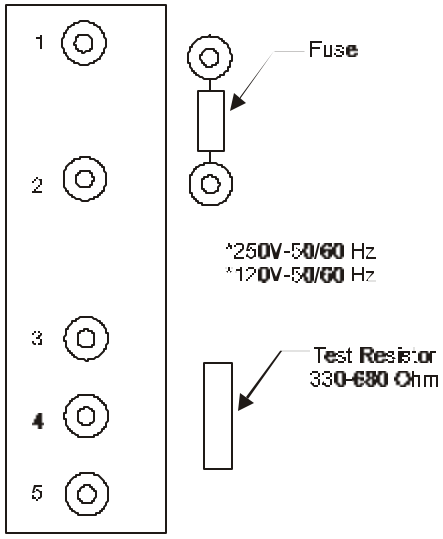
Each output on the Output Board consists of a solid-state relay, a LED, 5-amp fuse, and an MOV (metal oxide varistor).

Normally, when the MCB commands an output to energize, the solid-state relay turns on and the LED will glow. The output of each solid-state relay is in series with a 5-amp fuse. These fuses resemble small resistors and are located on the board adjacent to the relays they serve. The fuses are pressed into place. They can be removed with needle nose pliers. The MOV, which is located on the underside of the output board, protects the solid-state relay from high transient voltages. MOVs are part of the output board and cannot be replaced.

Following are troubleshooting procedures for various symptoms of output board problems.

Note: It should be possible to determine whether a solid-state relay is defective by using these procedures. However, if you need more information on troubleshooting them, refer to "Troubleshooting Solid-State relays" below.

Figure 18, Output Board Relay Socket



WARNING

Electric shock hazard. Can cause severe injury or death.

Even when power to the panel is off, solid-state relay socket terminals 1 and 2 on the output board could be connected to high voltage (see Figure 5, EXV board). Avoid them.

One LED out

If one of the Output Board LEDs fails to illuminate when the MCB is commanding the associated output to energize, perform the following procedure:

1. Remove power from the controller by opening CB1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation. Restore power by closing CB1.

   If the LED does not light, go to step 2.

   If the LED lights, the suspect relay is defective.

2. Remove power from the controller. Check the ribbon cable and connections between the OB and the MCB. Look for bent pins.

   If the cable and connections are intact, go to stop 3.

3. Remove the relay from the suspect socket. Install a 330-680 ohm resistor between terminals 3 and 5 as shown in Figure 5, EXV board. Restore power by placing CB1 to the ON position. The LED should light regardless of the controller's command.

   If the output LED illuminates, it is likely that the MCB is defective.

   If the LED does not illuminate, the output board is defective.

All LEDs out

If the MCB is commanding at least two outputs to energize and none of the Output Board LEDs are lit, perform the following procedure:

1. Verify that 5 VDC is present at the Output Board's power terminals.

   If 5 VDC is not present, go to step 2.

   If 3 VDC is present, check the ribbon cable and connections between the output board and MCB. Look for bent pins. If the cable and connections are intact, the Output Board or the MCB is defective.

2. Remove power from the controller by placing CB1 to the OFF position. Disconnect at least one wire from the power input terminals of the Output Board. The resistance should not be less than 3000 ohms.

   If the resistance is greater than the acceptable value, go to step 3.

   If the resistance is less the acceptable value, the Output Board is defective.

LED lit, output not energized

If the LED of a suspect relay is lit but the load connected to it is not energized, and everything is intact between the MCB and the control side of the relay, perform the following procedure to isolate the problem:

1. Verify that 24 or 120 VAC power is present at the suspect output's screw terminal on the Output Board.
2. Remove power from the controller by opening CB1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation. Restore power by closing CB1.

   If the output load energizes, the suspect relay is bad. Replace the relay.

   If the output load does not energize (when LED is lit again), check the load circuit wiring and components.

Output energized, LED not lit

If the LED of a suspect relay is not lit, but the load connected to it is energized, either the solid-state relay or the MOV is bad. The solid-state relay output and the MOV, which are in parallel, can both fail closed. Perform the following procedure to isolate the problem:

1. Remove power from the controller by opening CB1. Pull the solid-state relay from the suspect output's socket.
2. Restore power by closing CB1.

   If the output load remains energized when there is no relay in the socket, the output's MOV has failed and thus the Output Board must be replaced.

   If the output load de-energizes, the relay that was pulled is defective.

Contact chatter

Contact chatter is very rapid opening and closing of contacts. It is usually caused by low voltage at the electromechanical relay or contactor coil. If contact chatter is occurring on a relay or contactor connected to one of the Output Board solid-state relays, it is also possible that a faulty connection exists on the power supply terminals of the Aux/Out plug connector on the MCB and the Output Board. In very rare instances, contact chatter can be caused by a faulty solid-state relay. Perform the following procedure to isolate the problem:

1. Verify that the voltage at the load's power supply and at the solid-state relay contacts is adequate.
2. Remove power from the controller by opening CB1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation. Restore power by closing CB1. If the chatter does not stop, go to step 3. If the chatter stops, the suspect relay is defective. Replace the relay.
3. Remove power from the controller by opening CB1. Try to improve the connections in the AUX/Out plug insulation displacement terminals by pressing down on the wires with a small screwdriver.
4. Check all other wiring and connectors for bent pins or miswires. If the chatter does not stop, the electromechanical relay or contactor is probably defective.

Troubleshooting Solid-State Relays

As shown on the unit wiring diagrams, the solid-state relays on the Output Boards all have normally open "contacts". Actually, these contacts do not exist as they do in electromechanical relays. Instead of using contacts to switch the load, the solid-state relay changes its resistance from low (closed), when it is energized, to high (open), when it is de-energized. (This high resistance is approximately 1 00K ohms.) Because the output circuit through the solid-state relay remains continuous regardless of whether the relay is energized, troubleshooting a solid-state relay with a voltmeter can be tricky.

In a typical circuit, a power source is connected across a single relay output and a load (see Figure 19). In this circuit, a solid-state relay will behave like an electromechanical relay. If the relay is energized, the relay output will be hot. If the relay is deenergized, a small voltage will be present.

The circuit shown in Figure 20 is similar to a typical circuit; the difference is that there is an open set of contacts, or a disconnection between the relay output and the load. In this circuit, a solid-state relay will not behave like an electromechanical relay. If the solid-state relay is energized, the relay output will be hot (as expected). However, if the solid-state relay is de-energized, the relay output will still appear to be hot. This is because the relay output and the voltmeter form a continuous circuit in which the relay's resistance, though high, is insignificant compared to the voltmeter's resistance.

This means that nearly all the voltage is dropped across the voltmeter. Therefore, the voltmeter indicates that voltage is present. If a low wattage light bulb of the appropriate voltage is used instead of a voltmeter, the bulb's low resistance will load the circuit enough to eliminate the false voltage indication. In this situation, an incandescent test lamp is a better tool than a voltmeter.

Figure 19, Testing A Typical Relay Circuit

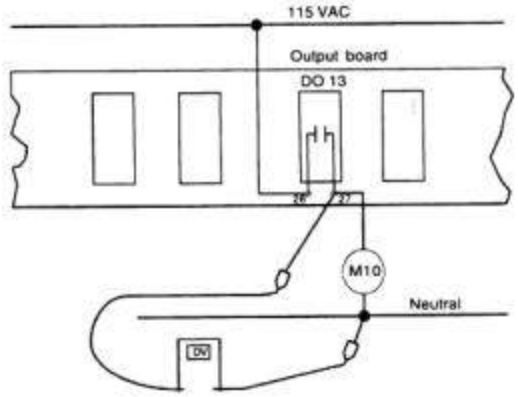
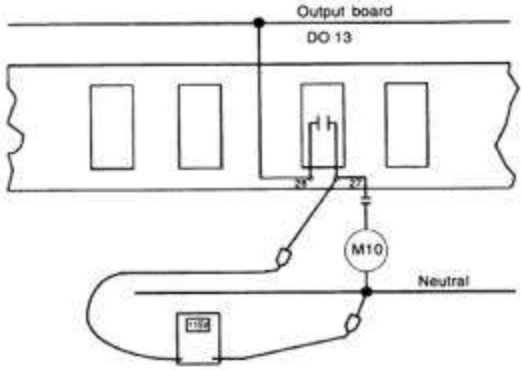


Figure 20, Testing A Typical Relay Circuit With A Disconnection



MCB Replacement

If an MCB board is defective and must be replaced, the proper controller software must be loaded into the replacement MCB. This can be done either at the factory or at the building site - if a PC equipped with appropriate Monitor software is available.

The factory will download the proper controller software into a replacement MCB board before it is shipped if you include the program code with the replacement MCB part order. Only McQuayService or authorized service agencies are allowed to do this.

Connecting the Communications Trunk

Use the following three procedures to connect the chiller controllers to the network.

Communications cable check

The network communications cable should have been installed in accordance with the instructions in the "Field Wiring" section of this manual. This procedure will verify that there are no shorts or stray voltages anywhere in the communications trunk.

Before beginning, verify that the port B connectors are disconnected from every controller on the trunk.

1. Verify that there is no voltage between any conductor and ground.

   Use a voltmeter to test for voltage at the field wiring terminal block or directly on the port B connector of the level-1 controller. With one lead on the control panel chassis (ground), check for voltage at the "+" "-", and "ground" terminals. There should be no AC or DC voltage (see the Signal and Terminal columns of Table 3). If the conductors are properly terminated, this check will test for stray voltage throughout the trunk.

   Note: If you get a 2 or 3 VDC reading, it indicates that one or more powered controllers are connected to the trunk. These controllers should be located and disconnected.

2. Verify that there are no shorts between any two conductors.

   Use an ohmmeter to test for shorts at field wiring terminal block or directly on the port B connector of the level-1 controller. For the three combinations of conductor pairs, there should be infinite resistance between the conductors. If the conductors are properly terminated, this check will test for shorts throughout the trunk.

   Note: If you find a resistance that is high but less than infinite, it indicates that one or more non-powered controllers are connected to the trunk. These controllers should be located and disconnected.

3. Verify that the communications wiring is continuous over the trunk and that the field terminations are correct. (This step is optional but recommended; to do it, you must know the physical layout of the network's communications trunk.)

   Go to the last controller on one end of the daisy-chain and place a jumper across the "+" to "ground" and "-" to "ground".

   Remove the jumper and repeat this step for the other two conductor pairs: "+" to "ground" and "-" to "ground".

   If there is continuity for each conductor pair, the wiring is continuous and it is likely (but not guaranteed) that the terminations are correct throughout the trunk.

   If there is no continuity for one or more conductor pairs, there may be a break in the trunk or the terminations at one or more controllers may have been mixed up.

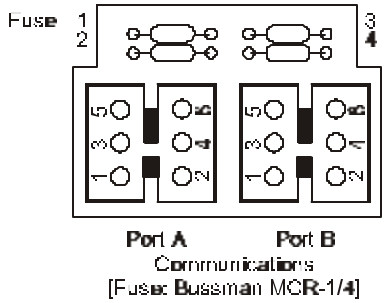
Table 20, Port B Voltages; AMP Type Connector

Port B (RS 485)		Acceptable Voltage Reading
Signal	**Terminal**	
+	4	3.0 ± 0.3 VDC
-	3	2.0 ± 0.3 VDC
Ground	5	0.0 ± 0.2 VDC

Table 21, Network Communications Field Wiring Terminals

Controller	Network Comm Field Terminal		
	+	-	Ground
CSC	T11-B+	T11-B-	T11-GND
Screw Chiller	TB4-54	TB4-53	TB4-55

Figure 21, AMP Connector Terminal Configuration



Level-1 controller connection

In order for the chillers and other level-2 controllers in a network to connect and communicate with the level 1 controller is connected first.

1. Set the network address to 00 (level 1). See "Addressing the Controllers" above for more information.
2. Push the circuit breaker (CB1) button to power up the CSC and verify that there is power to the MCB by observing the LEDs.
3. Check the voltages of port B on field wiring terminals (TB2).

   Use a DC voltmeter to test for proper voltages. With the ground lead on the control panel chassis (ground), check the voltage at the "+" "-", and "ground,' terminals. Refer to Table 20, Port B voltages; AMP type connector, for the correct voltage levels.

   If no voltage or improper voltage levels are found, verify that the panel is energized.
4. Plug the network communication AMP connector into port B.

Level-2 controller connection

This procedure will verify that proper communications have begun for each controller as it is connected to the network. You can connect the level-2 controllers in any order; however, it is better to follow the daisy-chain as you proceed. This will make troubleshooting easier if communications problems occur.

As a result of the previous procedures, the network communications connector should be disconnected from the B port at every controller on the trunk except for the level 1 controller. Be sure that this is true before beginning this procedure.

For communications to occur, each networked controller must have the proper hex switch setting and the proper voltages at its port B terminals.

1. Set the network address (hex switch setting) to match the address on the engineering schedule. Each controller must have a unique address.
2. Turn on power to the level-2 controller. Refer to the controller installation manuals for information on how to turn on power to each controller.
3. Check the voltages of port B directly on the AMP connector. The trunk must not be connected to the controller when you do this.

   Use a DC voltmeter to test for proper voltages. With the ground lead on the control panel chassis (ground), check the voltage at the "+" "-", and "ground" terminals. Refer to Table 21, Port B voltages; AMP type connector, for the correct voltage levels.

   If no voltage or improper voltage levels are found, verify that the controller is energized.
4. Check for proper communication trunk voltages at the field wiring terminals (if any) or directly on the connector. The trunk must not be connected to the controller when you do this.

If no voltage or improper voltages are found, check the wiring between the port terminals and the field terminals (if any), using Table 20, Port B voltages; AMP type connector, and Table 21. Verify that the three conductors are properly terminated in the network communications connector. If there is still a problem, verify that the level-1 controller is energized and that the communications trunk wiring is intact.

5. Plug the network connector into port B.

6. Verify communications have begun between the level-1 controller and the level-2 controller:

   To verify communications using Monitor for Windows software, network diagnostics must be performed. To run network diagnostics, select the pull-down menu "Comm." Select "Network Diagnostic," which will then display the "Network Diagnostics Parameters Setup" dialog box. Using the "Network Diagnostics Parameters Setup" dialog box, you can choose to continually loop the diagnostics, or have a single sweep of each controller being connected to the network. You can also perform the following functions:

   - Display Program ID and status
   - Restrict display of level-3s to units with errors
   - Clear communications errors if found
   - Log errors to file

   As the different controllers are connected to the network, their information is displayed on the Network Diagnostic Error Display screen. By looking at the headings labeled "Address" and "Error codes," network communications to a particular controller can be verified. If there are no error codes, network communications to the controller was successful. If the "Error code" reads "Does not respond," a communications problem has occurred. For more on network diagnostics, see "Chapter 5-Comm Menu" in "MicroTech Monitor for Windows" user's manual.

   If a communications problem occurred, check the following items:

   - Make sure the hex switches on each controller are set to the correct values.
   - Make sure the controller has power supplied to it. Make sure the communication line is properly connected to port B.
   - Make sure the controller is level 2 by directly connecting the PC to it. (You must know how to change communications passwords to do this.)

7. Go to the next controller and repeat steps 1 through 6. Do this for each controller being connected to the network.

Note: To verify communications more quickly and easily, use two people in the commissioning of the network. Because some jobs have units located throughout a building, having one person perform the commissioning procedure may be difficult. When there are two people, one person can stay at the PC connected to the level-l controller and the other person can go to each individual unit controller. Using a radio or other two-way communication equipment, they can indicate when a specific controller is connected and whether communications between the controllers is occurring.

Keypad Key Functions

The MicroTech keypad consists of twelve pressure sensitive membrane switches (Refer to Figure 7). These keys are used to step through, access, and manipulate the information in the MicroTech controller tree structure. The keypad keys are divided into four groups with two or four keys in each.

Keypad password

When changing any menu item entry, the user is prompted to enter the password. The change will not be allowed until the correct password is entered. The password for ALS units is always the successive pressing of the following "ACTION" group keys:

"ENTER" "ENTER" "ENTER" "ENTER"

Once this has been done, the user can make changes to menu item entries. After entering the correct password, the controller will allow a 5 minute time period during which the operator may make any necessary setpoint adjustments. Any keypad activity will reset the timer for the full 5 minutes so the password only needs to be entered once per session. After 5 minutes of inactivity, the password access time will expire providing protection against unauthorized users.

Category group

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 desired menu.

A. STATUS - Pressing the "STATUS" key at any time shifts the display to the first menu of the STATUS category which is Menu 1, CHILLER STATUS.

B. CONTROL - Pressing the "CONTROL" key at any time shifts the display the first menu of the CONTROL category which is:

   MENU 13 or 16 or 19, CONTROL MODE (2, 3, 4 compressor)

C. ALARMS - Pressing the "ALARMS" key at any time shifts the display to the first menu of the ALARMS category which is:

   MENU 28, 31, 34, #1 CURRENT ALARM 2, 3, 4, compressor)

D. SWITCH - Pressing the "SWITCH" key at any time toggles the display between 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 while the current menu item is menu item 4A (Leaving Evaporator=), the display shifts to menu item 14A (Leaving Evaporator Setpoint=). This provides for easy review of actual versus setpoint values.

Menu group

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

A. PREV. - Pressing "PREV." shifts the display to the previous menu.

> **Note**: When Menu 1, CHILLER STATUS, 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.

B. NEXT - Pressing "NEXT" shifts the display to the next menu.

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

Action Group

The keys in this group are for making changes to unit control parameters and setpoints or for clearing alarm conditions. Changes do not go into effect nor are they remembered until the ENTER key is pressed.

Note: Before a change to a parameter can be made or before an alarm can be cleared, the display prompts the user with an "Enter Password" message. At this prompt, the password must be entered before the user can continue with the action.

("Enter" "Enter" "Enter" "Enter")

A. **INCR**. - When changing the value of a menu item entry, pressing "INCR. +" increments the displayed value to the next higher value or selects the next available option.

B. **DECR**. - When changing the value of a menu item entry, pressing "DECR.-" decrements the displayed number to the next lower value or selects the previous available option.

C. **ENTER** - Once a change has been made to a desired value, pressing "ENTER" locks in the new value and causes it to take effect.

D. **CLEAR** - 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 clearing the alarm through the keypad.

Example of keypad operation

As an example of using the keypad key functions, consider reprogramming the Leaving Evaporator Setpoint from 44°F to 42°F. This consists of changing the Menu 14 (Two Screw Compressor), Lvg evap spts - values for R-22 refrigerant, entry from "44°F to 42°F." Assume Menu 1 Chiller 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 (Two Screw Compressor), Control mode (the first menu in the "CONTROL" category).
2. Press the "MENU" group "NEXT" key once. This shifts the display to Menu 14 (Two Screw Compressor), Lvg evap spts - values for R-22 refrigerant. (Leaving Evaporator Setpoint).
3. Press the "ACTION" group "DEC-" key one time. This prompts the user to enter the password.

   ("Enter" "Enter" "Enter" "Enter").
4. After the "Password Verified" message, press the "ACTION" group "DEC-" key four times. This changes the menu item entry to 42°F.
5. Press the "ACTION" group "ENTER" key one time. This stores the new entry into the MicroTech controller memory.
6. Pressing the "CATEGORY" group "STATUS" key then shifts the display back to Menu 1, Chiller status.

Personal Computer Specification

For McQuay Monitor Software

1. IBM PC or 100% true compatible, 486DX or better including:
    a) 3 ½inch, 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.
    b) 8 Megabyte RAM (Random Access Memory) - The computer must have 8 Megabytes in order to run the MicroTech Monitor Program.
    c) RS232 serial port - A direct communications interface connection between the PC and the MicroTech Controller. The communications port must be recognized as COM1 or COM2 and the connector should be a 9 Pin Male.
    d) Parallel Printer Port - For hard-copy custom reports of all accumulated data.
    e) Mouse or trackball.
    f) Hard Disk Drive (120 Megabyte min.) - A mass data storage area for the operator interface and custom report software.
    g) 101 Enhanced Keyboard - Required for more advanced functions of the operator interface and custom report software.
    h) The computer shall include MS-DOS 6.2 or greater, Windows 3.1 or greater and all owner's manuals.
    i) The computer shall have an internal time clock that is battery backed to maintain system time and date.
    j) The computer shall have an internal, 9600-Baud, Hayes compatible modem if remote access and monitoring of the MicroTech unit controller is desired. The modem shall be addressable as COM1 or COM2.
2. Multisync Super VGA Color Monitor - For use with the Super VGA graphics.
3. Printer, 192 CPS (Characters Per Second) Epson LQ-510 or equivalent. Must have the ability of supporting IBM extended character graphics.
4. Printer Cable, 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 MicroTech 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 cable from the unit control panel to the personal computer is shielded, twisted pair wire (Belden #8761 or equal). The communications adheres to the industry standards of RS232C and the rate of communications is 9600 baud. The recommended maximum distance from the personal computer to the control panel is 50 feet. If the required distance is in excess of 50 feet, an optional RS-232 extension kit is required (contact McQuay).

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-11C modular phone plug.

MicroTech Menu Structure

A complete listing of the information stored in the MicroTech controller tree structure is shown in the following tables. These tables show the menu numbers and names along with their corresponding menu items and menu item entries as they appear on the MicroTech display. The # symbol is used where the controller would normally display a numerical value. Also included in this figure is the corresponding switch menu for each menu item.

Notes:

1. **Status Category** - Where more than one menu item entry is listed under a menu item, the list includes all the entries that can appear in the display for the particular item. The entry that shows in the display depends on the operating status of the unit.
2. **Control Category** - Where more than one menu item entry is listed under a menu item, the list includes all the choices from which the user can select. The selected entry appears in the display.
3. **Alarm Category** - The entries listed include all the possible alarm messages. The display reads the alarm conditions that occur.

Status menus

Provide chiller operating information and display of sensor readings. The items listed under these status menus are affected by the settings under the associated control menus and are not directly adjusted via the keypad.

Control menus

All adjustable control parameters and setpoints, time schedules, control options and alarm thresholds are accessed through these menus.

CAUTION

Any changes to these parameters must be determined and implemented by qualified personnel with a thorough 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.

Alarm menus

Display any alarm conditions that may be present in the unit. All alarm messages are accompanied by the date and time when the alarm occurred.

Menus for Two (2) Screw Compressor Units

Table 22, Two Compressor Menu, Status

Menu	Item	Display	Default	Range
1	**Chiller Status**			
	1	Off: Manual Mode		
		Off: System Sw		
		Off: Remote Comm		
		Off: Remote Sw		
		Off: Time Clock		
		Off: Alarm		
		Off: PumpDnSw's		
		Off: AmbientLck		
		Starting		
		Waiting for Flow		
		Waiting for Load		
		CoolStageUp		
		CoolStageDn		
		Cool Staging #		
		ManualCool		
	2	InterStg=xxxsec		
	3	Hold stage = xxmin		
		Hi Loop Temp= xxx		
2	**Circ #1 Status**			
	1	Off: SystemSw		
		Off: ManualMde		
		Off: Alarm		
		Off: PumpDwnSw		
		Off: CycleTime xx		
		WaitFlooded		
		OFF: Ready		
		Starting….		
		Pre-Purge….		
		Opened EXV….		
		LowAmbStart		
		Cooling %Cap=xxx		
		Pumping Down		
3	**Circ #2 Status**			
		See Circ#1 Above		
4	**Water Temp's**			
	1	Lvg Evap=xxx.x°F(°C)		N/A,Open ,Short °F(°C)
	2	Ent Evap=xxx.x°F(°C)		N/A,Open ,Short °F(°C)
	3	Ent Cond=xxx.x°F(°C)		N/A,Open ,Short °F(°C)
	4	Lvg Cond=xxx.x°F(°C)		N/A,Open ,Short °F(°C)
5	**Circ #1 Pres's**			
	1	Evpxxx.xpsi(kPa) xx°F(°C)		145+°F, Open °F, Short °F(°C)
	2	Cndxxx.xpsi(kPa) xx°F(°C)		145+°F, Open °F, Short °F(°C)
	3	MinCondPr=xxx#		
	4	MaxCondPr=xxx#		
	5	EXV Position=xxx		
	6	Cond Fan Stage=x		
6	**Circ #2 Pres's**			
		See Circ#1 Above		
7	**Circ #1 Temp's**			
	1	Satur Evap=xxx°F(°C)		N/A xx°F(°C)
	2	SuctLine=xxx.x°F(°C)		N/A,Open, Short °F(°C)
	3	Super Ht=xxx.x°F(°C)		N/A xx°F(°C)

	4	Satur Cond=xxx°F(°C)		N/A xx°F(°C)
	5	CondAppr=xxx°F		N/A,Open, Short °F(°C)
	6	LiquidLn=xxx.x°F(°C)		N/A,Open, Short °F(°C)
	7	SubCoolg=xxx.x°F(°C)		N/A xx°F(°C)

Table 22, Continued

Menu	Item	Display	Default	Range
8	**Circ #2 Temp's**			
		See Circ#1 Above		
9	**Chiller Amps**			
	1	PercentRLA= xxx%		
10	**Comp RunHours**			
	1	#1 Total =xxxxxx		
	2	#2 Total =xxxxxx		
	3	#1 @ 25% =xxxxxx		
	4	#1 @ 50% =xxxxxx		
	5	#1 @ 75% =xxxxxx		
	6	#1 @ 100% =xxxxxx		
	7	#2 @ 25% =xxxxxx		
	8	#2 @ 50% =xxxxxx		
	9	#2 @ 75% =xxxxxx		
	10	#2 @ 100% =xxxxxx		
11	**Compr Starts**			
	1	#1 Total =xxxxxx		
	2	#2 Total =xxxxxx		
12	**Air Temp**			
	1	Outdoor =xxx.x°F(°C)		N/A,Open, Short °F(°C)

Table 23, Two Compressor Menu, Control Mode

Menu	Item	Display	Default	Range
13	**Control Mode**			
	1	Manual Unit Off	Manual Unit Off	
		Automatic		
		Manual Staging		
		AutoCirc#1-Off#2		
		OffCirc#1-Auto#2		
		Service Testing		
	2	Manual Stage=xx	0	0-8

Table 24, Two Compressor Menu, Set Points

Menu	Item	Display	Default	Range
14	**Lvg Evap Spts - (Values for R-22 Refrigerant)**			
	1	Actv Spt=xxx.x°F(°C)		Not Changeable
	2	Lvg Evap=xxx.x°F(°C)	44.0	10-80
	3	CntrlBand=x.x°F(°C)	3.0	**1.4-5**
	4	StartUpD-T=x.x°F(°C)	**2.0**	**0-8**
	5	ShutDnD-T=x.x°F(°C)	**0.5**	**0-1**
	6	MaxPullDn=x.x°F(°C)	**1.0**	**.1-2**
	7	ResetOpt=None	None	None, Return, 4-20ma, Ice, Network, Outdoor
	8	ResetSig=xx.xma		
	9	MaxChWRst=xx.x°F	10	0-45
	10	ReturnSpt=xx.x°F	54	15-80
	11	OaTBegRst=xx.x°F	75	0-90
	12	OaTMaxRst=xx.x°F	60	0-90
	13	HiChWTmp=xx.x°F	70	20-90
	14	Amb Lock=xx.x°F	0	-10-60
	15	AmbStage=xx.x°F	60	30-80
15	**SoftLoad Spts**			
	1	Time Left = xx min	0	0-254
	2	SoftLoad = xx min.	20	0-254
	3	SoftLdMaxStg = x	**3**	**2-8**
	4	LoadDelay = xx sec	15	0-254
16	**CompressorSPT**			
	1	LeadCircuit=Auto	Auto	Auto, #1, #2
	2	InterStg=xxxsec	**120**	**60-240**
	3	InterStgDiv=x	**1/5**	**1/2-1/10**
	4	MinST-ST=xxxmin	15	5-40
	5	MinSP-ST=xxxmin	5	3-30
	6	PrePurSp=xxxsec	**60**	0-99
17	**Head Pres Spt**			
	1	MinLift 25%=xxx	**100**	**80-120**
	2	MinLift 50%=xxx	**100**	**90-130**
	3	MinLift100%=xxx	140	**110-160**
	4	DeadBandMult=x.x	1.0	0.8-1.3
	5	StageUpErr=xxx	**300**	**200-990**
	6	StageDnErr=xxx	**80**	**50-300**
18	**Demand Limits**			
	1	Demand Lim=xstg		
		DemandSg=xxx.xma		
		Man Demand=xstg	8	4-8

Table 25, Two Compressor Menu, Time/Date

Menu	Item	Display	Default	Range
19	**Time / Date**			
	1	Time=xx:	Current hour	0-23
		xx:	Current min	0-59
		xx	Current sec	0-59
	2	xx/	Current day	N/A
		xx/	Current mon	1-12
		xx/xx/xx	Current date	1-31
		xx	Current year	0-99

Table 26, Two Compressor Menu, Schedule

Menu	Item	Display	Default	Range
20	**Schedule**			
	1	Override=xx.xxHr	0	0-63.5
	2	NMP Schedule=xx	N/A	1-32
	3	Sun xx: - :	0	0-23
		Sun :xx- :	0	0-59
		Sun : -xx:	23	0-23
		Sun : - :xx	59	0-59
	4-9	Same as 3 above		
	10	Hol xx: - :	0	0-23
		Hol :xx- :	0	0-59
		Hol : -xx:	23	0-23
		Hol : - :xx	59	0-59
21	**Holiday Date**			
	1	#1 Date=N/A	None	None-Dec
		#1 Date= xx	0	0-31
	2	#1 Dur=xxDay(s)	0	0-31

Table 27, Two Compressor Menu, Service Test

Menu	Item	Display	Default	Range
22	**Service Test**			
	1	#0 Output 0=Off		On-Off
	2	#1 Output 1=Off		On-Off
	3	#2 EXV Pos#1=xxx	0	0-760
	4	#3 EXV Pos#2=xxx	0	0-760
	5	#4 Output 4=Off		On-Off
	6	#5 Output 5=Off		On-Off
	7	#6 Output 6=Off		On-Off
	8	#7 Output 7=Off		On-Off
	9	#8 Output 8=Off		On-Off
	10	#9 Output 9=Off		On-Off
	11	#10Output 10=Off		On-Off
	12	#11Output 11=Off		On-Off
	13	#12Output 12=Off		On-Off
	14	#13Output 13=Off		On-Off
	15	#14Output 14=Off		On-Off
	16	#15Output 15=Off		On-Off
	17	#16Output 16=Off		On-Off
	18	#17Output 17=Off		On-Off
	19	#18Output 18=Off		On-Off
	20	#19Output 19=Off		On-Off
	21	#20 DH1=10110110		
	22	#21 DH2=10110110		
	23	#22 AI#5x.xxVdc		

Table 28, Two Compressor Menu, Alarm Spts.

Menu	Item	Display	Default	Range
23	**Alarm Spts**			
	1	StpPumpDn=xxxpsi	34	10-54
	2	FullPumpdown=xx	No/Yes	
	3	FreezStat=xxxpsi	54	20-60
	4	FreezH2O=xx.x°F	36	**N/A 0.5-40**
	5	Hi Pres =xxpsi	380	280-426
	6	LowSubcool=x.x°F	5°F	0-8°F

Table 29, Two Compressor Menu, Misc. Setup

Menu	Item	Display	Default	Range
24	**Misc Setup**			
	1	Unit Type=ALS125		
		Unit Type=ALS140		
		Unit Type=ALS155		
		Unit Type=ALS170		
		Unit Type=ALS175		
		Unit Type=ALS185		
		Unit Type=ALS195		
		Unit Type=ALS204		
	2	Units = xx	English	English/Metric
	3	AirCldCnd=xx	Local	Local/Remote
	4	SpeedTrol = xx	No	Yes/no
	5	Power =xxHz	60	50/60
	6	Port A Baud=xx	9600	ukwn,1200,2400,9600
	7	Pre-Alarm=xx	Blink	Blink,open,closed
	8	Alarm=xx	Closed	Closed,open,blink(N/O),blink(N/C)
	9	OAT Select=xx	LCL	None,lcl,rmt
	10	Amb Lockout=xx	No	Yes, No
	11	Low Amb Opr=xx	Yes	Yes, No
	12	LvgEvpAdj=xx.x°F	0	-.8 - .8
	13	EntEvpAdj=xx.x°F	0	-.8 - .8
	14	#1EvpAdj=xx.xpsi	0	**-2 - +2**
	15	#2EvpAdj=xx.xpsi	0	**-2 - +2**
	16	#1CndAdj=xx.xpsi	0	**-8 - +8**
	17	#2CndAdj=xx.xpsi	0	**-8 - +8**
	18	Refrigerant=xx	R22, R134a, R407C	
		**Refrigerant type is not selectable on keypad, new code must be downloaded.		
	19	Min Stage =x	1	1-2
	20	LowEvpDTmr=xxM	5	2-15
	21	MaxStg1Tmr= xxM	30	10-50M
	22	IDENT=SC22U20N		
	23	Rel. Date	MM/DD/YY	

Table 30, Two Compressor Menu, Alarms

Menu	Item	Display	Default	Range
25	**#1 Curr Alarm**			
	1	None		
		HiPresStageHld		
		HiPresStagDwn		
		FreezeStageDwn		
		LossofChWFlow		
		Can'tPumpDown		
		NoStart-LoEvap		
		FailedPrePurge		
		FailLow Amb Start		
		FreezeStatProt		
		LoEvapPress		
		Motor Protect		
		Repower a/loss		
		No CondWatFlow		
		NoEvapPresDrop		
		Below Min Lift		

Table Continued on Next Page

Table 30, Two Compressor Menu (Continued)

Menu	Item	Display	Default	Range
25	1	No Liquid Run		
		No Liquid Start		
		LowSubCoolTemp		
		HighLiqPressDrop		
		Hi Dschrg Temp		
		Hi Cond Press		
		Hi Mech Pres		
		BadSuctTempSen		
		BadEvapPresSen		
		BadCondPresSen		
		FailEXV/LoChrg		
		BadPhase/Volts		
		LvgWaterFreeze		
		No 5 Vdc @AI#5		
		BadLvgWaterSen		
	2	(@ hr:mn mm/dd/yy)		
	3	Evap = xx.xpsi		
		145+psi		
		Openpsi		
		Shortpsi		
	4	Cond = xx.xpsi		
		450+psi		
		Openpsi		
		Shortpsi		
	5	Suctline=xxx.x°F		
		n/a °F		
		Open °F		
		Short °F		
	6	LiquidLn=xxx.x°F		
		n/a °F		
		Open °F		
		Short °F		
	7	Evap Lvg=xxx.x°F		
		n/a °F		
		Open °F		
		Short °F		
	8	OA/LCnWT=xxx.x°F		
		n/a °F		
		Open °F		
		Short °F		
	9	Capacity = xxx.x%		
	10	Fan Stage=x		
	11	Evap Ent= xxx.x°F		
	12	ExpVPos=xxx		
	13	Subcool=x.x°F		
26	**#2Curr Alarm**			
	1	See #1 Curr Alarm Above		
27	**#1Prev Alarms**			
	1	1-same as menu 25		
	2	1-hr:mn mm/dd/yy		
	3	2-same as menu 24		
	4	2-hr:mn mm/dd/yy		
	5	3-same as menu 24		
	6	3-hr:mn mm/dd/yy		
	7	4-same as menu 24		
	8	4-hr:mn mm/dd/yy		
	9	5-same as menu 24		

	10	5-hr:mn mm/dd/yy		
28	**#2Prev Alarms**			
	2	See #1Prev Alarms Above		

Menus for Three (3) Screw Compressor Units

Table 31, Three Compressor Menu, Test Software

Menu	Item	Display	Default	Range
1	**TEST SOFTWARE**			
	1	Off: Manual Mode		
		Off: System Sw		
		Off: Remote Comm		
		Off: Remote Sw		
		Off: Time Clock		
		Off: Alarm		
		Off: PumpDnSw's		
		Off: AmbientLck		
		Starting		
		Waiting for Flow		
		Waiting for Load		
		CoolStageUp		
		CoolStageDn		
		Cool Staging #		
		ManualCool		
	2	InterStg=###sec		
	3	Hold stage = ##min		
	4	Hi Loop Temp= ###		

Table 32, Three Compressor Menu, Status

Menu	Item	Display	Default	Range
2	**Circ #1 Status**			
	1	Off: SystemSw		
		Off: ManualMde		
		Off: Alarm		
		Off: PumpDwnSw		
		Off: CycleTime ###		
		WaitFlooded		
		OFF: Ready		
		Starting….		
		Pre-Purge….		
		Opened EXV….		
		LowAmbStart		
		Cooling %Cap=###		
		Pumping Down		
3	**Circ #2 Status**			
	1	Same as Cir#1 above		
4	**Circ #3 Status**			
	1	Same as Cir#1 above		
5	**Water Temp's**			
	1	Lvg Evap=###.#°F(°C)		
	2	Ent Evap=###.#°F(°C)		
	3	Ent Cond=###.#°F(°C)	N/A	
	4	Lvg Cond=###.#°F(°C)	N/A	
6	**Circ#1 Pres's**			
	1	Evp###.#psi(kPa) ##°F(°C)		
	2	Cnd###.#psi(kPa) ##°F(°C)		
	3	MinCondPr=####		
	4	MaxCondPr=####		
	5	EXV Position=###		
	6	Cond Fan Stage=#		

Table Continued on Next Page

Table 32, Three Compressor Menu, Status (Continued)

Menu	Item	Display	Default	Range
7	**Circ#2 Pres's**			
	1	Same as above		
8	**Circ#3 Pres's**			
	1	Same as above		
9	**Circ#1 Temp's**			
	1	Satur Evap=###°F(°C)		
	2	SuctLine=###.#°F(°C)		
	3	Super Ht=###.#°F(°C)		
	4	Satur Cond=###°F(°C)		
	5	LiquidLn=###.#°F(°C)		
	6	SubCoolg=###.#°F(°C)		
	7	Dscharge=###.#°F(°C)		
10	**Circ#2 Temp's**			
	1	Same as above		
11	**Circ#3 Temp's**			
	1	Same as above		
12	**Chiller amps**			
	1	#1 PrcntRLA= ###%	N/A %	
	2	#2 PrcntRLA= ###%	N/A %	
	3	#3 PrcntRLA= ###%	N/A %	
13	**Comp RunHours**			
	1	#1 Total =######		
	2	#2 Total =######		
	3	#3 Total =######		
	4	#1 @ 25% =######		
	5	#1 @ 50% =######		
	6	#1 @ 75% =######		
	7	#1 @ 100% =######		
	8	#2 @ 25% =######		
	9	#2 @ 50% =######		
	10	#2 @ 75% =######		
	11	#2 @ 100% =######		
	12	#3 @ 25% =######		
	13	#3 @ 50% =######		
	14	#3 @ 75% =######		
	15	#3 @ 100% =######		
14	**Compr Starts**			
	1	#1 Total =######		
	2	#2 Total =######		
	3	#3 Total =######		
15	**Air temp**			
	1	Outdoor =###.#°F(°C)		

Table 33, Three Compressor Menu, Control Mode

Menu	Item	Display	Default	Range
16	**Control mode**			
	1	Manual Unit Off	Manual Unit Off	
		Automatic		
		Manual Staging	0	
		Service Testing		
	2	Manual Stage=##	0	0-12

Table 34, Three Compressor Menu, Set Points

Menu	Item	Display	Default	Range
17	**Lvg Evap Spts - (values for R-22 refrigerant)**			
	1	Actv Spt=###.#°F(°C)	44	Not Changeable
	2	Lvg Evap=###.#°F(°C)	44.0	10-80, .5
	3	CntrlBand=#.#°F(°C)	3.0	1-5, .2
	4	StartUpD-T=#.#°F(°C)	2.0	0-8, .5
	5	ShutDn D-T=#.#°F(°C)	0.5	0-1, .5
	6	MaxPullDn=#.#°F(°C)	2.0	.5-5, .1
	7	ResetOpt=None	None	None, Return, 4-20ma, Network, Ice, Outdoor
	8	ResetSig=##.#ma	0.0ma	
	9	MaxChWRst=##.#°F	10	0-45, .5
	10	ReturnSpt=##.#°F	54	15-80, .5
	11	No OaTRst=##.#°F	75	0-90, 1
	12	MaxOaTRst=##.#°F	60	0-90, 1
	13	HiChWTmp=##.#°F	70	20-90, .5
	14	Amb Lock=##.#°F	0	-10-60, 1
	15	AmbStage=##.#°F	60	30-80, 1
18	**SoftLoad Spts**			
	1	Time Left = ## min	0	0-254, 1
	2	SoftLoad = ## min.	20	0-254, 1
	3	SoftLdMaxStg = #	7	2-12
	4	LoadDelay = ## sec	15	0-254, 1
19	**CompressorSPT**			
	1	Lead/Lag = xxxx	Auto	Auto,(123)(132)(213)(231)(312)(321)
	2	InterStg=###sec	120	60-240, 10sec
	3	InterStgDiv= ##	1/5	1/ (2-10), x InterStg
	4	MinST-ST=###min	15	5-40, 1min
	5	MinSP-ST=###min	5	3-30, 1min
	6	MinLdTmr=###min	5	5-30, 1min
	7	PrePurSp=###sec	60	0-198, 1sec
20	**Head Pres Spt**			
	1	MinLift 25%=###	100	80-120, 1
	2	MinLift 50%=###	110	90-130, 1
	3	MinLift100%=###	140	110-160, 1
	4	DeadBandMult=#.#	1	8-1.3, .1
	5	StageUpErr=###	300	200-990, 10
	6	StageDnErr=###	80	50 - 300, 10
21	**Demand Limits**			
	1	Demand Lim=#stg	12stg	
	2	DemandSg=###.#ma	0.0ma	
	3	Man Demand=###stg	4	6-12
22	**Time / Date**			
	1	Time=##:##:##		
	2	Day of week ##/##/##		

Table 35, Three Compressor Menu, Schedule

Menu	Item	Display	Default	Range
23	**Schedule**			
	1	Override=##.##Hr		
	2	NMP Schedule=xx	N/A	N/A,1-32
	3	Day ##:##-##:##		
	4-9	Same as 3 above		
	10	Hol xxx ##:##-##:##		
24	**Holiday Date**			
	1	#1 Date= xxx #	N/A	Jan-Dec

	2	#1 Dur= ## Day(s)	0	0-31
	3-28	same as 1 and 2 above	Up to 14 Holidays Stored	

Table 36, Three Compressor Menu, Service Test

Menu	Item	Display	Default	Range
25	**Service Test**			
	1	#0 Output 0=Off	OFF	On-Off
	2	#1 Output 1=Off	OFF	On-Off
	3	#2 EXV Pos#1=###	0	0-760
	4	#3 EXV Pos#2=###	0	0-760
	5	#4 EXV Pos#3=###	0	0-760
	6	#5 Output 4=xxx	OFF	On-Off
	7	#6 Output 5=xxx	OFF	On-Off
	8	#7 Output 6=xxx	OFF	On-Off
	9	#8 Output 7=xxx	OFF	On-Off
	10	#9 Output 8=xxx	OFF	On-Off
	11	#10 Output 9=xxx	OFF	On-Off
	12	#11Output 10=xxx	OFF	On-Off
	13	#12Output 11=xxx	OFF	On-Off
	14	#13Output 12=xxx	OFF	On-Off
	15	#14Output 13=xxx	OFF	On-Off
	16	#15Output 14=xxx	OFF	On-Off
	17	#16Output 15=xxx	OFF	On-Off
	18	#17Output 16=xxx	OFF	On-Off
	19	#18Output 17=xxx	OFF	On-Off
	20	#19Output 18=xxx	OFF	On-Off
	21	#20Output 19=xxx	OFF	On-Off
	22	#21Output 20=xxx	OFF	On-Off
	23	#22Output 21=xxx	OFF	On-Off
	24	#23Output 22=xxx	OFF	On-Off
	25	#24Output 23=xxx	OFF	On-Off
	26	#25Output 24=xxx	OFF	On-Off
	27	#26Output 25=xxx	OFF	On-Off
	28	#27Output 26=xxx	OFF	On-Off
	29	#28Output 27=xxx	OFF	On-Off
	30	#29 DH1=########	10110110	
	31	#30 DH2=########	10110110	
	32	#31 DH3=########	10110110	
	33	#32 AI#5=#.## Vdc	4.55	
26	**Alarm Spts**			
	1	StpPumpDn=###psi	34	10-54, 2
	2	FullPumpDown=xx	No	No/Yes
	3	FreezStat= ##psi	54	20-60, 2
	4	FreezH2O=##.#°F	36	N/A 0.5-40, .5
	5	Hi Pres =##psi	380	280-426, 2
	6	LowSubcool=#.#°F	5°F	0-8°F, .1
27	**Misc Setup**			
	1	Unit Type=ALS###	ALS205	ALS205, 220, 235, 250, 265, 280
	2	Units = xxxxxxx	English	English/Metric
	3	SpeedTrol = xx	No	Yes/no
	4	Power =##Hz	60	50/60
	5	Port A Baud=####	9600	1200,2400,9600,ukwn
	6	Pre-Alarm=xxxxxx	Blink	Blink,open,closed
	7	Alarm=xxxxxx	Closed	Closed,open,blink(N/O),blink(N/C)
	8	OAT Select=xxx	Lcl	None,lcl,rmt
	9	Amb Lockout=xx	No	Yes, No
	10	Low Amb Opr=xx	Yes	Yes, No
	11	LvgEvpAdj=##.#°F	0	-.8 - .8, .1
	12	EntEvpAdj=##.#°F	0	-.8 - .8, .1
	13	#1EvpAdj=##.#psi	0	-4 - +4, .1
	14	#2EvpAdj=##.#psi	0	-4 - +4, .1
	15	#3EvpAdj=##.#psi	0	-4 - +4, .1
	16	#1CndAdj=##.#psi	0	-10 - +15, .1
	17	#2CndAdj=##.#psi	0	-10 - +15, .1
	18	#3CndAdj=##.#psi	0	-10 - +15, .1
	19	Refrigerant=R22	R22	Must download correct code to change
	20	IDENT=SC22x20#		

	21	Rel. Date	MM/DD/YY	

Table 37, Three Compressor Menu, Alarms

Menu	Item	Display	Default	Range
28	**#1 Curr Alarm**			
	1	None		
		HiPresStageHld		
		HiPresStageDwn		
		FreezeStageDwn		
		LossofChWFlow		
		Can'tPumpDown		
		NoStart-LoEvap		
		FailedPrePurge		
		FailLowAmbient		
		FreezeStatProt		
		HighLiqPressDrop		
		Motor Protect		
		Repower a/loss		
		NoEvapPresDrop		
		Below Min Lift		
		No Liquid Run		
		No Liquid Start		
		Hi Dschrg Temp		
		Hi Cond Press		
		Mech Hi Press		
		BadSuctTempSen		
		BadEvapPresSen		
		BadCondPresSen		
		BadPhase/Volts		
		LvgWaterFreeze		
		No 5 Vdc @AI#5		
		BadLvgWaterSen		
		LowSubcoolTemp		
	2	(@ hr:mn mm/dd/yy)		
	3	Evap = ##.#psi		
		145+psi		
		Openpsi		
		Shortpsi		
	4	Cond = ###.#psi		
		450+psi		
		Openpsi		
		Shortpsi		
	5	Suctline=###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	6	LiquidLn=###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	7	Subcool = #.#°F		
	8	Evap Lvg=###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	9	Evap Ent= ###.#°F		
	10	OutsideA= ###.#°F		
		n/a °F		
		Open °F		
		Short °F		

	11	Capacity = ###%		
	12	Fan Stage=#		
	13	ExpV Pos = ###		
29	**#2 Curr Alarm**			
	1	Same as #1Curr above		

Table Continued on Next Page

Table 37, Three Compressor Menu, Alarms (Continued)

Menu	Item	Display	Default	Range
30	**#3 Curr Alarm**			
	1	Same as #1Curr above		
31	**#1Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		
32	**#2Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		
33	**#3Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		

Menus for Four (4) Screw Compressor Units

Table 38, Four Compressor Menu, Test Software

Menu	Item	Display	Default	Range
1	**Test Software**			
	1	Off: Manual Mode		
		Off: System Sw		
		Off: Remote Comm		
		Off: Remote Sw		
		Off: Time Clock		
		Off: Alarm		
		Off: PumpDnSw's		
		Off: AmbientLck		
		Starting		
		Waiting for Flow		
		Waiting for Load		
		CoolStageUp		
		CoolStageDn		
		Cool Staging #		
		ManualCool		
	2	InterStg=###sec		
	3	Hold stage = ##min		
	4	Hi Loop Temp= ###		

Table 39, Four Compressor Menu, Status

Menu	Item	Display	Default	Range
2	**Circ #1 Status**			
	1	Off: SystemSw		
		Off: ManualMde		
		Off: Alarm		
		Off: PumpDwnSw		
		Off: CycleTime ###		
		WaitFlooded		
		OFF: Ready		
		Starting….		
		Pre-Purge….		
		Opened EXV….		
		LowAmbStart		
		Cooling %Cap=###		
		Pumping Down		
3	**Circ #2 Status**			
	1	Same as Cir#1 above		
4	**Circ #3 Status**			
	1	Same as Cir#2 above		
5	**Circ #4 Status**			
	1	Same as Cir#3 above		
6	**Water Temp's**			
	1	Lvg Evap=###.#°F(°C)		
	2	Ent Evap=###.#°F(°C)		
7	**Circ#1 Pres's**			
	1	Evp###.#psi(kPa) ##°F(°C)		
	2	Cnd###.#psi(kPa) ##°F(°C)		
	3	MinCondPr=####		
	4	MaxCondPr=####		
	5	EXV Position=###		
	6	Cond Fan Stage=#		
8	**Circ#2 Pres's**			
	1	Same as above		

9	**Circ#3 Pres's**			
	1	Same as above		
10	**Circ#4 Pres's**			
	1	Same as above		

Table 39, Four Compressor Menu, Status (Continued)

Menu	Item	Display	Default	Range
11	**Circ#1 Temp's**			
	1	Satur Evap=###°F(°C)		
	2	SuctLine=###.#°F(°C)		
	3	Super Ht=###.#°F(°C)		
	4	Satur Cond=###°F(°C)		
	5	LiquidLn=###.#°F(°C)		
	6	SubCoolg=###.#°F(°C)		
12	**Circ#2 Temp's**			
	1	Same as above		
13	**Circ#3 Temp's**			
	1	Same as above		
14	**Circ#4 Temp's**			
	1	Same as above		
15	**Chiller amps**			
	1	#1+3 PctRLA= ###%	N/A %	
	2	#2+4 PctRLA= ###%	N/A %	
16	**Comp RunHours**			
	1	#1 Total =######		
	2	#2 Total =######		
	3	#3 Total =######		
	4	#4 Total =######		
	5	#1 @ 25% =######		
	6	#1 @ 50% =######		
	7	#1 @ 75% =######		
	8	#1 @ 100% =######		
	9	#2 @ 25% =######		
	10	#2 @ 50% =######		
	11	#2 @ 75% =######		
	12	#2 @ 100% =######		
	13	#3 @ 25% =######		
	14	#3 @ 50% =######		
	15	#3 @ 75% =######		
	16	#3 @ 100% =######		
	17	#4 @ 25% =######		
	18	#4 @ 50% =######		
	19	#4 @ 75% =######		
	20	#4 @ 100% =######		
17	**Compr Starts**			
	1	#1 Total =######		
	2	#2 Total =######		
	3	#3 Total =######		
	4	#4 Total =######		
18	**Air temp**			
	1	Outdoor =###.#°F(°C)		

Table 40, Four Compressor Menu, Control Mode

Menu	Item	Display	Default	Range
19	**Control Mode**			
	1	Manual Unit Off	Manual Unit Off	
		Automatic		
		Manual Staging	0	
		Service Testing		
	2	Manual Stage=##	0	0-16
	3	Circ 1 Mode=xxxx	Auto	Auto, Off
	4	Circ 2 Mode=xxxx	Auto	Auto, Off
	5	Circ 3 Mode=xxxx	Auto	Auto, Off

	6	Circ 4 Mode=xxxx	Auto	Auto, Off

Table 41, Four Compressor Menu, Set Points

Menu	Item	Display	Default	Range
20	**Lvg Evap Spts - (values for R-22 refrigerant)**			
	1	Actv Spt=###.#°F(°C)	44	Not Changeable
	2	Lvg Evap=###.#°F(°C)	44.0	10-80, .5
	3	CntrlBand=#.#°F(°C)	3.0	1.4-5, .2
	4	StartUpD-T=#.#°F(°C)	2.0	0-8, .5
	5	ShutDn D-T=#.#°F(°C)	0.5	0-1, .5
	6	MaxPullDn=#.#°F(°C)	2.0	.5-5, .1
	7	ResetOpt=None	None	None, Return, 4-20ma, Network, Ice, Outdoor
	8	ResetSig=##.#ma	0.0ma	
	9	MaxChWRst=##.#°F	10	0-45, .5
	10	ReturnSpt=##.#°F	54	15-80, .5
	11	OaTBegRst=##.#°F	75	0-90, 1
	12	OaTMaxRst=##.#°F	60	0-90, 1
	13	HiChWTmp=##.#°F	70	20-90, .5
	14	Amb Lock=##.#°F	0	-10-60, 1
	15	AmbStage=##.#°F	60	30-80, 1
21	**SoftLoad Spts**			
	1	Time Left = ## min	0	0-254, 1
	2	SoftLoad = ## min.	20	0-254, 1
	3	SoftLdMaxStg = #	12	1-16
	4	LoadDelay = ## sec	15	0-254, 1
22	**CompressorSPT**			
	1	Lead = xxxx	Auto	Auto,(1234)(1324)(2143)(2413)(3412)(3142)(4321)(4231)
	2	InterStg=###sec	120	60-480, 10sec
	3	InterStgDiv= ##	1/5	1/ (2-10), x InterStg
	4	MinST-ST=###min	15	5-40, 1min
	5	MinSP-ST=###min	5	3-30, 1min
	6	PrePurSp=###sec	60	0-198, 2sec
23	**Head Pres Spt**			
	1	MinLift 25%=###	100	80-120, 1
	2	MinLift 50%=###	110	90-130, 1
	3	MinLift100%=###	140	110-160, 1
	4	DeadBandMult=#.#	1	.8-1.3, .1
	5	StageUpErr=###	300	200-990, 10
	6	StageDnErr=###	80	50 - 300, 10
24	**Demand Limits**			
	1	Demand Lim=#stg	16stg	
	2	DemandSg=###.#ma	0.0ma	
	3	Man Demand=###stg	16	8-16
25	**Time / Date**			
	1	Time=##:##:##		
	2	Day of week ##/##/##		

Table 42, Four Compressor Menu, Schedule

Menu	Item	Display	Default	Range
26	**Schedule**			
	1	Override=##.##Hr		
	2	NMP Schedule=xx	N/A	N/A,1-32
	3	Day ##:##-##:##		
	4-9	Same as 3 above		
	10	Hol xxx ##:##-##:##		
27	**Holiday Date**			

	1	#1 Date= xxx #	N/A	Jan-Dec
	2	#1 Dur= ## Day(s)	0	0-31
	3-28	same as 1 and 2 above	Up to 14 Holidays Stored	

Table 43, Four Compressor Menu, Service Test

Menu	Item	Display	Default	Range
28	**Service Test**			
	1	#0 Output 0=Off	OFF	On-Off
	2	#1 Output 1=Off	OFF	On-Off
	3	#2 EXV Pos#1=###	0	0-760
	4	#3 EXV Pos#2=###	0	0-760
	5	#4 EXV Pos#3=###	0	0-760
	6	#5 EXV Pos#4=###		
	7	#6 Output 4=xxx	OFF	On-Off
	8	#7 Output 5=xxx	OFF	On-Off
	9	#8 Output 6=xxx	OFF	On-Off
	10	#9 Output 7=xxx	OFF	On-Off
	11	#10 Output 8=xxx	OFF	On-Off
	12	#11 Output 9=xxx	OFF	On-Off
	13	#12Output 10=xxx	OFF	On-Off
	14	#13Output 11=xxx	OFF	On-Off
	15	#14Output 12=xxx	OFF	On-Off
	16	#15Output 13=xxx	OFF	On-Off
	17	#16Output 14=xxx	OFF	On-Off
	18	#17Output 15=xxx	OFF	On-Off
	19	#18Output 16=xxx	OFF	On-Off
	20	#19Output 17=xxx	OFF	On-Off
	21	#20Output 18=xxx	OFF	On-Off
	22	#21Output 19=xxx	OFF	On-Off
	23	#22Output 20=xxx	OFF	On-Off
	24	#23Output 21=xxx	OFF	On-Off
	25	#24Output 22=xxx	OFF	On-Off
	26	#25Output 23=xxx	OFF	On-Off
	27	#26Output 24=xxx	OFF	On-Off
	28	#27Output 25=xxx	OFF	On-Off
	29	#28Output 26=xxx	OFF	On-Off
	30	#29Output 27=xxx	OFF	On-Off
	31	#30Output 28=xxx		
	32	#31Output 29=xxx		
	33	#32Output 31=xxx		
	34	#33Output 32=xxx		
	35	#34Output 33=xxx		
	36	#35Output 34=xxx		
	37	#36Output 35=xxx		
	38	#37Output 36=xxx		
	39	#38Output 37=xxx		
	40	#39Output 38=xxx		
	41	#40 DH1=########	10110111	
	42	#41 DH2=########	10110110	
	43	#42 DH3=########	10110100	
	44	#43 DH4=########	10110100	
	45	#44 AI#5=#.## Vdc	4.55	
29	**Alarm Spts**			
	1	StpPumpDn=###psi	34	10-54, 2
	2	FullPumpDown=xx	No	No/Yes
	3	FreezStat= ##psi	54	20-60, 2
	4	FreezH2O=##.#°F	36	N/A 0.5-40, .5
	5	Hi Pres =##psi	380	280-426, 2
	6	LowSubcool=#.#°F	5°F	0-8°F, .1

Table Continued on Next Page

Table 43, Four Compressor Menu, Service Test (Continued)

Menu	Item	Display	Default	Range
30	**Misc Setup**			
	1	Unit Type=ALS###	ALS300	ALS315, 330, 340, 360, 370, 380, 425
	2	Units = xxxxxxx	English	English/Metric
	3	SpeedTrol = xx	No	Yes/No
	4	Power =##Hz	60	50/60
	5	Port A Baud=####	9600	1200,2400,9600,ukwn
	6	Pre-Alarm=xxxxxx	Blink	Blink,open,closed
	7	Alarm=xxxxxx	Closed	Closed,open,blink(N/O),blink(N/C)
	8	OAT Select=xxx	Lcl	None,lcl,rmt
	9	Amb Lockout=xx	No	Yes, No
	10	Low Amb Opr=xx	Yes	Yes, No
	11	LvgEvpAdj=##.#°F	0	-.8 - .8, .1
	12	EntEvpAdj=##.#°F	0	-.8 - .8, .1
	13	#1EvpAdj=##.#psi	0	-4 - +4, .1
	14	#2EvpAdj=##.#psi	0	-4 - +4, .1
	15	#3EvpAdj=##.#psi	0	-4 - +4, .1
	16	#4EvpAdj=##.#psi	0	-4 - +4, .1
	17	#1CndAdj=##.#psi	0	-10 - +15, .1
	18	#2CndAdj=##.#psi	0	-10 - +15, .1
	19	#3CndAdj=##.#psi	0	-10 - +15, .1
	20	#4CndAdj=##.#psi	0	-10 - +15, .1
	21	Refrigerant=R22	R22	Must download correct code to change
	22	IDENT=SC42x20x		
	23	REL. 00/00/00		

Table 44, Four Compressor Menu, Alarms

Menu	Item	Display	Default	Range
31	**#1 Curr Alarm**			
	1	None		
		HiPresStageHld		
		HiPresStageDwn		
		FreezeStageDwn		
		LossofChWFlow		
		Can'tPumpDown		
		NoStart-LoEvap		
		FailedPrePurge		
		FailLowAmbient		
		FreezeStatProt		
		HighLiqPressDrop		
		Motor Protect		
		Repower a/loss		
		NoEvapPresDrop		
		Below Min Lift		
		No Liquid Run		
		No Liquid Start		
		Hi Dschrg Temp		
		Hi Cond Press		
		Mech Hi Press		
		BadSuctTempSen		
		BadEvapPresSen		
		BadCondPresSen		
		BadPhase/Volts		
		LvgWaterFreeze		
		No 5 Vdc @AI#5		
		BadLvgWaterSen		
		LowSubCoolTemp		
	2	(@ hr:mn mm/dd/yy)		

Table Continued on Next Page

Table 44, Four Compressor Menu, Alarms (Continued)

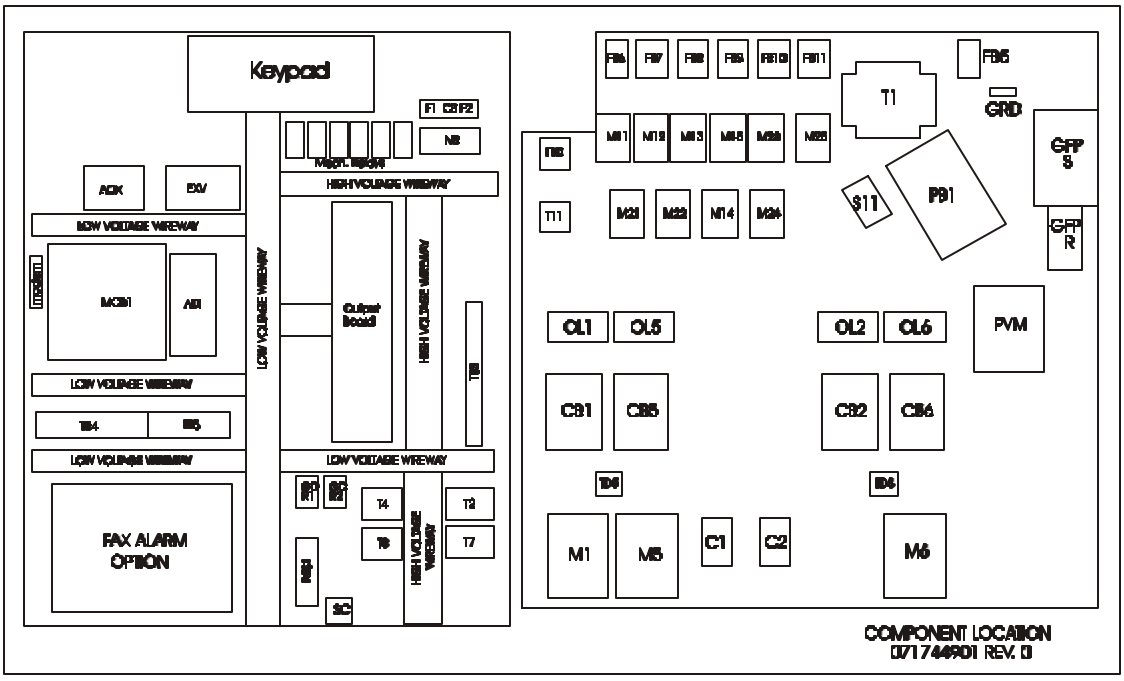
Menu	Item	Display	Default	Range
31	3	Evap = ##.#psi		
		145+psi		
		Openpsi		
		Shortpsi		
	4	Cond = ###.#psi		
		450+psi		
		Openpsi		
		Shortpsi		
	5	Suctline=###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	6	LiquidLn=###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	7	Subcool = #.#°F		
	8	Evap Lvg=###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	9	Evap Ent= ###.#°F		
	10	OutsideA= ###.#°F		
		n/a °F		
		Open °F		
		Short °F		
	11	Capacity = ###%		
	12	Fan Stage=#		
	13	ExpV Pos = ###		
32	**#2 Curr Alarm**			
	1	Same as #1 Curr above		
33	**#3 Curr Alarm**			
	1	Same as #1 Curr above		
34	**#4 Curr Alarm**			
	1	Same as #1 Curr above		
35	**#1Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		
36	**#2Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		
37	**#3Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		
38	**#4Prev Alarms**			
	1	1-Alarm Title(menu22)	5 Alarms Stored in Buffer	
	2	1-hr:mn mm/dd/yy		

Schematics and Drawings

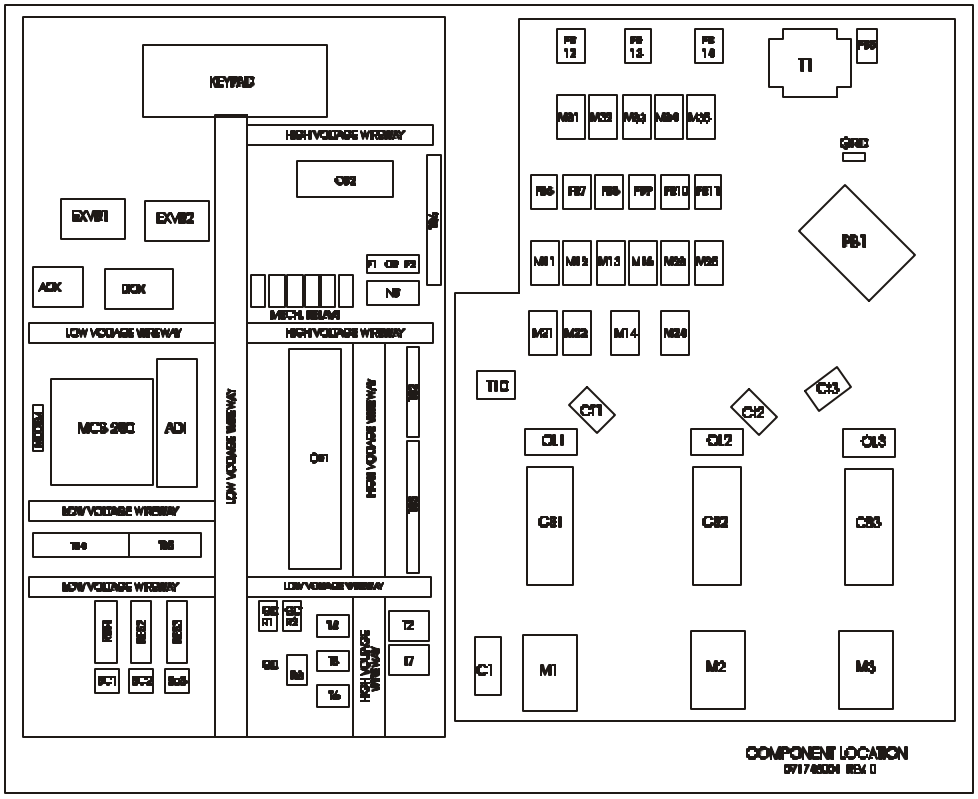
Table 45, ALS Schematics & Diagrams

Unit	Control Cabinet Layout	Wiring Legend	Unit Control	Stage Output	MicroTech Schematic	Field Wiring
ALS 070A-100A	073176801	704352C-01	074558501	074558601	074558401	719740C-01
ALS 125A-204A	717449-01	704352C-01	716995D-01	716996D-01	716997D-01	719740C-01
ALS 205A-280A	717460-01	704352C-01	718507D-01	718508D-01	718509D-01	719740C-01
ALS 300A-425A	719869-01	704352C-01	718640D-01	718641D-01	718642D-01	719740C-01

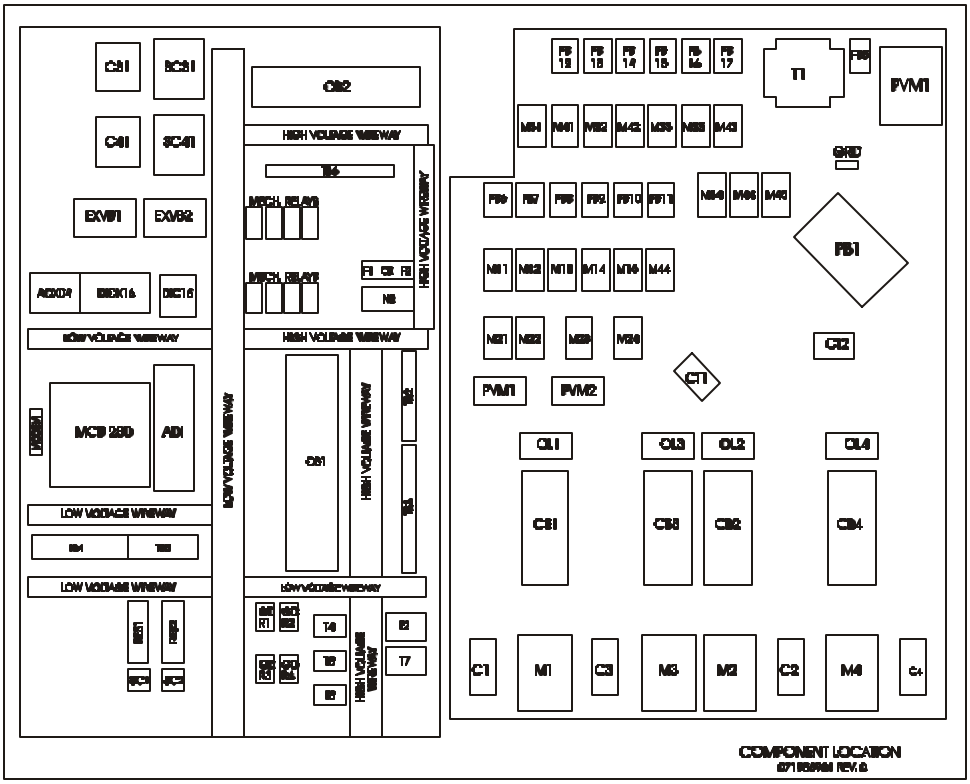
Control Cabinet Layout - ALS 125A-204A



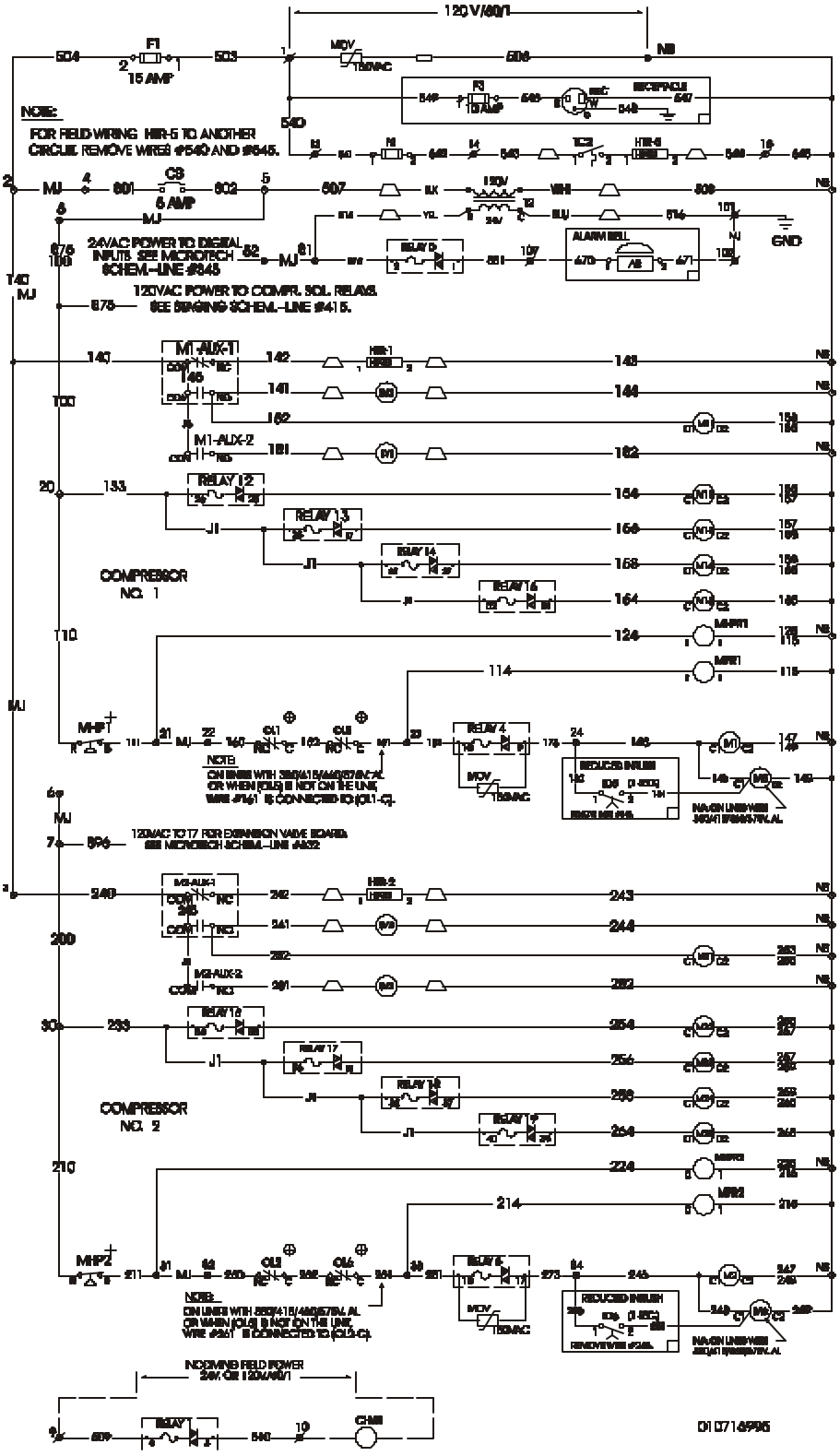
Control Cabinet Layout - ALS 205A-280A



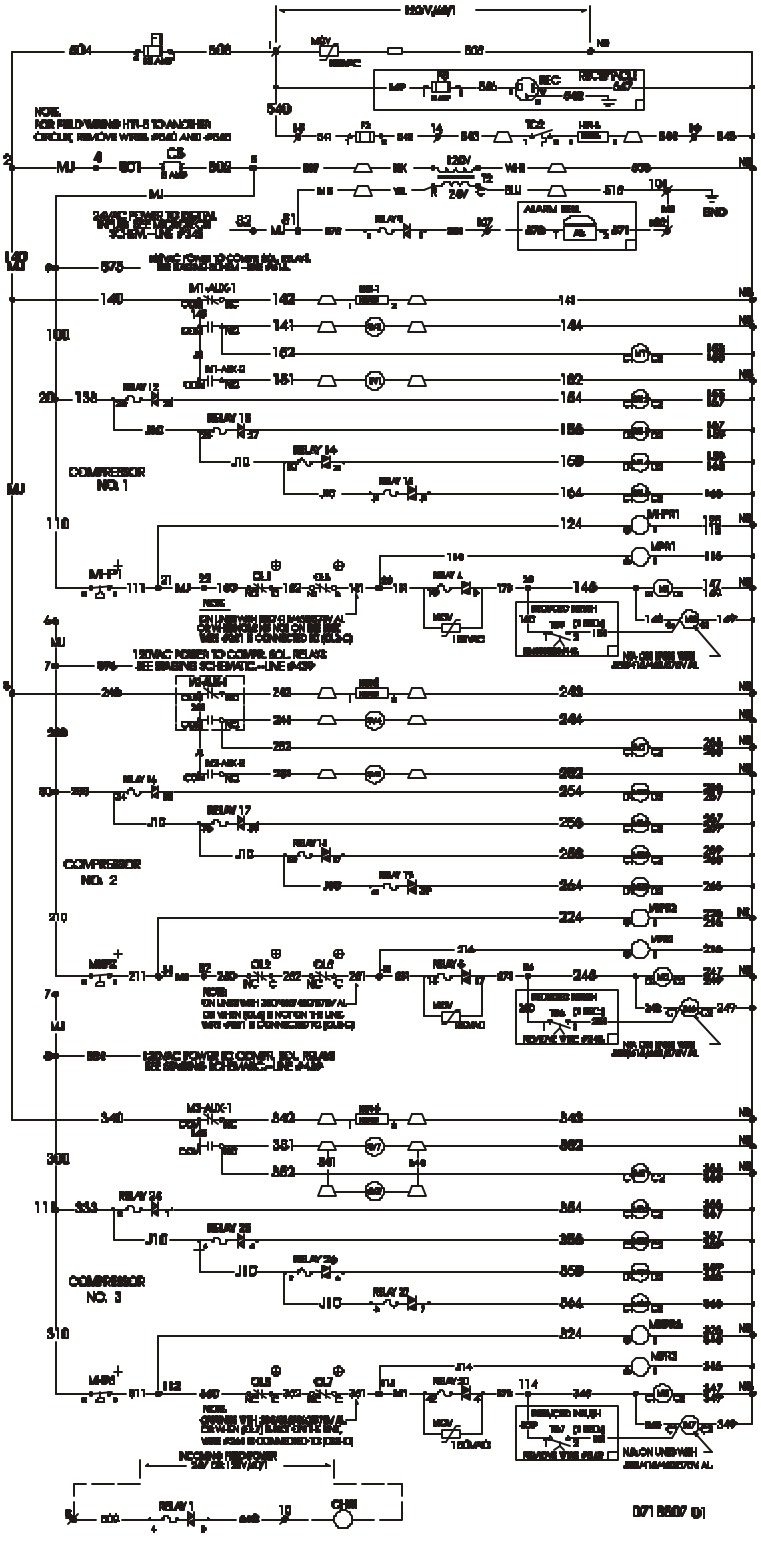
Control Cabinet Layout - ALS 300A-425A



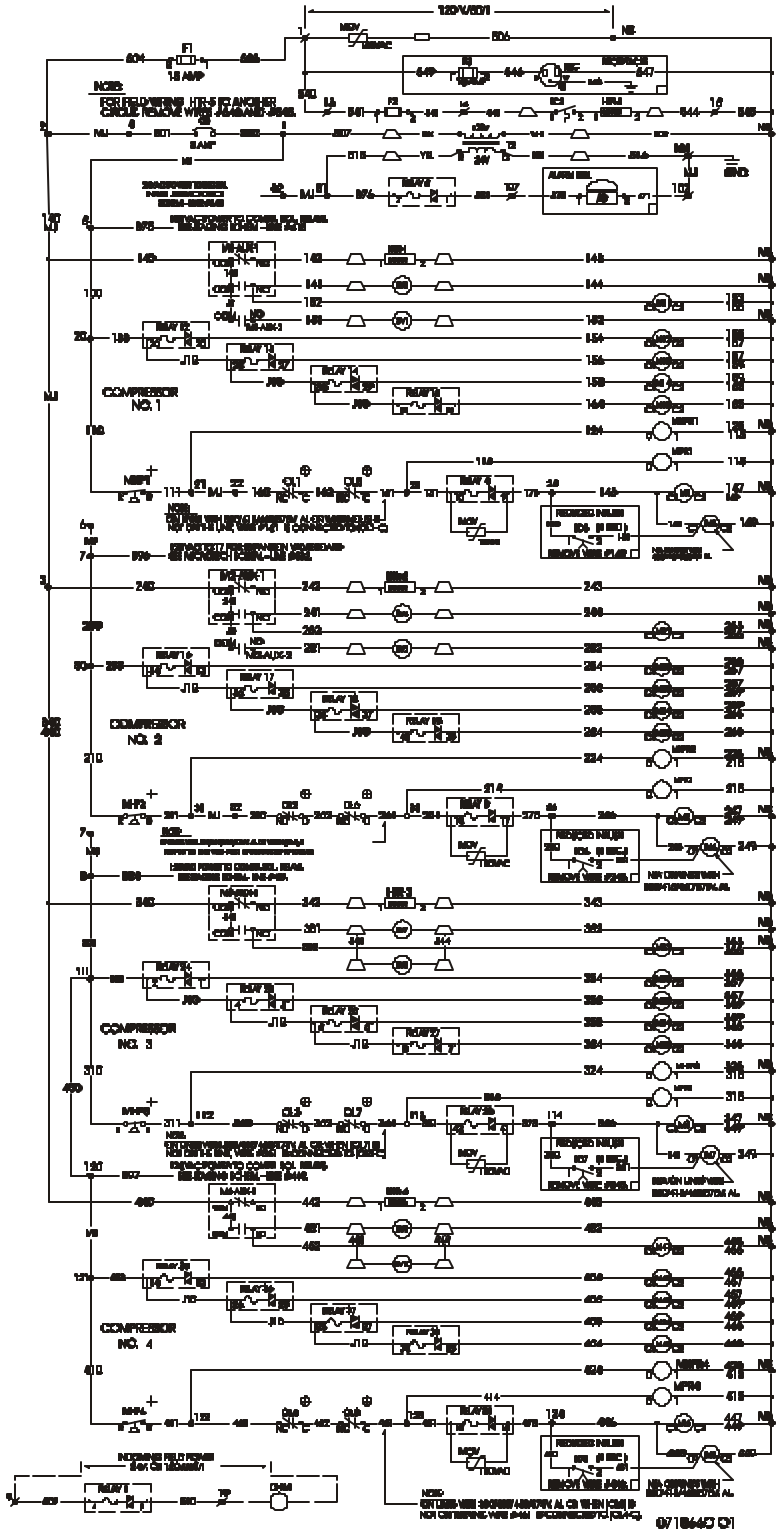
ALS 125A - 204A Unit Control



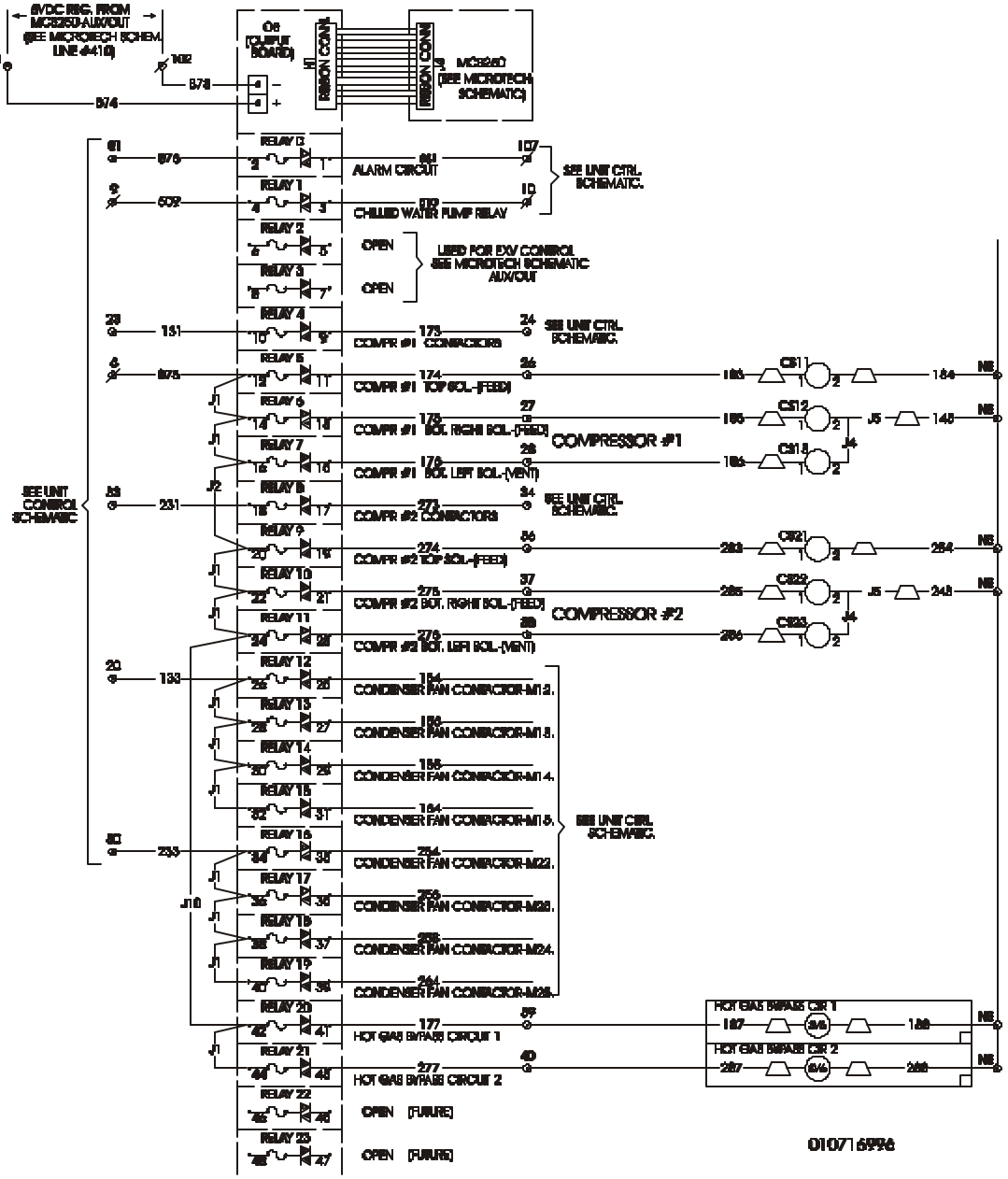
ALS 205A - 208A Unit Control



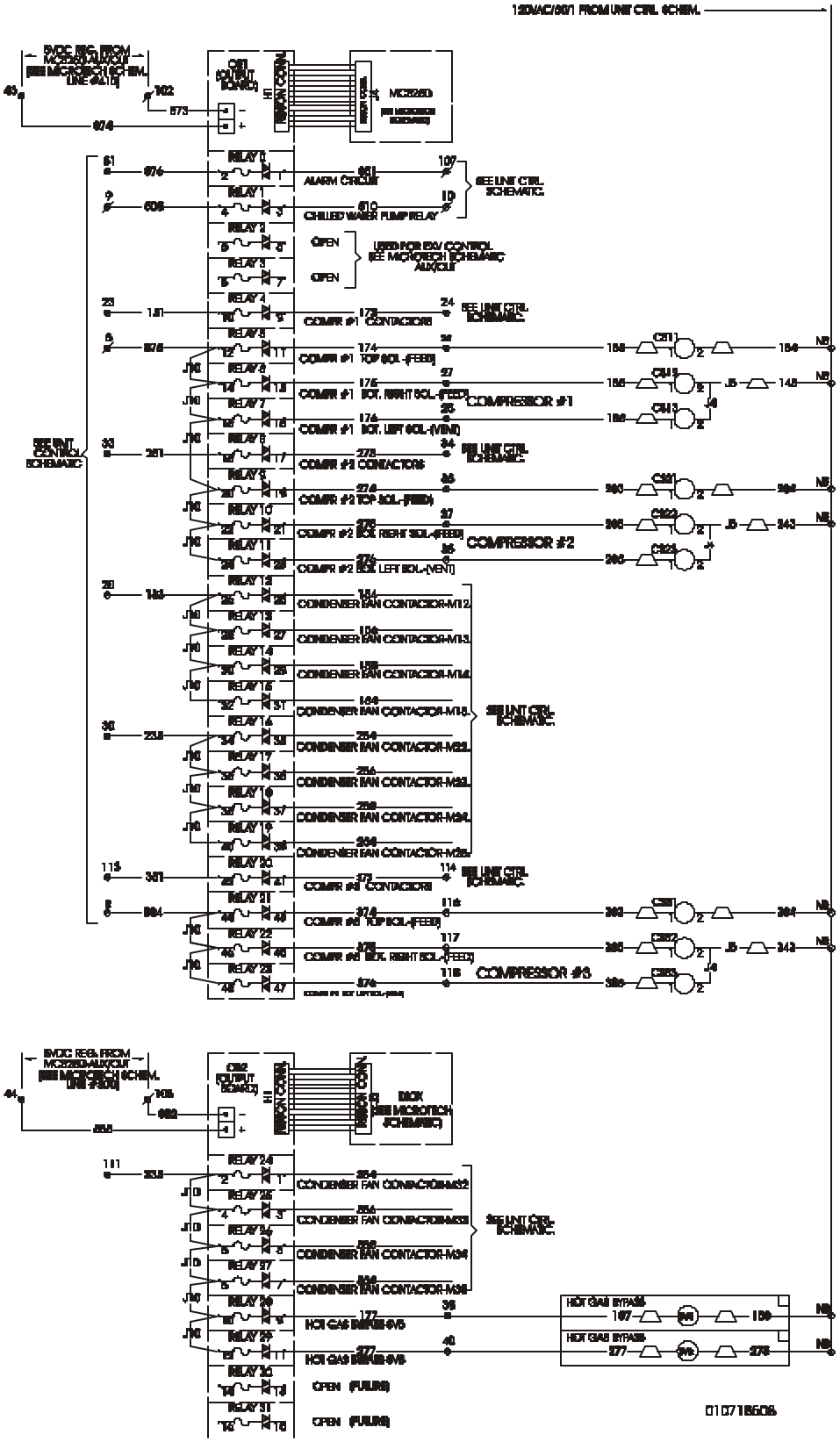
ALS 300A - 425A Unit Control



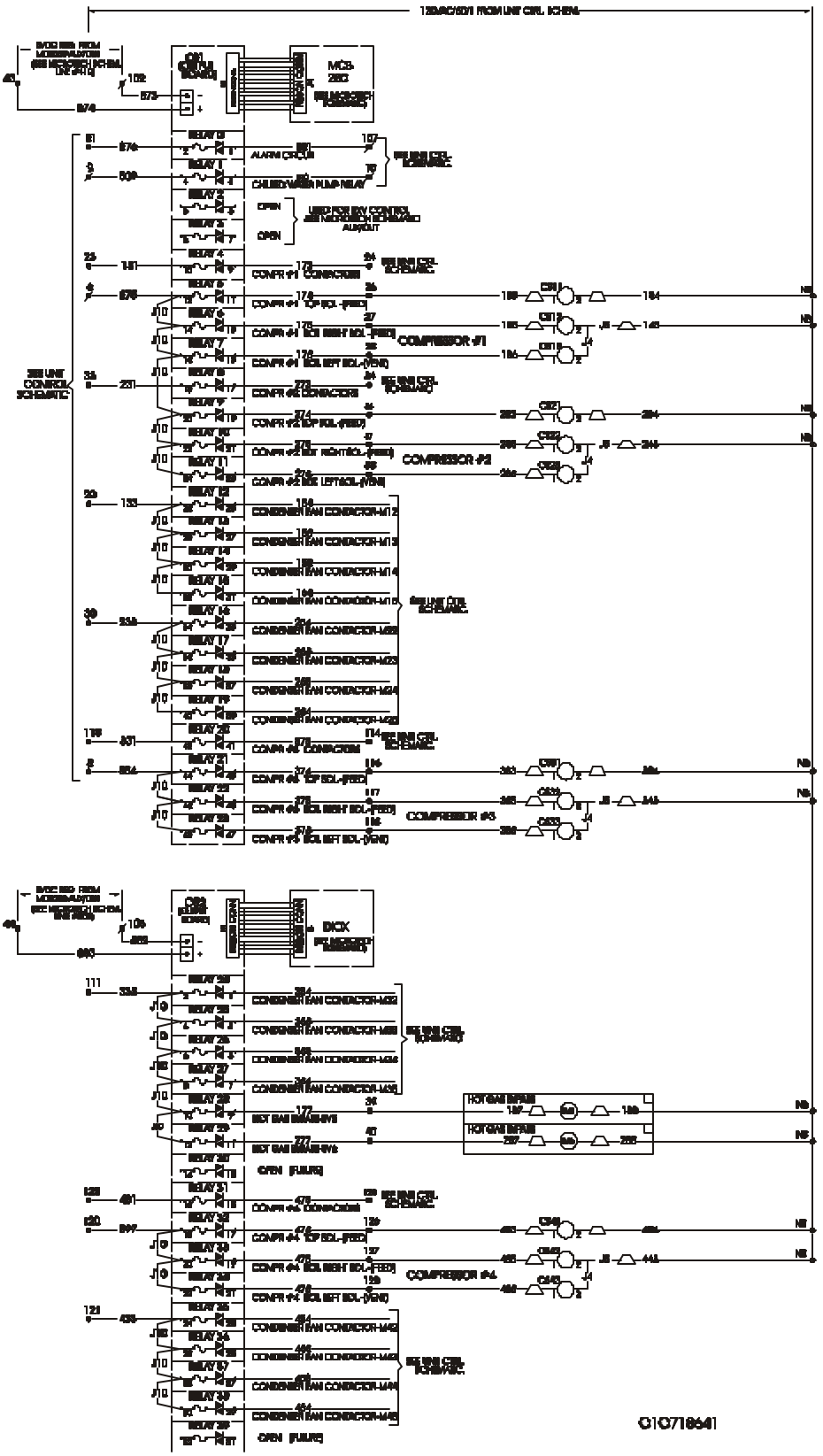
ALS 125A - 204A Staging Output Schematic



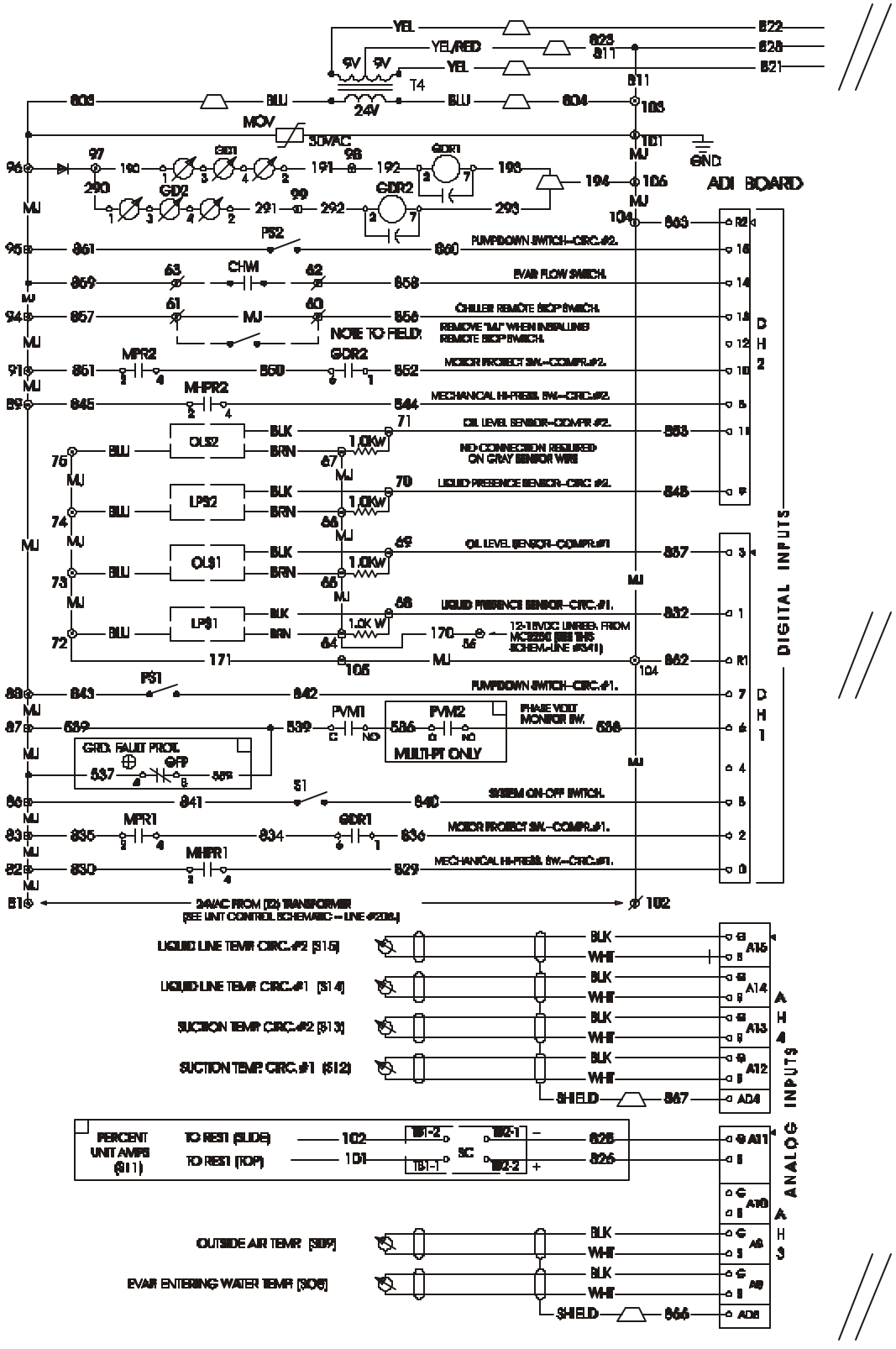
ALS 205A - 280A Staging Output Schematic



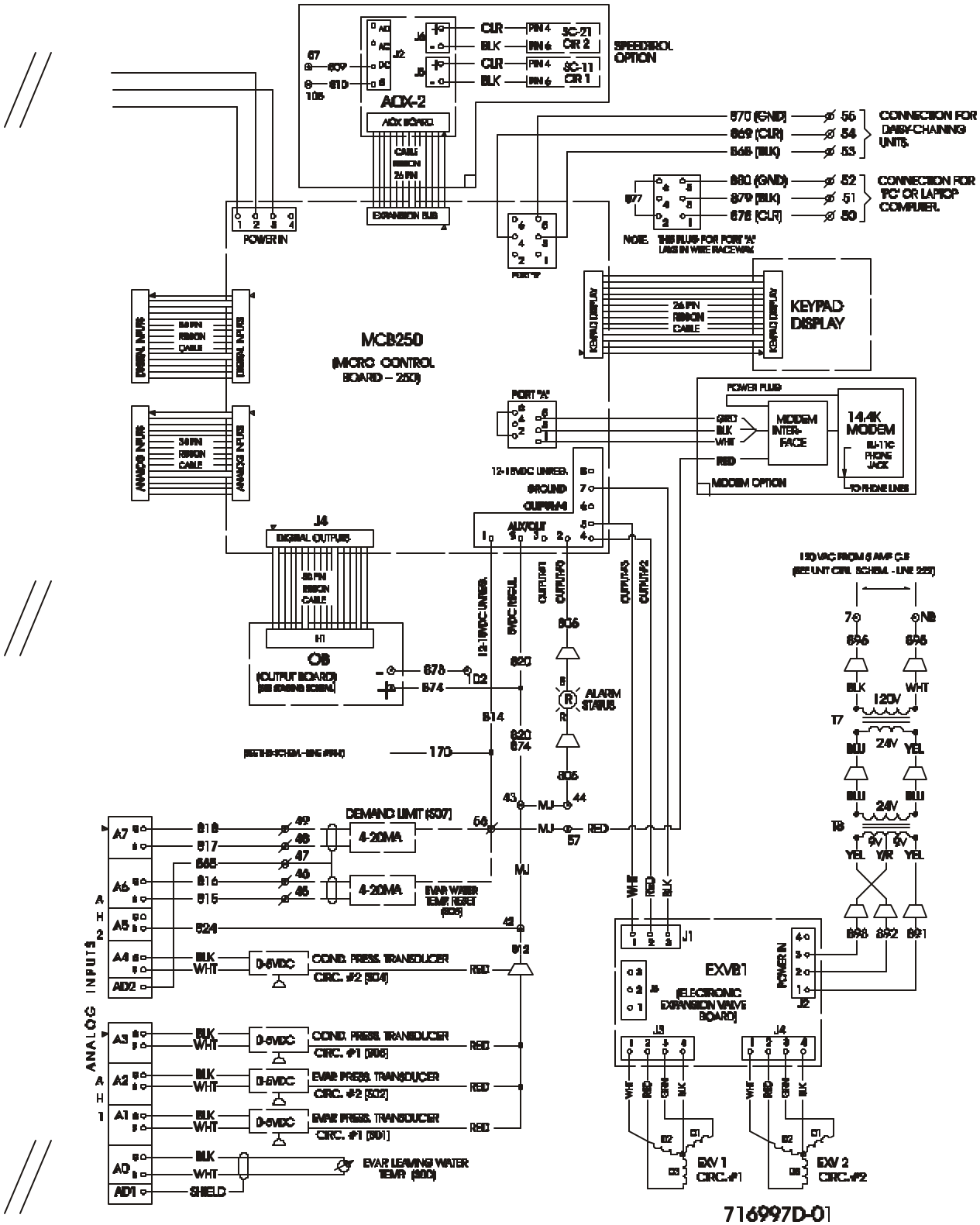
ALS 300A - 425A Staging Output Schematic



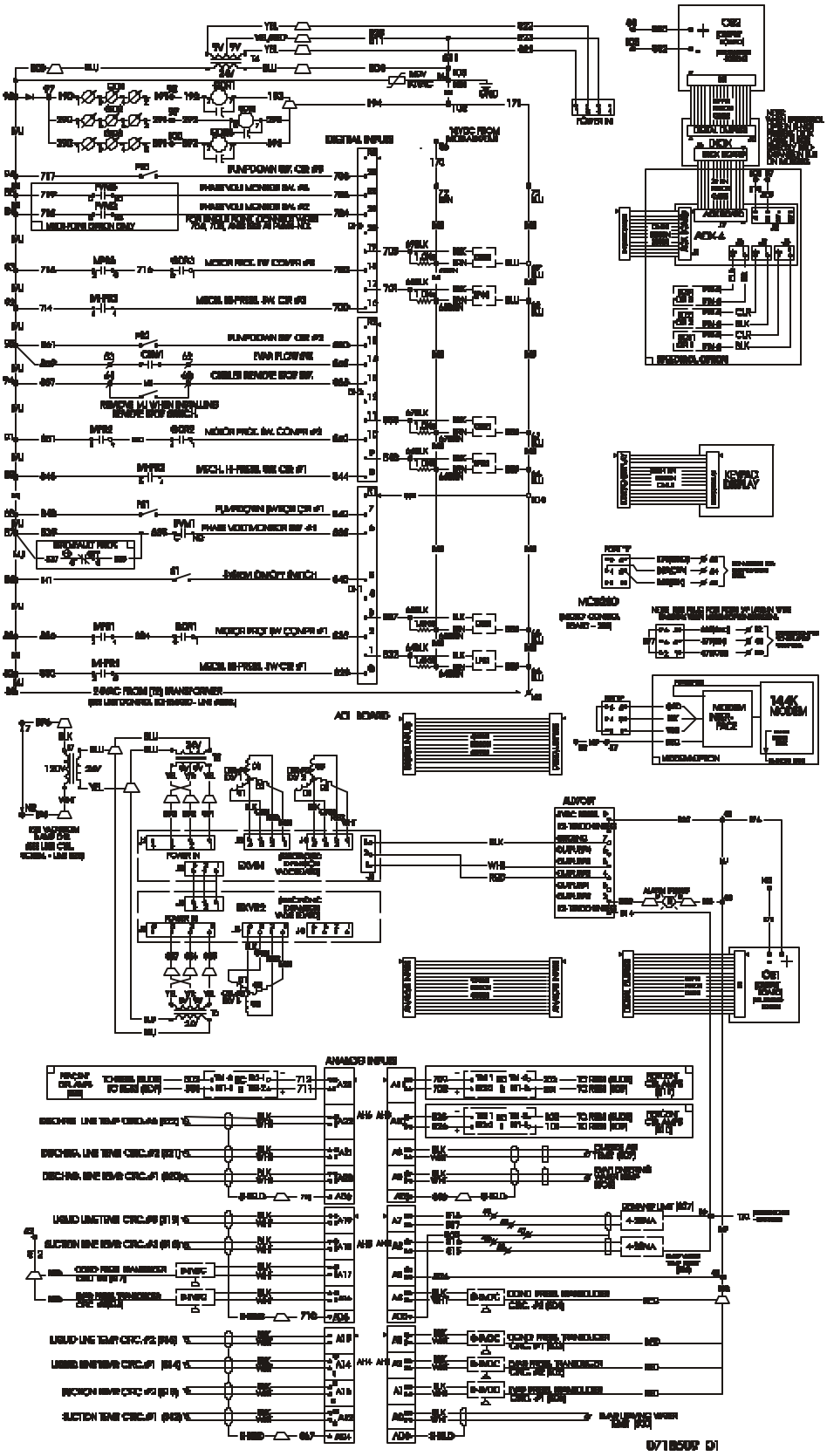
ALS 125A - 204A MicroTech Schematic



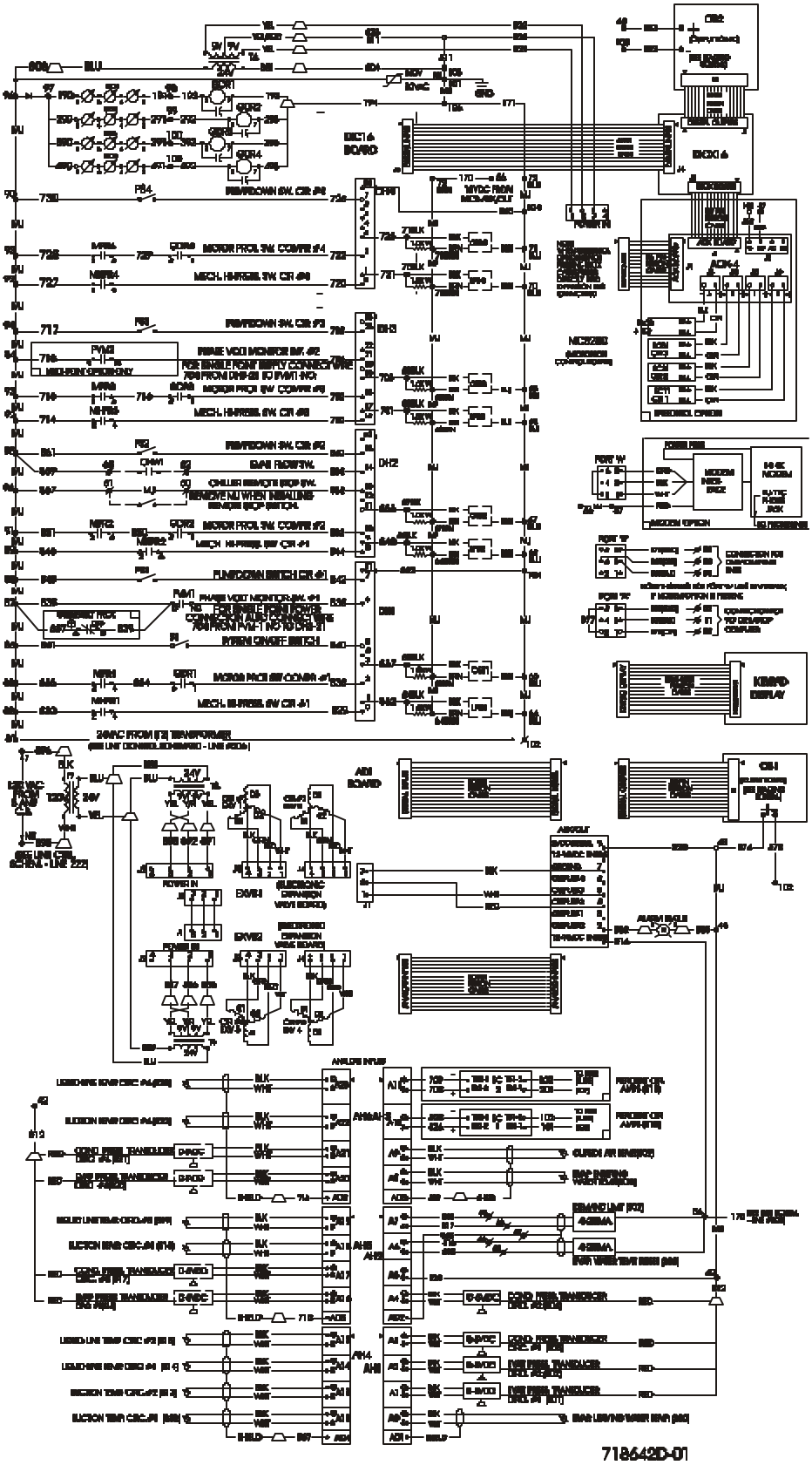
ALS 125A - 204A MicroTech Schematic, continued



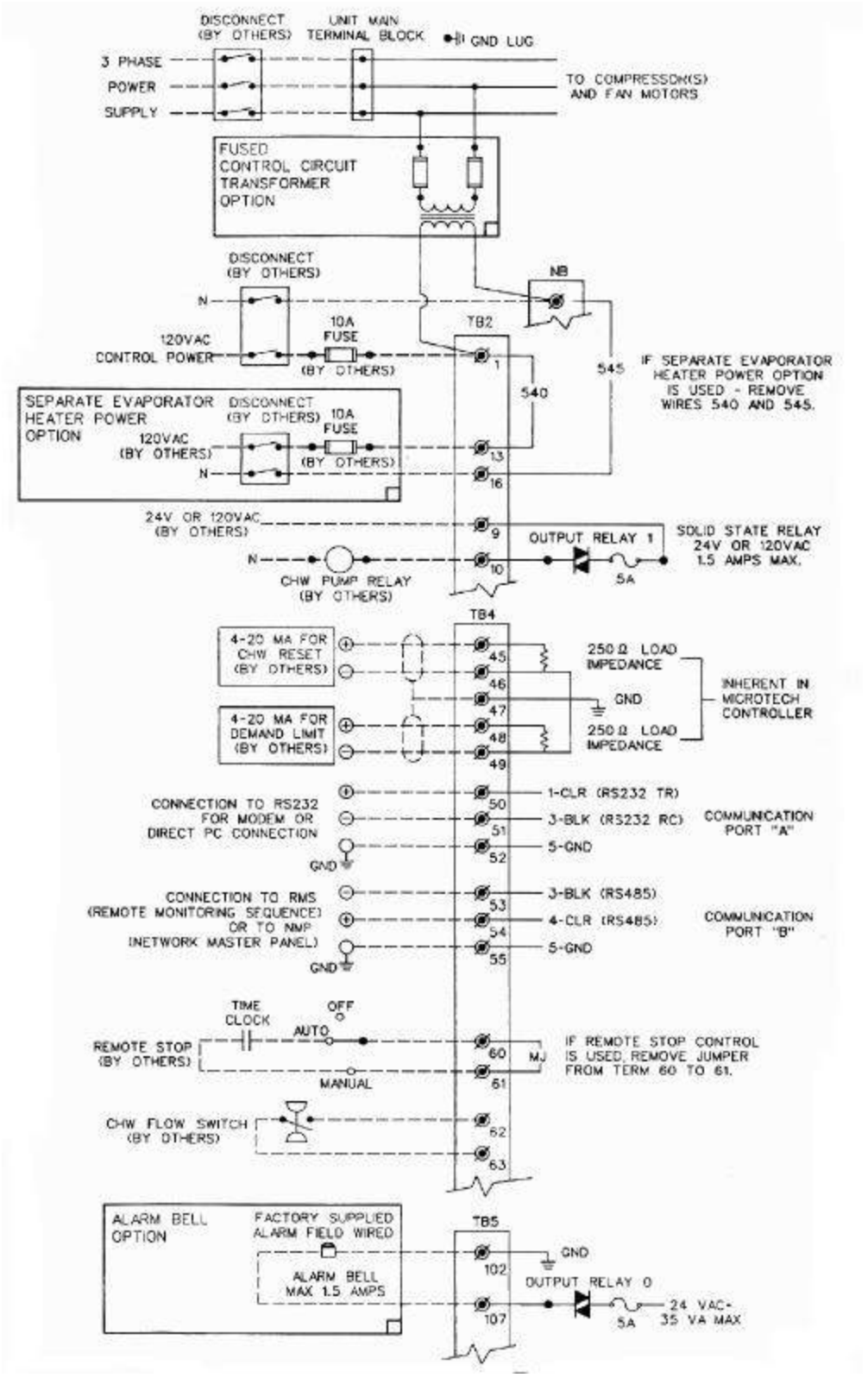
ALS 205A - 280A MicroTech Schematic



ALS 300A - 425A MicroTech Schematic



ALS Field Wiring - 0719740C-01



Wiring Legend

AB	ALARM BELL	BACK OR SIDE OF CTRL BOX
RESI,RES2	RESISTOR, CURRENT TRANSFORMER	CTRL BOX, POWER PANEL
ADI	ANALOG DIGITAL INPUT BOARD	CTRL BOX, CTRL PANEL
CI-C3	SURGE CAPACITOR, COMPRESSOR	CTRL BOX, POWER PANEL
CII,C2I	CAPACITOR, SPEEDTROL	INSIDE SPEEDTROL BOX
CBI-CB6	CIRCUIT BREAKER (POWER)	CTRL BOX, POWER PANEL
CB9	CIRCUIT BREAKER (MICROTECH)	CTRL BOX, CTRL PANEL
CBIO	CIRCUIT BREAKER (FAX ALARM)	CTRL BOX, CTRL PANEL
CHWI	CHILLED WATER INTERLOCK	FIELD INSTALLED
COMPR I-3	COMPRESSORSI-3	ON BASE RAIL
CS8-CS33	COMPRESSOR SOLENOID	ON COMPRESSOR
CTI,CT2	CURRENT TRANSFORMER	CTRL BOX, POWER PANEL
DS1,DS2	DISCONNECT SWITCH, MAIN	CTRL BOX, POWER PANEL
EXV	ELECTRONIC EXPANSION VALVE	CTRL BOX, CTRL PANEL
FI	FUSE, CONTROL CIRCUIT	CTRL BOX, SWITCH PANEL
F2	FUSE, COOLER HEATER	CTRL BOX, SWITCH PANEL
FB5	FUSEBLOCK, CONTROL POWER	CTRL BOX, POWER PANEL
FB6-FB15	FUSEBLOCKS, FAN MOTORS	CTRL BOX, POWER PANEL
GDI-GD3	GUARDISTOR RELAY	CTRL BOX, CTRL PANEL
GFP	GROUND FAULT PROTECTOR	CTRL BOX, POWER PANEL
GRD,GND	GROUND	CTRL BOX, POWER PANEL
HTRI-HTR8	COMPRESSOR HEATER	ON COMPRESSORS
HTR5	HEATER,EVAPORATOR	WRAPPED ARDUND EVAP.
JI-JI3	JUMPERS (LEAD)	CTRLBOX, CTRLPANEL
JB5	JUNCTION BOX, EVAP. HEATER	NEAR EVAP. ON BASE RAIL
KEYPAD	KEYPAD SWITCH & DISPLAY	CTRL BOX, KEYPAD PANEL
LPSI-LPS3	LIQUID PRESENCE SENSOR	ON COMPRESSOR
MI-M6	CONTACTORS, COMPRESSOR	CTRLBOX, POWERPANEL
MI-M37	CONTACTOR, FAN MOTORS	CTRL BOX, POWER PANEL
MCB250	MICROTECH CONTROL BOARD-250	CTRL BOX, CTRL PANEL
MHPRI-MHPR3	MECH. HIGH PRESSURE RELAY	CONTROL BOX, CTRL PANEL
MJ	MECHANICAL JUMPER	CTRL BOX, CTRL PANEL
MODEMI	MODEM, MICROTECH	CTRL BOX, CTRL PANEL
MODEM2	MODEM, FAX	CTRL BOX, CTRL PANEL
MPRI-MPR3	MOTOR PROTECTOR RELAY	CONTROL BOX, CTRL PANEL
MTRJI-MTR37	MOTORS, CONDENSER FANS	CONDENSER SECTION
NB	NEUTRAL BLOCK	CTRL BOX, CTRL PANEL
OB	OUTPUT BOARD, MICROTECH	CTRL BOX, CTRL PANEL
OLI-OL6	OVERLOADS	CTRL BOX, POWER PANEL
OSI-OS3	OIL SAFETY SWITCH	CTRL BOX, CTRL PANEL
PBI-PB3	POWER BLOCK, MAIN	CTRL BOX, POWER PANEL
PSI-PS3	PUMPDOWN SWITCHES	CTRL BOX, SWITCH PANEL
PVMI-PVM3	PHASE VOLTAGE MONITOR	CTRL BOX, POWER

RES1,RES2	RESISTOR, CURRENT TRANSFORMER	CTRL BOX, POWER PANEL-
SI	SWITCH, MANUAL START/STOP	CTRL BOX, KEYPAD PANEL
SCI,SC21,SC31	SPEED CONTROL	INSIDE SPEEDTROL BOX
SIG.CONV(SC)	SIGNAL CONVERTER	CTRL BOX, CTRL PANEL
SVI,SV2,SV7	SOLENOID VALVE, LIQ. LINES	ON LIQUID LINES
SV3,SV4,SV8	SOLENOID VALVE, LIQ. INJECTION	ON COMPR LIQ. INJ. LINE
SV5,SV6,SV9	SOLENOID VALVE, HG BYPASS	ON LINE TO HOT GAS VALVE
TI	TRANSFORMER, MAIN CONTROL	CTRL BOX, POWER PANEL
T2, T5	TRANSFORMER, 120 TO 24V CONTROL	CTRL BOX, CTRL PANEL
T3	TRANSFORMER, 575 TO 208-230V SPEEDTROL	CTRL BOX, CTRL PANEL
T4,T6	TRANSFORMER, 24 TO 18V CONTROL	CTRL BOX, CTRL PANEL
TIO	TRANSFORMER, 208-240 TO 24V OR 460 TO 24V -SPEEDTROL	CTRL BOX, CTRL PANEL
TB2	TERMINAL BLOCK, 120V FIELD	CTRL BOX, CTRL PANEL
TB3	TERMINAL BLOCK, 24V FIELD	CTRL BOX, CTRL PANEL
TB4-TB6	TERMINAL BLOCK, CONTROL	CTRL BOX, CTRL PANEL
TB7	TERM114AL BLOCK, FIELD CONN. (LESS THAN 24V ONLY)	CTRL BOX, CTRL PANEL
TB9	TERMINAL BLOCK, MICROTECH ONLY	CTRL BOX, CTRL PANEL
TBIO	TERMINAL BLOCK, FAX ALARM	CTRL BOX, CTRL PANEL
TDS-TD7	TIME DELAY, COMPR. REDUCED INRUSH	CTRL BOX, CTRL PANEL