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McQuay®
Air Conditioning

Installation and Maintenance Data

Bulletin No. IM 608
October 1997
Form No. 579080Y

MicroTech®
Self-contained Air Conditioning Systems
Unit Controller



Used with McQuay models SWP, SWT and SCP

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Introduction

This manual provides information about the MicroTech® control system used in the McQuay® self-contained air conditioning systems unit product line. It describes the MicroTech components, input/output configurations, field wiring options and requirements, and service procedures.

For a description of operation and information on using and programming the MicroTech unit controller, refer to the appropriate program-specific operation manual (see Table 1). For installation and commissioning instructions and general information on a particular self-contained unit, refer to its model-specific installation manual (see Table 2).

Table 1. Program-Specific Self-contained Unit Operation Literature

Self-contained Unit Control Config.	Operation Manual Bulletin Number
VAV	OM 123
CAV-ZTC	OM 124
CAV-DTC	OM 123

* Program numeration is explained in the "Software ID" section of this manual; see Table 5.

Table 2. Model-Specific Self-contained Unit Installation Literature

Self-contained Unit Model Bulletin Number	Installation & Maintenance Data
SWP	IM 550

⚠WARNING

Electric shock hazard. Can cause personal injury or equipment damage.

This equipment must be properly grounded. Connections and service to the MicroTech control panel must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled.

⚠WARNING

Excessive moisture in the control panel can cause hazardous working conditions and improper equipment operation.

When servicing this equipment during rainy weather, the electrical components in the main control panel must be protected from the rain.

⚠CAUTION

Extreme temperature hazard. Can cause damage to system components.

This MicroTech controller is designed to operate in ambient temperatures from –20°F to 125°F. It can be stored in ambient temperatures from –40°F to 140°F. It is designed to be stored and operated in relative humidity up to 95% (non-condensing).

⚠CAUTION

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components.

Discharge any static electrical charge by touching the bare metal inside the main control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, relay modules, or power plugs while power is applied to the panel.

NOTICE

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

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General Description

The MicroTech self-contained air conditioning systems unit controller is a microprocessor-based control system designed to provide sophisticated control of self-contained air conditioning system units. In addition to providing normal temperature and static pressure control, the controller is capable of providing alarm monitoring and alarm-specific component shutdown if critical system conditions occur.

A 12-key keypad and a 2-line by 16-character display give the operator access to temperatures, pressures, operating states, alarm messages, setpoints, control parameters, and schedules. The controller includes password protection to protect against unauthorized or accidental setpoint or parameter changes.

This MicroTech controller is capable of complete, stand-alone unit control. If desired, it can be incorporated into a MicroTech network by using the Network Master Panel (NMP), the Remote Monitoring and Control (RMC) Panel, or both. Regardless of whether the controller is stand-alone or included in a network, an IBM® compatible computer containing Monitor™ software can be connected to give the operator full-screen unit monitoring and control capability. The computer can be connected directly or via telephone lines with an optional modem.

Component Data

Component Data

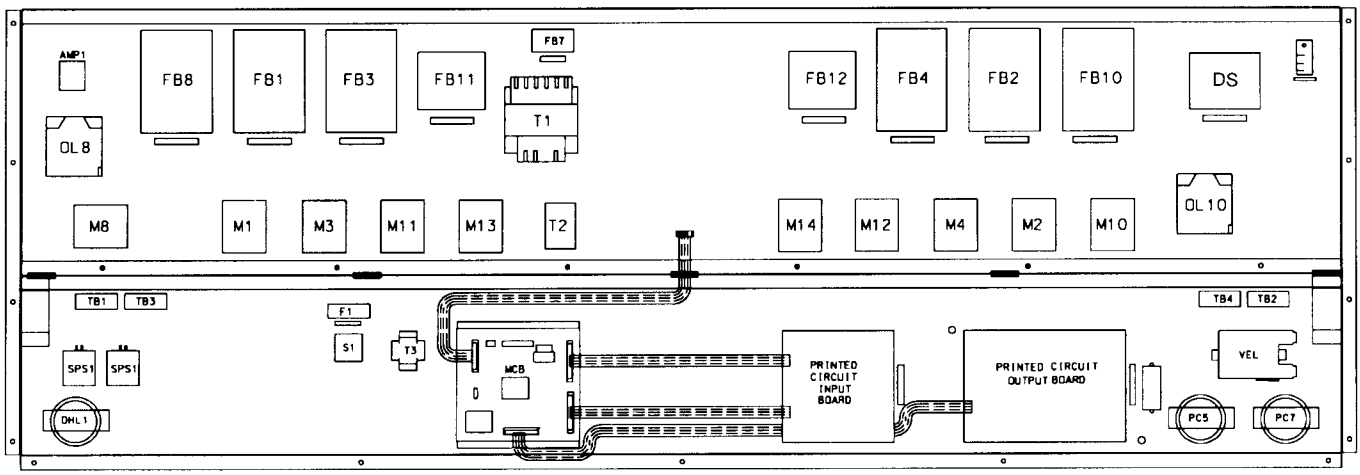
All electrical controls are enclosed in a central control located at the front of the unit. The control center is divided into two separate compartments, high and low voltage. The upper compartment houses the high voltage components and can be accessed through the two "Electrical Access" panels indicated on the dimensional drawing. Behind these access panels are hinged dead front panels for further operator safety. High voltage components include fan motor contactor (M10) and fusing (F10), fan motor overload (OL10), compressor contactors (M1 to M4), compressor fusing (F1 to F4), electric heat contactors (M11 to M18), high to low voltage transformers (T1 & T2), power block (PB1) and optional disconnect switch (DS1). If the optional disconnect switch is provided, the switch handle is visible and accessible without removing any safety or access panels.

Low voltage components are located in the lower compartment and are accessed through the "Mechanical Access" panel(s), as shown on the dimensional drawing. Low voltage components include the MicroTech main control board (MCB1), a printed circuit input board, a printed circuit output board, duct static pressure sensor (SPS1), duct high limit switch (DHL1), clogged filter switch (PC5), proof of airflow switch (PC7) MicroTech reset switch and Class II wiring terminals. Class II are connections made at the input and output circuit boards. All of these major components are interconnected by ribbon cables, shielded multi-conductor cables, or discrete wiring. Power for the system is provided by transformers T1, T2 and T3.

Located on the face of the unit is the interactive MicroTech keypad/display, unit switch, system indicator light and power indicator.

Following are descriptions of these MicroTech components and their input and output devices.

Figure 1. Typical Control Center Layout High and Low Voltage Compartments

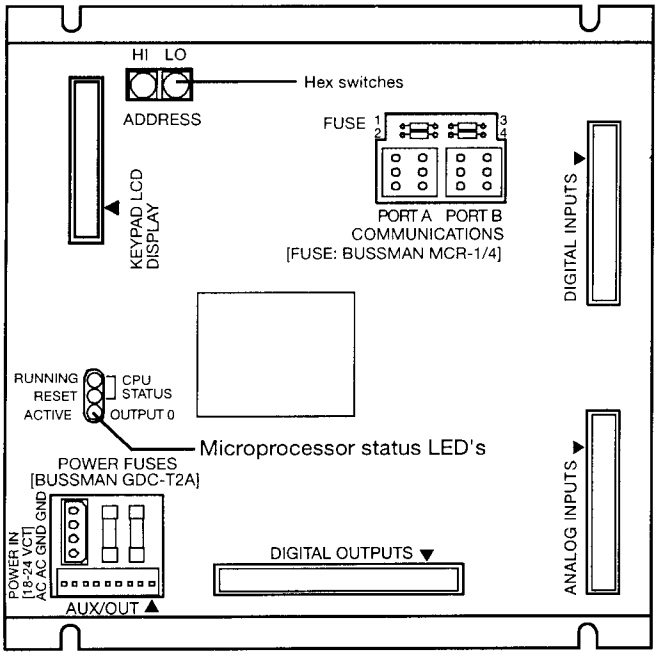


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Microprocessor Control Board

The Microprocessor Control Board (MCB1) is shown in Figure 2. It contains a microprocessor that is preprogrammed with the software required to monitor and control the unit. MCB1 receives input signals, processes them, and sends appropriate commands to the output relays. The various MCB1 connections and components are described below.

Figure 2. Microprocessor Control Board (MCB1)



Analog Input Connection

Conditioned analog inputs are received from the input board through the "Analog Inputs" port via a plug-in ribbon cable. These inputs are 0 to 5 VDC analog signals.

Digital Input Connection

Conditioned digital inputs are received from the input board through the "Digital Inputs" port via a plug in ribbon cable. These inputs are 24 VAC.

Digital Outputs Connection

After processing all input conditions, MCB1 sends the appropriate output signals to the Output Board through the "Digital Outputs" port via a plug-in ribbon cable.

Aux/Out Terminal Strip

The "Aux/Out" terminal strip provides 12 VDC power for the optional phone modem. The "Aux/Out" terminal also provides 5 VDC power for the keypad display and the potentiometers for the inlet vanes and economizer. 5VAC is also available for field connection (100 mA).

Power In Terminal Strip

MCB1 receives 18 VAC power from the Output Board through the "Power In" terminal strip. This power drives all logic and input reference circuitry, the Aux/Out terminal strip, and the keypad/display. A schedule of the Power In connections is included in the "Power and Auxiliary Connections" section of this manual. Refer to this section and the unit wiring diagrams for more information.

Power Fuses

Two identical fuses are located to the right of the Power In terminal strip. These fuses are in the MCB1 18 VAC power supply circuit.

Microprocessor Status LEDs

The green, red, and amber LEDs on MCB1 provide information about the operating status of the microprocessor. The amber LED also indicates the existence of alarm conditions in the unit.

Note that the Remote Alarm Output relay (K0) is driven by same signal that drives the amber LED. For more information on the Remote Alarm Output relay, refer to the "Relay Outputs" section of this manual which is under "Field Wiring."

Following is the normal start-up sequence that the three status LEDs should follow when power is applied to MCB1:

1. The red ("Reset") LED turns on and remains on for approximately 5 seconds. During this period MCB1 performs a self-test.
2. The red LED turns off and the green ("Running") LED turns on. This indicates that the microprocessor has passed the self-test and is functioning properly.
3. The amber ("Active") LED turns on and remains on continually if no alarm conditions exist in the unit. This indicates that the programmed routines are executing. (If alarm conditions exist, the amber LED will flash or turn off depending on the Alarm Out setting as shown in Table 4.)

If the above sequence does not occur after power is applied to the controller, there is a problem with MCB1 or its power supply. For more information, refer to the "Test Procedures" section of this manual, which is under "Service Information."

Tables 3 and 4 summarize the green, red, and amber status LED indications.

Table 3. Green and Red Status LED Indication

Green LED State	Red LED State	Indication
Off	Off	No power to MCB1
Off	On*	Self-test failure or power supply problem
On	Off	MCB1 operating normally

** For longer than 5 seconds.*

Table 4. Amber Status LED and Alarm Output K0 Indication

Amber LED & OBA0 LED States	Indication
On Continually	Normal operation
Off	No power to MCB1 or programmed routines not executing or alarm condition (Menu 25. Alarm out= off)
On 1/2 second; Off 1/2 second	Alarm condition (Menu 25. Alarm out= blink
On 9/10 second; Off 1/10 second	Dirty filter

Keypad/LCD Display Connection

MCB1 receives input commands and operating parameters from the keypad and sends requested information to the display through the "Keypad/LCD Display" port via a plug-in ribbon cable.

Hex Switches

MCB1 includes two hex (hexadecimal) switches that are used to set the network address for units that are part of a MicroTech network. For more information on network applications, refer to the "MicroTech Monitoring and Networking Options" section of this manual.

The HI and LO hex switches are shown in Figure 3. A

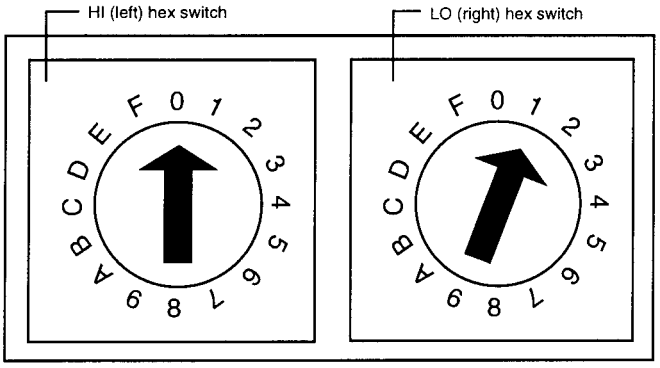
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"hex switch setting" is defined as the HI switch digit followed by the LO switch digit. For example, a hex switch setting of 2F would have the HI switch set to "2" and the LO switch set to "F."

The factory set hex switch setting should be 01. If the unit is not part of a network, leave the switches at the factory setting.

Note: If the hex switch setting is changed, power to MCB1 must be cycled in order to enter the new setting into memory. This can be done by opening and then closing system switch S1 in the main control box.

Figure 3. Hex Switches



Communication Ports

MCB1 has two communication ports: port A and port B. Each port has six terminals and is set up for either an RS-232 or RS-485 communications format. Following are brief descriptions of each port's function. For further information, refer to the "MicroTech Monitoring and Networking Options" section of this manual.

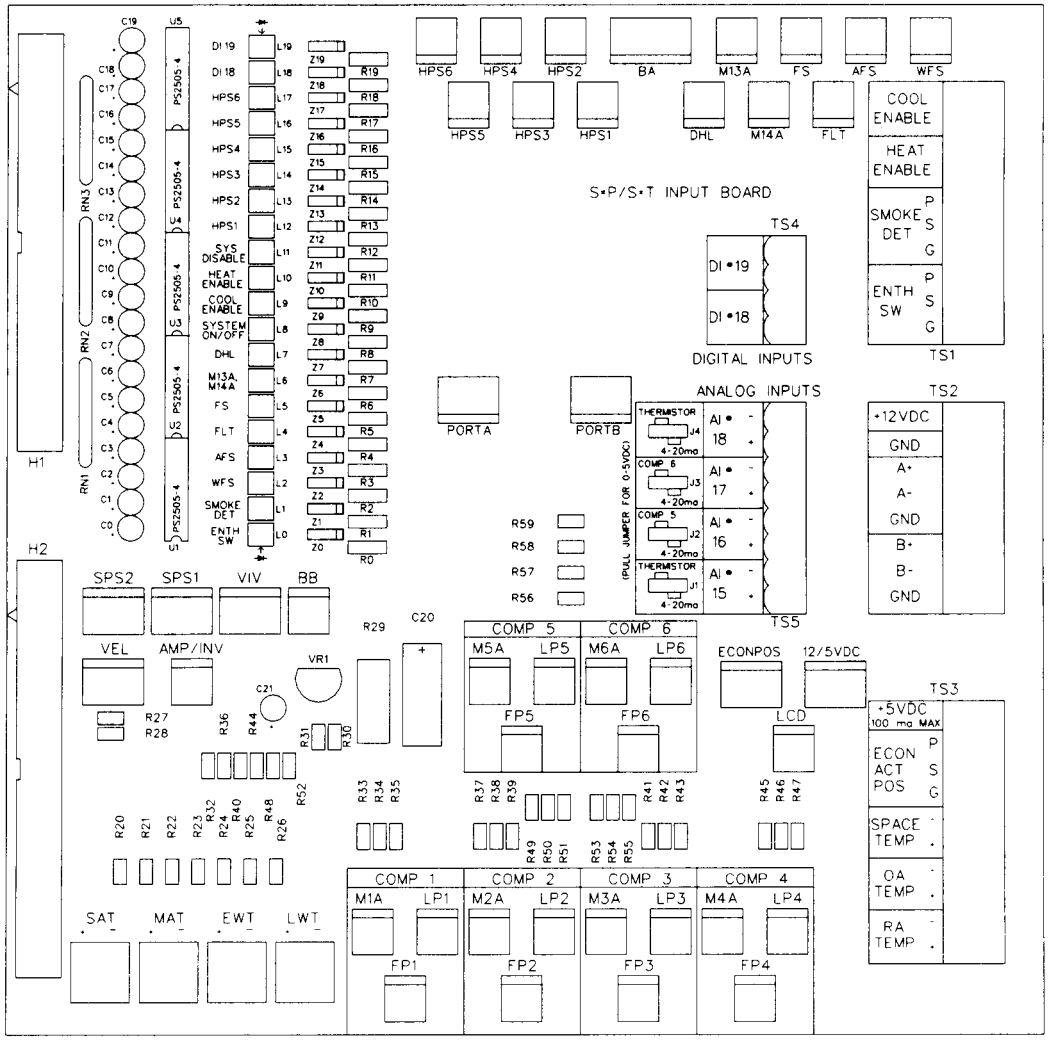
Port A: Port A is for communications with an IBM compatible PC using the RS-232 format. The PC can be directly connected, over a limited distance, using a twisted, shielded pair cable connected to terminals A+, A- and GND at TS2 on the input board or it can be remotely connected via phone lines using an optional modem. The default communications rate is 1200 baud.

Port B: Port B is for MicroTech network communications using the RS-485 format. If required, a twisted, shielded pair cable can be connected to port B at terminals B+, B- and GND at TS2 on the Input Board. The default communications rate is 9600 baud.

Input Board

The Input Board is shown in Figure 4. It collects all analog and digital input information and sends them to MCB1 via a plug-in ribbon cable. The various DB1 inputs, connections, and components are described below.

Figure 4. Input Board



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Digital Inputs

The 20 possible digital inputs are connected at the Input Board. LEDs L0 through L19 indicate the status of each digital input. When the input device's switch or contacts close, its associated LED will glow. Digital input schedules are included in the "Controller Inputs" section of this manual. Refer to this section and the unit wiring diagrams for more information.

Analog Inputs

The 19 possible analog inputs are connected at the Input Board. Analog input schedules are included in the "Controller Inputs" section of this manual. Refer to this section and the unit wiring diagrams for more information.

Power

The Input Board receives voltage from three sources: (1) 5 and 12 VDC through the 12/5VDC terminal. This DC voltage comes from the MCB1 Aux/Out terminal; (2) 12 VDC through the BA terminal. This voltage comes from the Output Board; (3) 30 VDC through the BB terminal. This voltage comes from the Output Board.

Output Board

Output Board is shown in Figure 5. It can hold up to 26 electromechanical, plug-in relays which are labeled K0 through K29 (see "Relays" below). The standard number of relays installed on the Output Board is 24 relays. Each relay has an associated LED that will light when the relay is energized.

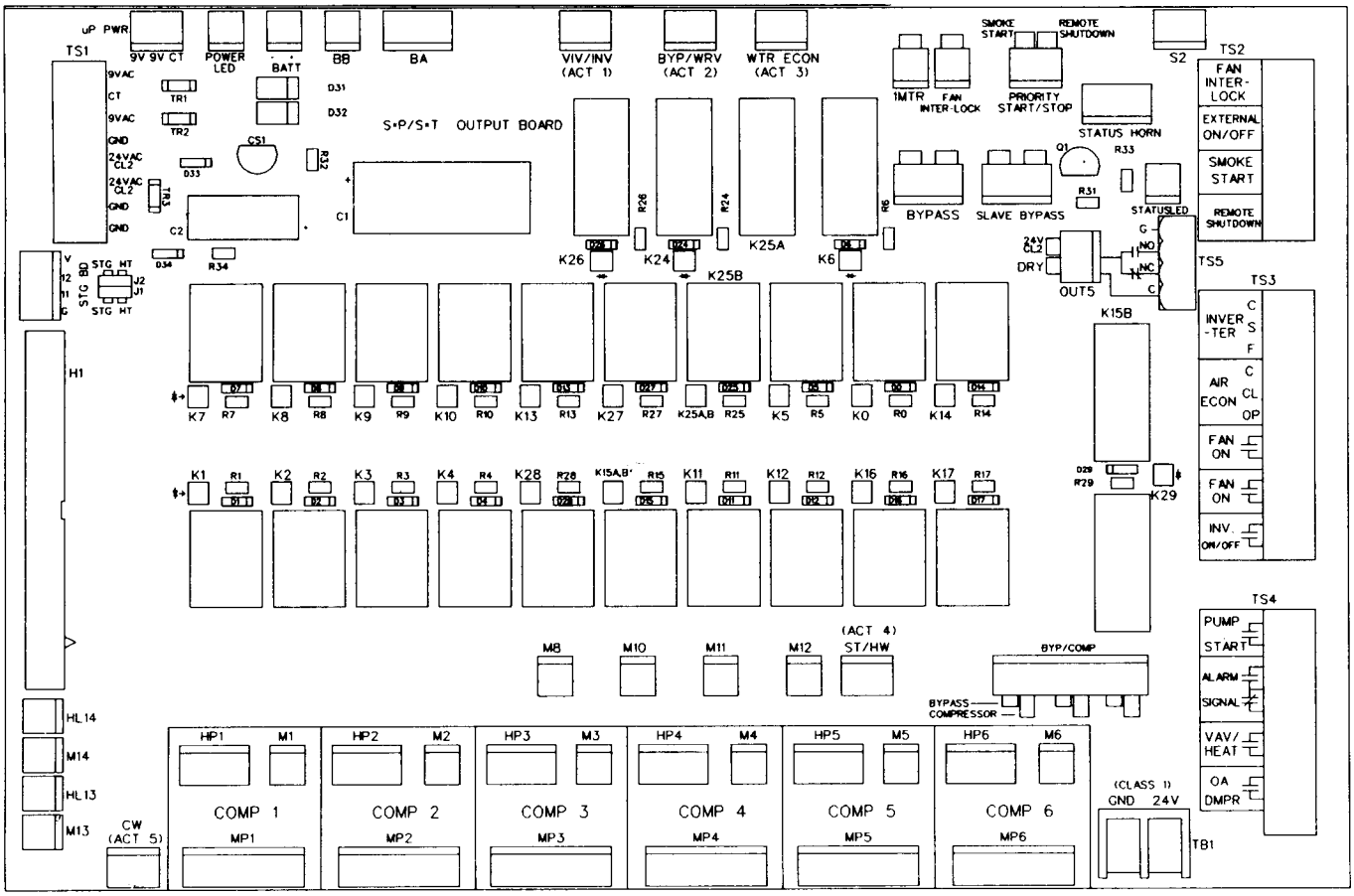
Listings of the Output Board relay outputs are included in the "Controller Outputs" section of this manual. Refer to this section and the unit wiring diagrams for more information.

Power

The Output Board receives power from three sources:

1. 18 VAC at terminal block TS1 across both 9VAC terminals. The 18 VAC for these terminals is supplied directly from transformer T3. This voltage is converted by the Output Board to supply the 12 VDC circuitry.
2. 24 VAC at terminal block TS1 across terminal 24 VAC CL2 and a GND terminal. The 24 VAC for these terminals is supplied directly from transformer T2. This voltage is converted by the Output Board to supply the 24 VDC circuitry.
3. 24 VAC at terminal block TB1. The 24 VAC for these terminals is supplied directly from transformer T1. This voltage is used by the Output Board for compressor, heat, and chilled water outputs.

Figure 5. Output Board



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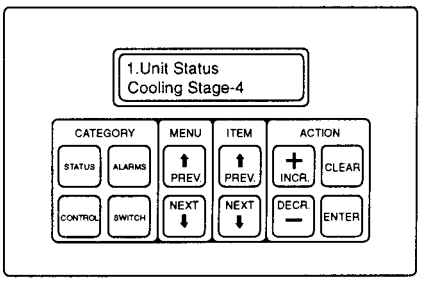
Relays

The relays used on the output board are electromechanical. They are rated for a maximum load of 3.25 A at 24 VAC. The power for the relay must be from a Class II transformer. The electromechanical relays have normally open contacts that close and normally closed contact that open whenever their coils are energized. When this occurs, an associated LED mounted on the output board will glow.

Keypad/Display

The keypad/display, shown in Figure 6, provides the user or operator a local interface with MCB1. All operating conditions, system alarms, control parameters, and schedules can be monitored from the display. If the password has been entered, any adjustable parameter or schedule can be modified with the keypad. For information on using the keypad/display, refer to the "User Interface" section of the applicable operation manual (see Table 1).

Figure 6. Keypad/Display



Temperature Sensors

The MicroTech controller uses negative temperature coefficient (NTC) thermistors for temperature sensing. A thermistor chart, which provides voltage-to-temperature and resistance-to-temperature conversion data (Table 35), is included in the "Test Procedures" section of this manual which is under "Service Information."

Pressure Transducers

The MicroTech controller uses 0 to 5 in. wc and, if necessary, duct static pressure. If building static pressure control is required, a –0.25 to 0.25 in. wc, 1 to 5 VDC static pressure transducer is also used. Voltage-to-pressure conversion data is included in the "Test Procedures" section of this manual which is under "Service Information" (Figures 15 and 16).

The Calibrate feature automatically shuts down the unit and zeroes all pressure transducer inputs to MCB1. For more information on Calibrate, refer to "Control Mode" in the "Manual Operation" section of the applicable operation manual (see Table 1).

Actuators

The MicroTech controller uses tri-state actuators for valve, damper, and variable inlet vane modulation. They are controlled using the Step-and-Wait control algorithm.

Battery option available to drive economizer and bypass valve actuators closed on loss of power. The battery option also drives the airside economizer damper actuators closed on loss of power.

Actuator position feedback is supplied to the controller for the waterside economizer valves, outside air damper and the supply fan inlet vanes. The Calibrate feature automatically shuts down the unit and records the position feedback values for these actuators after they have been driven fully open and fully closed. For more information on Calibrate, refer to "Control Mode" in the "Manual Operation" section of the applicable operation manual (see Table 1).

Software ID

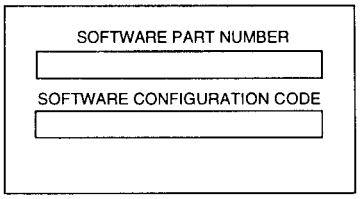
Software ID

MicroTech self-contained air conditioning systems unit controller software is factory installed and tested in each unit prior to shipment. The software is identified by a "software part number" and a "software configuration code." These codes are printed on the software ID tag, a small label affixed to the control panel next to MCB1. Refer to Figure 1. An example of the software ID tag is shown in Figure 7.

The software part number is also encoded in the controller's memory and is available for display on menu 25 of the keypad/display. (See the applicable operation manual for information on using the keypad/display.) Using menu 25 of the keypad/display is the most reliable way of determining the controller's software part number.

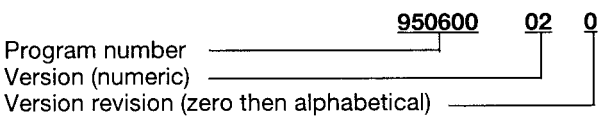
Note: Over time, changes to the controller software may be required because of software updates or new job requirements. It is recommended that these changes (if any) be documented and kept in a safe place. If MCB1 fails and needs to be replaced, this record will help to ensure that the new MCB1 board is loaded with the proper software. For more information, see the "MCB1 Replacement" section of this manual.

Figure 7. Software ID Tag



Software Part Number

The standard software part numbers used by the various types of self-contained air conditioning systems units is as follows:



If the unit's program number does not match the number above, it means that a special program has been loaded into the controller. In this case, the information in this manual and the associated operation manuals that is related to standard software may not be applicable.

Note: The information in this manual should be applicable with software version revisions following "0" (i.e., A, B, etc.).

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Software Configuration Code

The software configuration code string defines how a standard program has been modified to match the specific options that are present in a particular unit. For example, it describes the type of outside air damper control, the types of cooling and heating equipment (if any), the number of stages, the airflow modulation method (if any), and the number of static pressure sensors (if any). If a controller is equipped with a special program, the software configuration code usually is not applicable and is not printed on the software ID tag.

Because of its complexity, configuration string codification will not be explained here. The software configuration code is written on the software ID tag for the use of factory service personnel.

MicroTech Monitoring and Networking Options

PC Monitoring

A PC (personal computer) equipped with the appropriate MicroTech Monitor software can be used to provide a high-level interface with the MicroTech controller (see PC specification below). Monitor software features a high resolution graphic display, multilevel password access, and advanced trend-logging. The PC can be connected to the controller either directly via a single twisted, shielded pair cable, or remotely via phone lines with an optional modem. If the controller is part of a MicroTech network (see below), PC monitoring can be done via network communications. For more information on connecting the PC to the controller, refer to the "Communications" section of this manual which is under "Field Wiring."

For maximum convenience and functionality, the PC should be considered dedicated to the MicroTech system. However, you can exit the Monitor program to perform other tasks without affecting equipment control. Refer to the user's manual supplied with the Monitor software for additional information.

PC Specification

A direct or remote connected computer can be used for monitoring unit operation, changing setpoints, scheduling, trend logging, downloading software, and diagnostics. The PC must be an IBM or 100% true compatible. Table 6 shows the minimum and preferred PC specifications.

Table 6. PC Specification

Preferred Configuration	Minimum Configuration
486DX microprocessor, 66MHz or better	386SX microprocessor, 16 MHz
8 MB of RAM	4 MB of RAM
120 MB hard disk drive or better	60 MB hard disk drive
3½" floppy disk drive	3½" floppy disk drive
Serial port (9 pin male; Com1 or Com2)	Serial port (9 or 25 pin male; Com1 or Com2)
Parallel port	–
Internal time clock, battery backed	Internal time clock, battery backed
Super VGA graphics capability	VGA graphics capability
Super VGA monitor	VGA monitor
Printer	–
Bus mouse or trackball	Serial mouse or trackball*
101 enhanced keyboard	101 enhanced keyboard
9600 baud modem, compatible with the AT command set (optional)	1200 baud modem, compatible with the AT command set (optional)
MS-DOS® 6.2 or higher	MS-DOS® 5.0
Microsoft® Windows™ 3.1 or higher	Microsoft® Windows™ 3.1
MicroTech® Monitor™ software	MicroTech® Monitor™ software

* If a serial pointing device is used, there must be another serial port (Com1 or Com2) available for connecting the PC to the MicroTech controller.

Remote Monitoring & Control Panel

One to as many as eight Self-contained units can be incorporated into a network with the MicroTech Remote Monitoring and Control (RMC) Panel. The optional RMC Panel provides the following capabilities:

- Remote unit monitoring (up to 8 units)
- Common control of multiple units (groups of 2 to 8)
- Common unit scheduling

For further information, contact your McQuay sales representative or refer to Bulletin No. OM 121, MicroTech Remote Monitoring and Control Panel.

Network Master Panel

The MicroTech Network Master Panel (NMP) allows multiple self-contained unit controllers to be incorporated into a building-wide network with other MicroTech unit and auxiliary controllers. In conjunction with a PC and Monitor software, it gives the building operator the capability to perform advanced equipment control and monitoring from a central or remote location. The NMP can be used with or without the RMC Panel (see above). The following features are provided by the optional NMP:

- Remote unit monitoring
- Advanced scheduling features
- Advanced alarm management
- Global operator override by unit type
- Demand metering
- Historical electrical data logging

For further information, contact your McQuay sales representative.

Open Protocol

MicroTech Open Protocol provides an interface between the self-contained unit controller and the building automation system of one of many participating manufacturers. With the Open Protocol, the building automation system can do the following:

- Set the unit's operating mode
- Monitor most controller inputs, outputs, setpoints, parameters, and alarms
- Set most controller setpoints and parameters
- Clear alarms
- Reset the cooling discharge air temperature setpoint (VAV and CAV-DTC units)
- Reset the heating discharge air temperature setpoint (VAV and CAV-DTC units with modulating heat)
- Reset the duct static pressure setpoint (VAV units)
- Set the heat/cool changeover temperature (Control Temperature for VAV and CAV-DTC units)
- Set the representative zone temperature (Control Temperature for CAV-ZTC units)

If two or more units will be connected to the building automation system, an Open Protocol Master (OPM) Panel may be required. For further information, contact your local McQuay sales representative.

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Field Wiring

Following are descriptions of the various options and features that may require field wiring to the MicroTech controller. Refer to the job plans and specifications. Field connections to the Input Board are made at terminal blocks TS1, TS2, TS3, TS4, and TS5. Field connections to the Output Board are made at terminal blocks TS2, TS3, and TS4. Note that these connection are intended for low voltage NEC Class 2 circuits only.

Digital Outputs

The following digital outputs may be available for field connection to any suitable device:

- Remote alarm output (K0)
- VAV/Heat box output (K6)
- Pump Start (K6 & K15)
- OA Damper (K14)
- Fan On output (K15)

The remote alarm and occupied outputs are available on all units. The VAV box output is available only on VAV units.

Alarm Signal Output

K0 output

The remote alarm output can be used to provide a remote alarm signal. It is energized by the same signal that lights the amber status LED on MCB1 (see Table 4). Both N/O and N/C contacts for Alarm Signal are available at TS4 on the Output Board.

Heat/VAV Box Signal

K6 output

The Heat/VAV Box Output is used to indicate whether or not heat is being supplied by the air handling unit or to signal unit in heat mode. When this signal is in the Cool (on) position, all VAV boxes should modulate normally to maintain the desired space temperature. When this signal is in the Heat (off) position, cooling only VAV boxes should be driven fully open.

The Heat/VAV Box Output is in the Cool (on) during normal operation. It is in the Heat (off) position when heat is supplied, during the Recirculation period, and during the Post Heat period. It is also off during the Start Initial state to keep the pump off. It is also in the Heat (off) position in the Unoccupied state whenever airflow is detected. This provides a means to drive open all of the VAV boxes when the fan is turned on directly through the Smoke Start Input.

The Heat/VAV Box Output is turned off during the Recirculation period so that Cooling Only VAV boxes are fully opened to provide more airflow and thus a more accurate measure of the load when Return Air Temperature is used as the Control Temperature. Another reason for having the VAV boxes open during the Recirculation period is to provide improved heating operation when the unit goes to heating from the Recirculation state.

When the Heat/VAV Box Output is turned off, variable inlet vanes are controlled toward the fully open position to maintain the desired duct static pressure setpoint. When the Heat/VAV Box signal changes to the Cool (on) position, relatively cool spaces can cause the VAV boxes to close immediately. Some VAV boxes can close much faster then the variable inlet vanes which can cause the unit to be locked out on the high duct pressure alarm. To prevent this, the Heat/VAV Box Output is kept off for a Post Heat time after it is required while the Inverters are slowed down and Variable Inlet Vanes driven toward the 17% minimum position. The Heat/VAV Box Output is then turned on allowing the VAV boxes to control normally and the variable inlet vanes are released to normal duct static pressure control. The VAV boxes close and the variable inlet vanes open until equilibrium is attained. Units without variable inlet vanes or Inverters go rapidly through the Post Heat state because such control is not required.

For more information on Heat/VAV Box Output operation, refer to the "Operating States and Sequences" section of the applicable VAV operation manual (see Table 1).

Pump Start

K6 and K15B outputs

This output is controlled in all units to provide the Pump Start Output. A set of contacts from this output in series with a set of contacts from the Fan On Output provides a digital signal to turn on the pump whenever both outputs are on. These contacts are located at TS4 on the Output Board.

Outside Air Damper

Output K14 output

For control of units with return air, the Damper Output is closed and the airside economizer minimum position is set to zero if any of the following is true:

- Unit is in the Off state
- Unit is in the Recirc state
- Unit is in the Morning Warmup state
- Unit is operating during the Unoccupied period due to Night Setback or Night Setup.

For control of units with 100% outside air, the Remote Damper Output is closed during the Start Initial period, and it remains closed during all operating stages. This output remains closed after the fan is turned off until 30 seconds after the airflow switch (digital input) indicates loss of airflow. This keeps the outside air dampers open in case there is a failure or external override that keeps the fan running after it is turned off by MicroTech.

A N/O contact for outside air damper is located at TS4 on the Output Board.

Fan On

K15 outputs

When unit operation is required for any reason, the Supply Fan is turned on after a Start Initialization period. During this period, the Fan Operation output is on to allow isolation dampers and normally closed VAV boxes to be opened prior to starting the fan. When unit operation is no longer required, the supply fan is turned off. The Fan Operation Output remain on after the fan is turned off until 30 seconds after the airflow switch digital input indicates

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loss of airflow. This keeps the isolation dampers and normally closed VAV boxes open in case there is a failure or external override that keep the fan running after it is turned off by MicroTech. If the fan is turned on by bypassing MicroTech controls that have it off, the Fan Operation c put is not turned on.

Three N/O contacts for Fan On are available at TS3 the Output Board.

Analog Inputs

If used, the following options require field wiring to analog inputs. Field wiring is not required if the option is not used. Either RAT or Space temperature sensor is required for operation of unit.

Table 7. Anolog Inputs

Analog Input Number	Description	Location on Input Board
A4	Return Air Temp	TS3
A5	Outside Air Temp	TS3
A6	Space Temperature	TS3
A7	Airside Economizer Actuator Pos	TS3
A15	External Reset	TS5
A15	Humidity	TS5

Digital Inputs

If used, the following options require field wiring to digital inputs. All units are shipped with factory installed mechanical jumper at Cool Enable. If required, remove jumper and install switch. Except for the Remote Monitor Panel option, field wiring is not required if an option is not used. Refer to "Remote Monitor Panel" below for more information.

Twisted, shielded cable is not required for digital input wiring.

Table 8. Digital Inputs

Digital Input Number	Description	Location on Input Board
D0	Enthalpy Switch	TS1
D1	Smoke Detector	TS1
D9	Cool Enable	TS1
D10	Heat Enable	TS1
D18	Spare	TS4
D19	Spare	TS4

Communications

PC Connection

Regardless of whether the PC is connected directly or via phone lines, the connection to the controller is at TS2 terminal block on the Input Board. The default RS-232 communications rate is 1200 baud; however, it can be changed. Refer to the user's manual supplied with the Monitor software for more information.

Direct Connection

An RS-232 communications cable kit that allows a PC to be directly connected to any MicroTech controller is available from McQuay. The part number is 0057186802. The kit includes three cables for connection to the PC's 9-pin serial port (If the PC has a 25-pin serial port, obtain an adapter). Use the following directions when connecting the cables to the Input Board:

1. Connect cable number #1 into the PC's 9-pin serial port.
2. Connect cable #3 into cable #1
3. Remove the connnectors from the end of the cable #3
4. Connect the three wires at terminal block TS2 on the Input Board. Connect the white wire to the A+ terminal, black wire to the A- terminal, and the green wire to the GND terminal.

Installation and wiring instructions for the cable kit are included in Bulletin No. 500, MicroTech PC Communications Cable Kit. This bulletin is included with the kit.

The cable length is 12 feet. If more length is required, a twisted, shielded pair cable can be spliced into the kit cable (see "Cable Specification for Direct PC Connection" below). If this is done, splice the conductors with crimp-type butt connectors (better) or solder (best). Do not use wire nuts.

The maximum allowable cable length for direct connection between the PC and a controller is 50 feet. If the desired length is over 50 feet, an RS-232 cable extension kit is required. This kit can extend the maximum allowable distance between the PC and the controller to 4000 feet. The part number is 0065487001.

Remote Connection

A voice quality, direct-dial telephone line is required for remote or off-site PC access to the unit. The phone line should be terminated with a standard RJ-11 modular phone plug. A modem enables a remote or off-site PC to communicate with the networked controllers via phone lines.

A modem is a standard Self-contained unit option; however, a modem kit that can be field installed in the unit is available from McQuay. The part number is 0635850A-01. The kit comes complete with a 14,400 baud modem (set up for 9600 baud) and a wiring harness. If a remote PC connection is required, it is recommended that the modem at the MicroTech controller be supplied by McQuay.

Installation and wiring instructions for the modem kit are included in Bulletin No. IM 564, "MicroTech Modem Kit.." This bulletin is included with the kit.

Cable Specification for Direct PC Connection

A properly terminated, twisted, shielded pair cable is required to directly connect a PC to a MicroTech controller. The cable must meet the following minimum requirements: twisted, shielded pair with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer

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jacket (Belden 8762 or equivalent). It must also be properly terminated to an AMP plug on one end and a female DB9 or DB25 connector on the other (AMP is the manufacturer). See Figures 8 and 9 for cable pinouts. The AMP part numbers for the AMP connector shown in these figures are as follows: 1-480270-0 (plug) and 60617-1 (female pin terminals). This AMP plug can be connected to a Self-contained unit controller or any other MicroTech controller that has the same type of AMP socket. The DB9 or DB25 connector is for connection to a 9-pin or 25-pin serial port on the PC. Note that some local codes or applications may require the use of plenum rated cable. Do not install the cable in the same conduit with power wiring.

Note: A factory-assembled cable that meets this specification is provided with the PC communications cable kit, which is available from McQuay. This cable has a DB9 connector. The part number of the kit is 0057186802.

Figure 8. RS-232 Cable Pinouts for 9-Pin Serial Ports

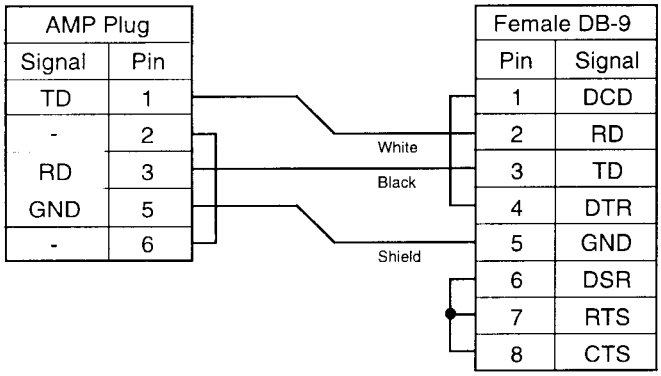
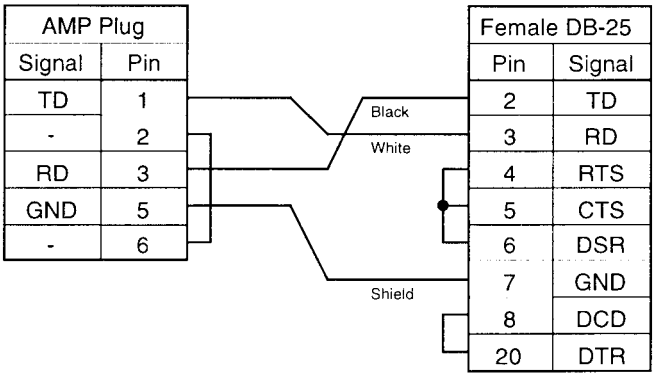


Figure 9. RS-232 Cable Pinouts for 25-Pin Serial Ports



Network Connection

If any type of networking application is required, the self-contained units must be connected together with the applicable MicroTech panels (RMC, NMP, OPM) in a daisy-chain manner by using twisted, shielded pair cable (Belden 8762 or equivalent). The network communications connection to the Self-contained unit controller is at port B on MCB1. As shown on the unit wiring diagram, field wiring to port B can be accomplished by connecting to terminals at TS2 on the Input Board.

For more information, refer to the installation manual supplied with applicable MicroTech network panels.

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Controller Inputs

Analog Inputs

The 18 possible analog inputs to the controller are connected on the Input Board. The analog inputs available for field connections are located at terminal strips TS3 and TS5 on the Input Board.

Table 9. Analog Inputs

Analog Input Number	Description	Sensor Reading	Measured Data
A0	Supply Air Temp	Thermistor Resistance	Air Temp
A1	Mixed Air Temp	Thermistor Resistance	Air Temp
A2	Entering Water Temp	Thermistor Resistance	Water Temp
A3	Leaving Water Temp	Thermistor Resistance	Water Temp
A4	Return Air Temp	Thermistor Resistance	Air Temp
A5	Outside Air Temp	Thermistor Resistance	Air Temp
A6	Space Temperature	Thermistor Resistance	Air Temp
A7	Economizer Actuator Pos	0 - 5 volts	0 - 100%
A8	Compressor #1 Inputs	①	①
A9	Compressor #2 Inputs	①	①
A10	Compressor #3 Inputs	①	①
A11	Compressor #4 Inputs	①	①
A12	Air Velocity	②	②
A12	Duct Static Pressure #2	1 - 5 Volt	0 - 4 IWC
A13	Duct Static Pressure #1	1 - 5 volt	0 - 4 IWC
A14	VIV Pos/Fan Speed	0 - 5 volt	0 - 100%
A14	Low Speed Motor Amps	0 - 5 volt	0 - Max Amps
A15	External Reset	1 - 5 volt	Min - Max Cooling Setpoint
A15	Humidity	0 - 5 volt	0 - 100%
A15	Refrigerant Pressure	1.056V - 3.419V	60 - 300 psig
A16	Compressor #5 Inputs	①	①
A17	Compressor #6 Inputs	①	①
A18	Spare	0-5V, 4-20mA, or thermister	-

Notes:
1. Multiplexed signal that provides three digital inputs per compressor.
2. A 2 - 10 volt signal to the PC Board is converted to a 1- 5 volt signal to the controller via the PC Board. 1 volt implies 0 fpm, 5 volts implies 1675 fpm.

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Digital Inputs

The 20 possible digital inputs to the controller are connected on the Input Board. The digital inputs sense the presence or absence of an external 24 VAC power source (transformer T2) or an external 12 VDC power source (transformer T3). The external voltage is is connected to the input through a switch or set of contacts. When 24 VAC or 12 VDC is applied to an input, its associated LED (L0 through L19) will glow. All digital input circuits are optically isolated.

The following table summarize the digital input connections and LED indications for the Input Board.

Table 10. Digital Inputs

Digital Input Number	Description	Voltage	Open	Closed
D0	Enthalpy Switch	24 VAC	High	Low
D1	Smoke Detector	24 VAC	Alarm	Normal
D2	Water Flow Switch	24 VAC	No Flow	Flow
D3	Airflow Switch	24 VAC	No Flow	Flow
D4	Filter Switch	24 VAC	Alarm	Normal
D5	Freeze Stat	24 VAC	Alarm	Normal
D6	Heat Fail	24 VAC	Alarm	Normal
D7	Duct High Limit	24 VAC	Alarm	Normal
D8	System On/Off	12 VDC	Auto	On
D9	Cool Enable	12 VDC	Disable	Enable
D10	Heat Enable	12 VDC	Disable	Enable
D11	System Disable	12 VDC	Enable	Off
D12	High Press SW, Comp #1	24 VAC	Normal	Alarm
D13	High Press SW, Comp #2	24 VAC	Normal	Alarm
D14	High Press SW, Comp #3	24 VAC	Normal	Alarm
D15	High Press SW, Comp #4	24 VAC	Normal	Alarm
D16	High Press SW, Comp #5	24 VAC	Normal	Alarm
D17	High Press SW, Comp #6	24 VAC	Normal	Alarm
D18	Spare	24 VAC	-	-
D19	Spare	24 VAC	-	-

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Controller Outputs

Digital Outputs

An Output Board is supplied with all units. It can hold up to 26 electromechical, plug-in relays which are labeled K0 through K29. The standard Output Board is supplied with 24 relays. Each relay has an associated LED which is wired in parallel with the relay. Note that the LED will light with or without the relay installed and functioning.

Table 11. Digital Outputs

Digital Output Number	Description	Off	On
K0	Alarm	Blinking or Off	Normal
K1	Compressor #1	Off	On
K1	Close CW Valve	—	Close
K2	Compressor #2	Off	On
K2	Open CW Valve	—	Open
K3	Compressor #3	Off	On
K4	Compressor #4	Off	On
K5	Bypass Valve	Close	Open
K6	Heat/VAV Output	Heat	Cool
K7	Water/Air Economizer Close	—	Close
K8	Water/Air Economizer Open	—	Open
K9	VIV Close	—	Close
K9	Inverter Slow Down	—	Slower
K10	VIV Open	—	Open
K10	Inverter Slow Up	—	Faster
K10	Dual Motor Switchover	LoSpd	HiSpd
K11	Electric Heat #1	Off	On
K11	Water/Steam Close	—	Close
K12	Electric Heat #2	Off	On
K12	Water/Steam Open	—	Open
K13	Fan	Off	On
K14	Outdoor Air Damper	Close	Open
K15	Fan Operation	Off	On
K16	Compressor #5	Off	On
K16	Water Regulating Valve, Close	—	Close
K17	Compressor #6	Off	On
K17	Water Regulating Valve, Open	—	Open

Power and Auxiliary Connections

Connections to MCB1

The following tables list the possible connections to the Power In and Aux/Out terminal strips on the Microprocessor Control Board (MCB1). Refer to the unit wiring diagrams for additional information.

Table 12. MCB1 Power In Terminal Strip Connections

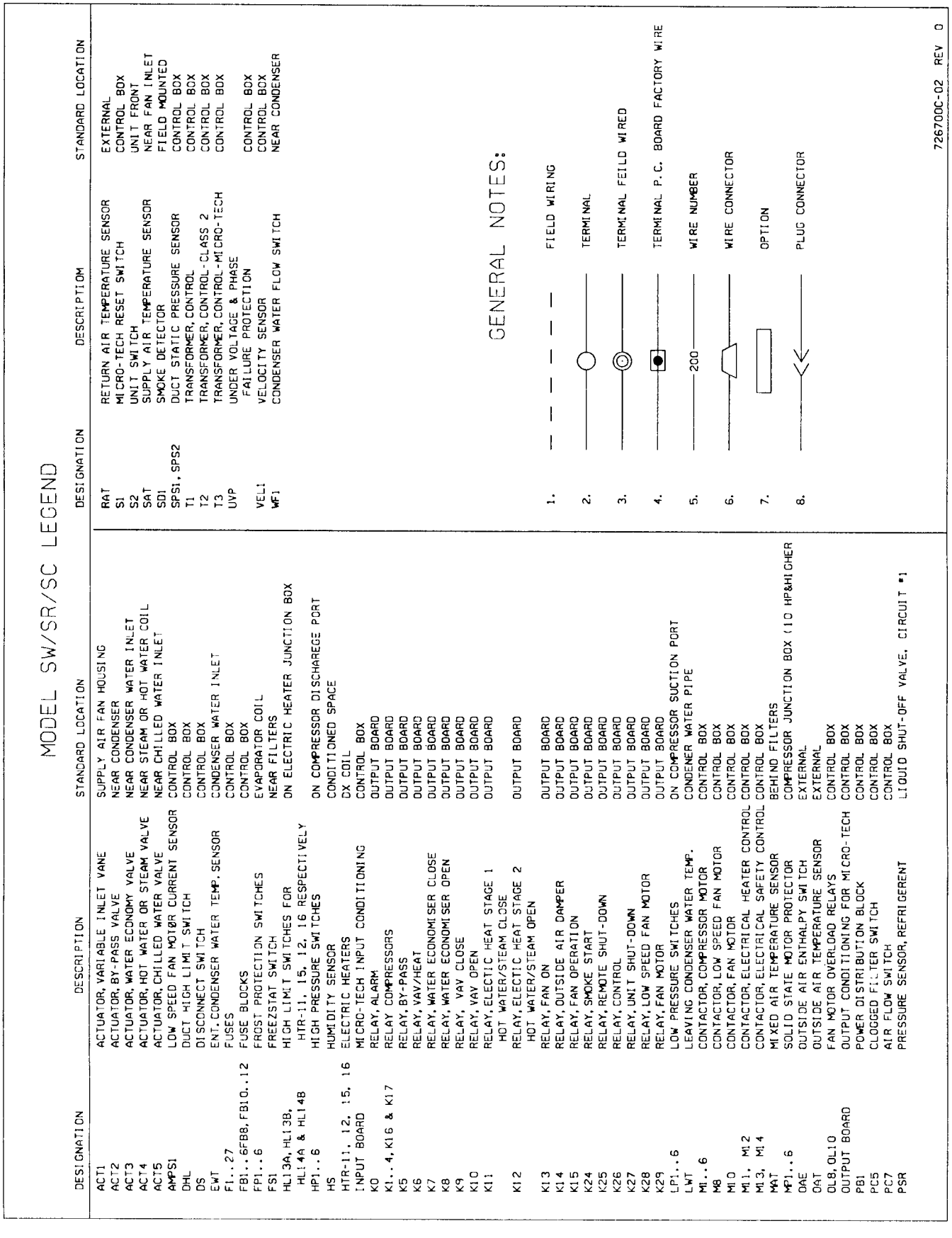
Terminal	Connection Description
1	9 VAC from Output Board
2	9 VAC from Output Board
3	Ground from Output Board
4	Not Used

Table 13. MCB1 Aux/Out Terminal Strip Connections

Terminal	Connection Description
9	5 VDC
8	12 VDC
7	GND
6	Not Used
5	Not Used
4	Not Used
3	Not Used
2	Not Used
1	Not Used

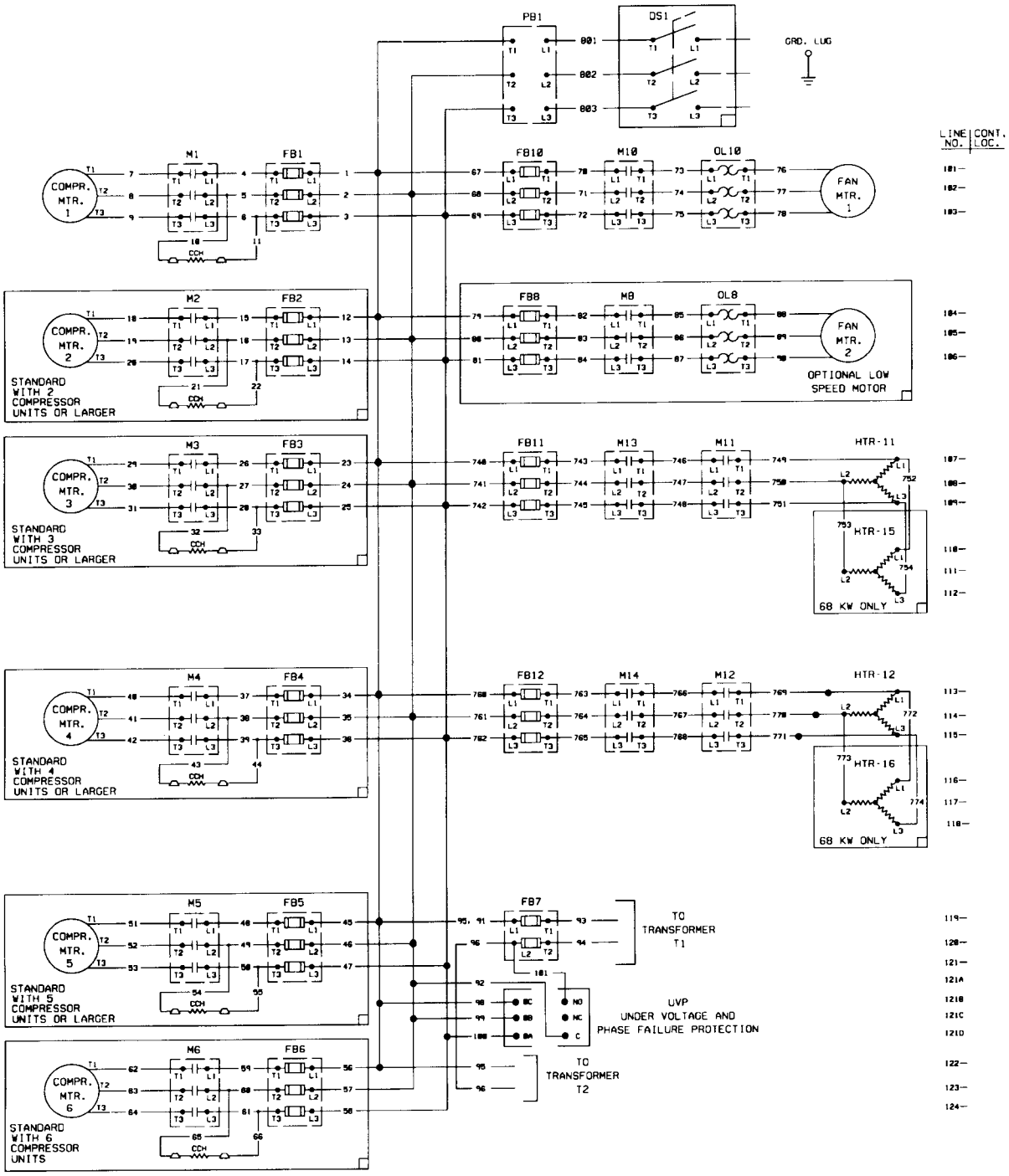
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Figure 10. Electrical Schematic Legend



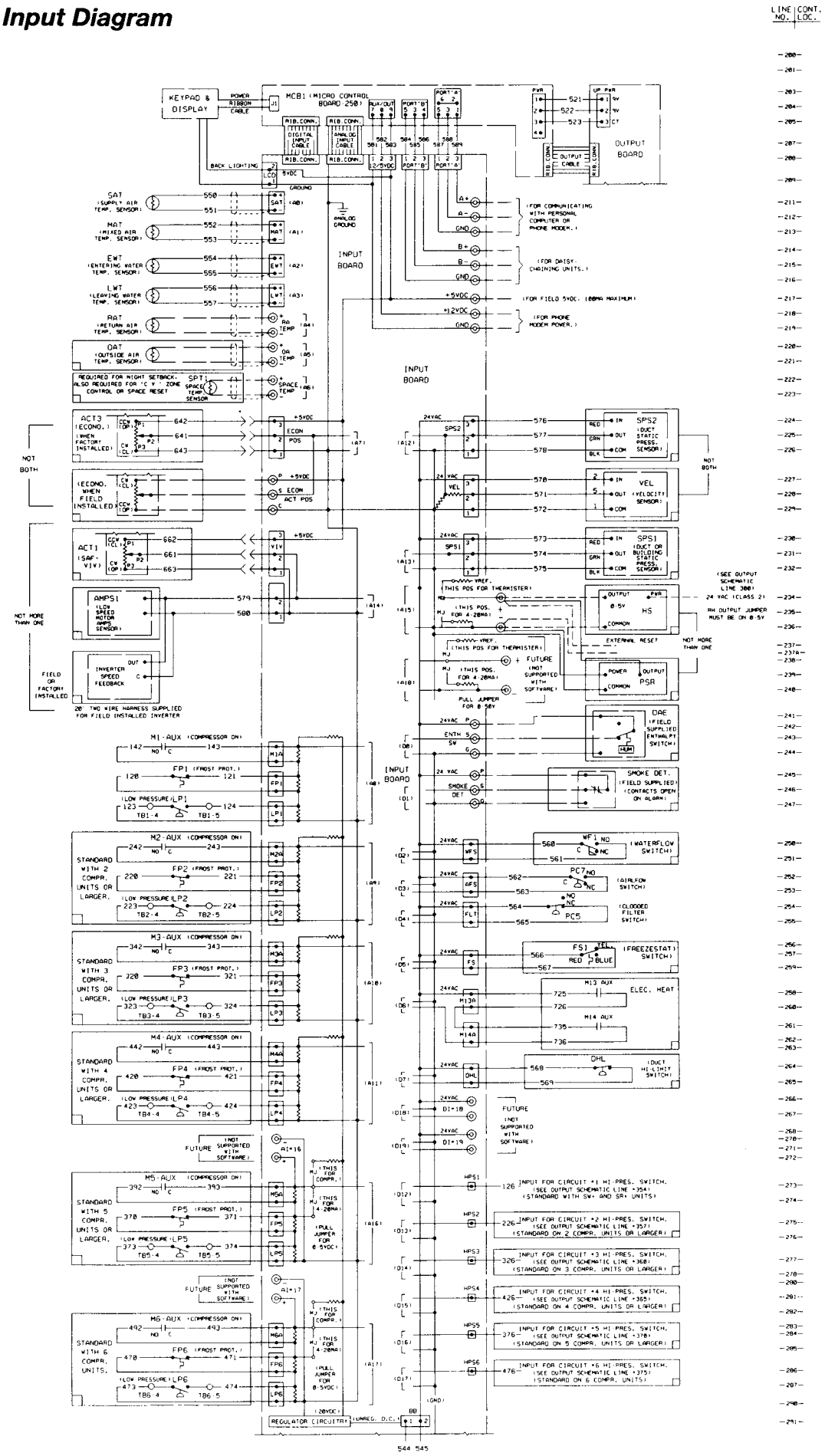
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Figure 11. Power Schematic



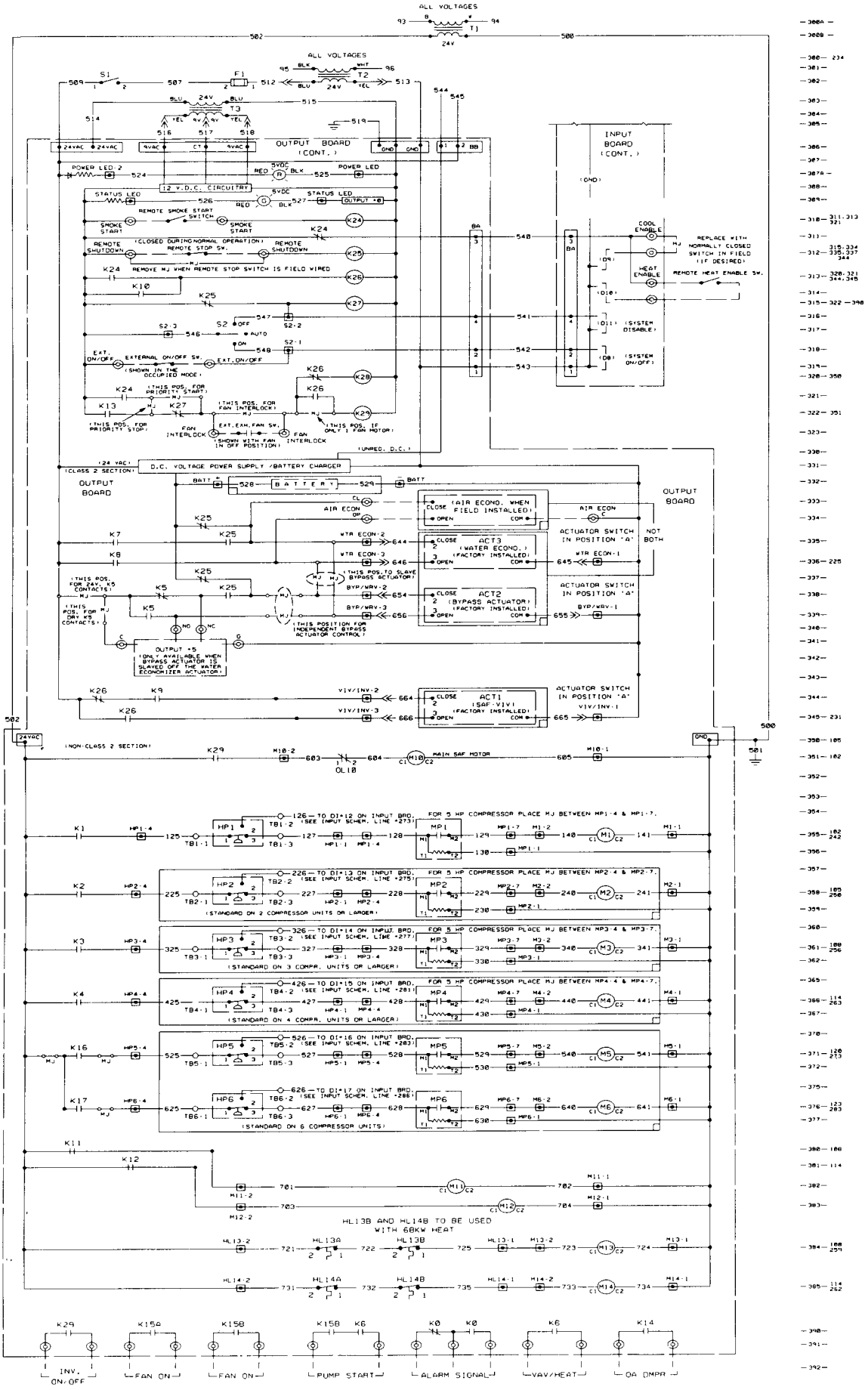
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Figure 12. Input Diagram



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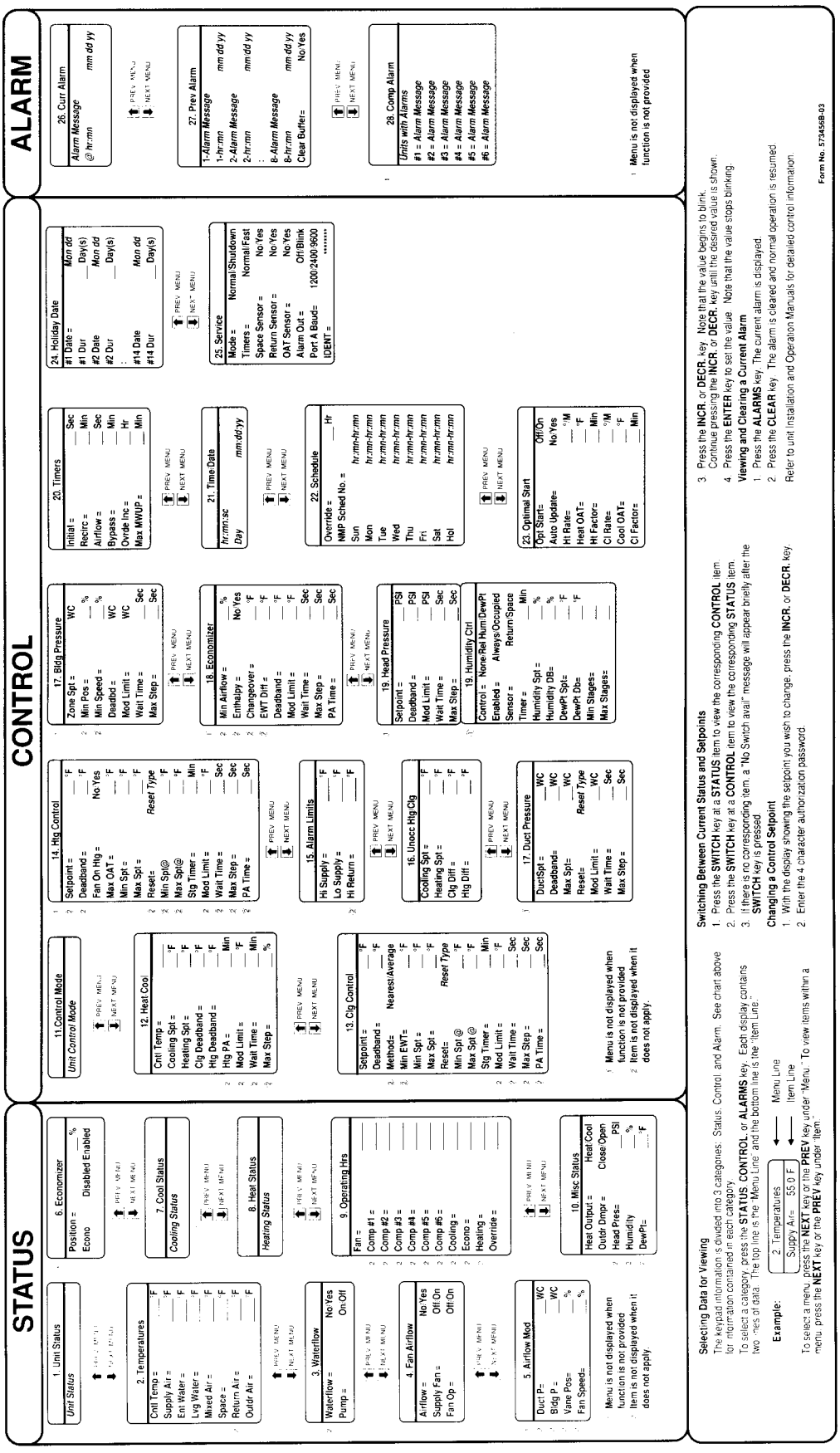
Figure 13. Output Diagram



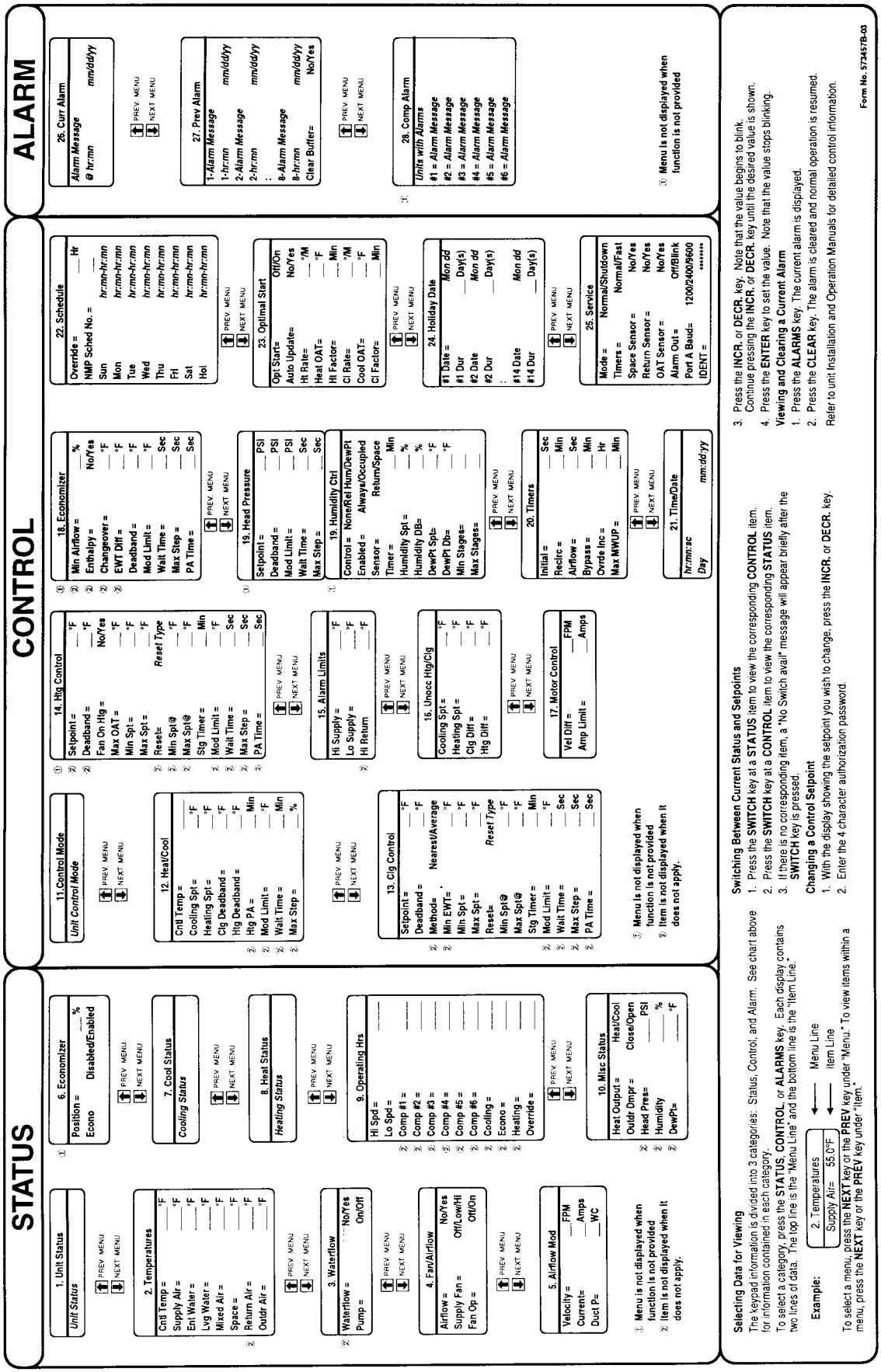
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Keypad Menu/Item Guide

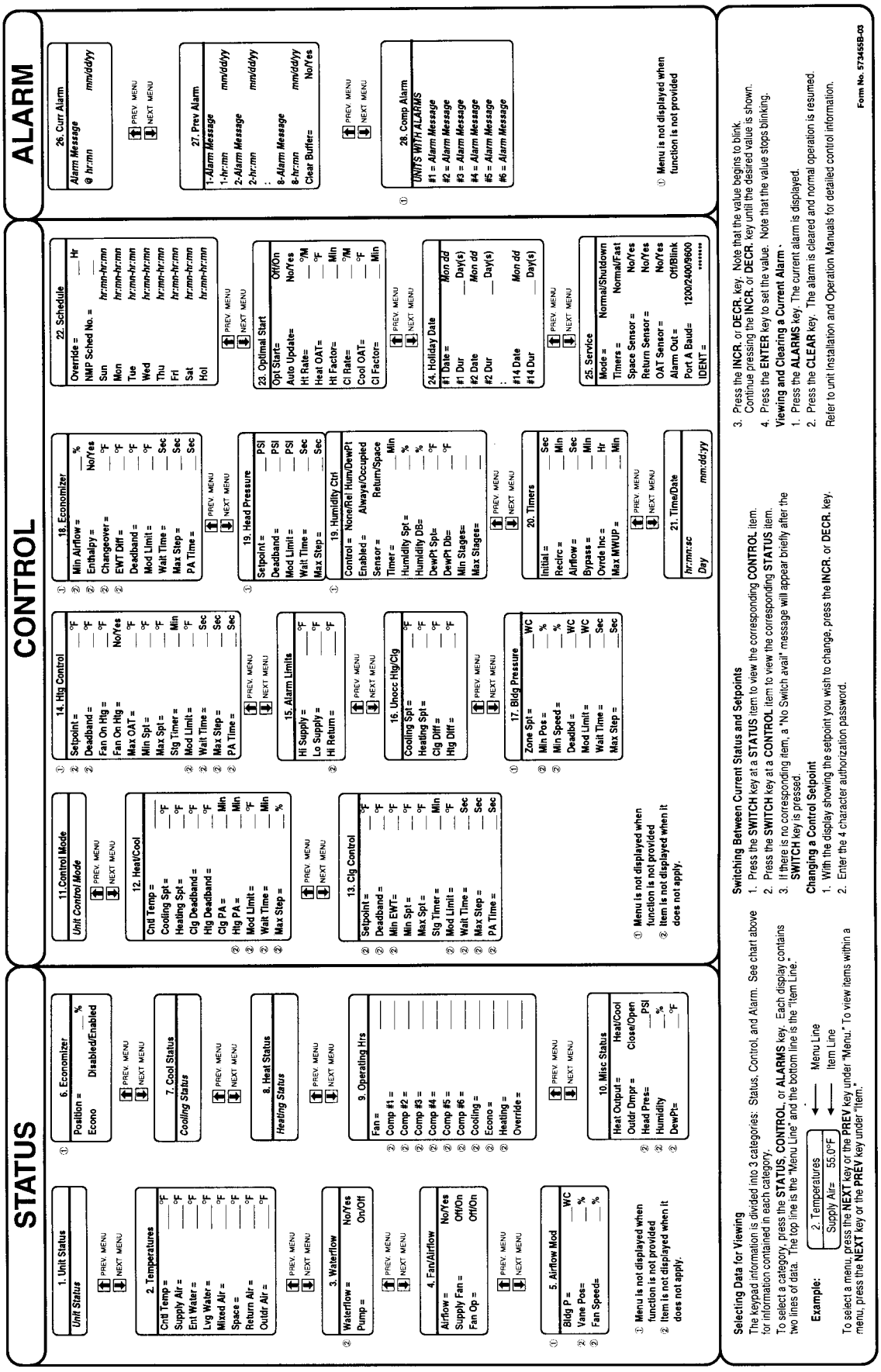
Supply Air Temperature Control with One Fan Motor



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Test Procedures

When troubleshooting the various MicroTech components, it may be necessary to remove power to the controller by opening system switch S1 in the main control panel.

A listing of MicroTech related part numbers is included in the "Parts List" section of this manual. If MCB1 must be replaced, refer to the "MCB1 Replacement" section of this manual.

Status LED Diagnostics

The MCB1 status LED indications can aid in controller diagnostics. If the status LEDs do not operate normally as described in the "Component Data" section of this manual (see Tables 3 and 4), there is a problem with MCB1. 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 LED's Off

If the red and green LED's 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.

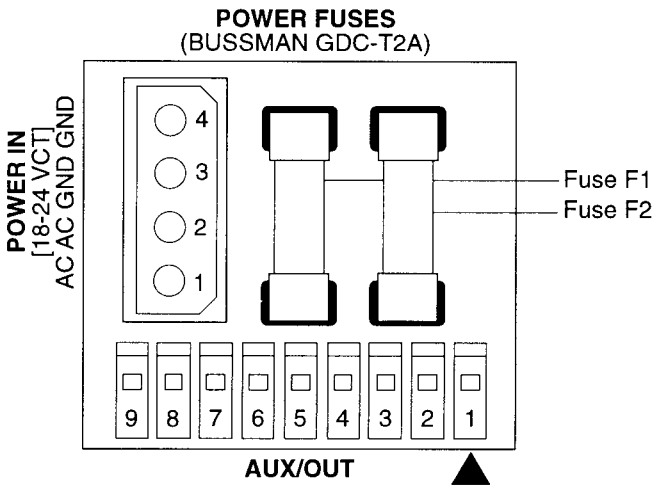
Amber LED Off and Green LED On

The following conditions are true when Menu 25. Alarm Out= Blink. If the amber LED is off and the green LED is on, the programmed routines are not executing for some reason. Try downloading new software into MCB1. (This requires a PC and appropriate Monitor and controller software.) If the download does not correct the problem, MCB1 is defective and must be replaced.

Troubleshooting Power Problems

Transformers T1, T2, and T3 provide power to the MCB1 controller, Output Board and Input Board. A problem that exists in any of these components can affect the entire control system. Power problems can be caused by a 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 that this procedure may require two or three spare MCB1 fuses (see parts list). Refer to the unit wiring diagrams or Figures 10 - 13 as you proceed.

Figure 14. MCB1 Power Supply Terminals



MCB1 Blown Fuse Problem

1. Verify that system switch S1 is closed.
2. Check for 18 VAC at Up PWR outside terminals on the Output Board (see Figure 4).
   If 18 VAC is not present, go to step 3.
   If 18 VAC is present, Output Board is functioning properly. Go to step 4.
3. Remove power from the controller by opening system switch S1.
   Close S1 and check the input voltages at terminals 9 VAC, CT, and 9 VAC at terminal block TS1 on the Output Board. The voltage between terminals 9 VAC and 9 VAC should be 18 VAC. The voltage between CT and either 9 VAC terminal should be 9 VAC. If the proper voltages are present, the Output Board is defective and must be replaced. If the proper voltages are not present, check the wiring and transformers T1 and T2.
4. Check for 18 VAC between the AC terminals on the MCB1 Power In terminal strip (see Figure 4). If 18 VAC is present, go to step 5.
   If 18 VAC is not present, check the wiring and connections between the Output Board Up PWR terminals and the MCB1 Power In terminals.
5. Remove power from the controller (open S1). Check MCB1 power supply input fuses F1 and F2 (see Figure 14).
   If the a fuse is blown, replace it. Go to step 6.
   If the fuses are intact, MCB1 is defective.
6. Disconnect all connectors from MCB1 except for the Power In plug. Cycle power to the controller (close and then open S1). Check MCB1 fuses F1 and F2.
   If a fuse does not blow, go to step 7.
   If a fuse blows, MCB1 is defective.
7. Reconnect the keypad/display ribbon cable. Cycle power to the controller (close and then open S1). Check MCB1 fuses F1 and F2.
   If a fuse does not blow, go to step 8.
   If a fuse blows, the keypad/display or the connecting ribbon cable is defective.
8. Reconnect the analog input ribbon cable. Cycle power to the controller (close and then open S1). Check MCB1 fuse F1 and F2.
   If a fuse does not blow, go to step 9.

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If a fuse blows, Input Board or the connecting ribbon cable is defective.

9. Reconnect the digital input ribbon cable. Cycle power to the controller (close and then open S1). Check MCB1 fuse F1 and F2.
   If a fuse does not blow, go to step 10.
   If a fuse blows, Input Board or the connecting ribbon cable is defective.
10. Reconnect the digital output ribbon cable. Cycle power to the controller (close and then open S1). Check MCB1 fuse F1 and F2.
    If a fuse does not blow, go to step 11.
    If a fuse blows, Output Board or the connecting ribbon cable is defective.
11. The problem is indeterminate. Obtain factory service.

Input Board Problems

The Input Board receives voltage from three sources:

1. 5 and 12 VDC through the 12/5 VDC terminal. This DC voltage comes from the MCB1 Aux/Out terminal. The 12/5 DC power is available for phone modem, keypad display, economizer potentiometer, VIV potentiometer, and 5 VDC for field use up to 100mA.
2. 12 VDC through the BA terminal. This voltage comes from the Output Board. The 12 VDC provides power for system disable, heat enable, cool enable, and system on/off.
3. 30 VDC through the BB terminal. This voltage comes from the Output Board. The 30 VDC is used to power the remaining analog and digital inputs.

Start troubleshooting input board problems by determining if the proper voltage is being provided. Use the wiring diagrams to determine the terminal providing the voltage. If the proper voltage is not available, trace the power supply path with the following information for each Input Board power supply terminal:

1. 12/5 VDC terminal power supply path
   - 12 and 5 VDC at Aux/Out terminal on MCB1 controller
   - 18 VAC at Power In on MCB1
   - 18 VAC at UP PWR terminal on Output Board
   - 18 VAC at terminal block TS1 on the Output Board. Measure the 18 VAC across the two 9 VAC terminals.
   - 18 VAC at transformer T3. Measure the 18 VAC across the two 9 VAC terminals.
2. BA terminal power supply path
   - 12 VDC at BA terminal on the Output Board
   - 18 VAC at terminal block TS1 on the Output Board. Measure the 18 VAC across the two 9 VAC terminals.
   - 18 VAC at transformer T3. Measure the 18 VAC across the two 9 VAC terminals.
3. BB terminal power supply path
   - 30 VDC at BB terminal on the Output Board
   - 24 VAC at terminal block TS1 on the Output Board. Measure the 24 VAC from the 24VAC CL2 terminal to a GND terminal.
   - 24 VAC at transformer T2.

Use the wiring diagrams and the proper power supply path to determine the point were the failure is occuring for the suspect component in question.

Output Board Problems

The Output Board receives power from three sources:

1. 18 VAC at terminal block TS1 across both 9 VAC terminals. The 18 VAC for these terminals is supplied directly from transformer T3. This voltage is converted by the Output Board to supply the 12 VDC circuitry.
2. 24 VAC Class II at terminal block TS1 across terminal 24 VAC CL2 and a GND terminal. The 24 VAC for these terminals is supplied directly from transformer T2. This voltage is converted by the Output Board to supply the 30 VDC circuitry.
3. 24 VAC at terminal block TB1. The 24 VAC for these terminals is supplied directly from transformer T1. This voltage is used by the Output Board for compressor, heat, and chilled water outputs.

Start troubleshooting Output Board problems by determining if the proper voltage is being provided. Use the wiring diagrams to determine the terminal providing the voltage. If the proper voltage is not available, trace the power supply path for each Output Board power supply terminal. Use the wiring diagrams and the proper power supply path to determine the point where the failure is occurring.

LED Lit, Output Not Energized

If the LED of a suspect output is lit but the load connected to it is not energized, everything is intact between MCB1 and the coil side of the relay. Perform the following procedure to isolate the problem:

1. Verify that 12 VDC power is present at the suspect output relays plug terminal on the output board.
2. Remove power from the controller by opening system switch S1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation; for example, K0. Restore power by closing S1.
   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.

Contact Chatter

Contact chatter is very rapid opening and closing of contacts. It is usually caused by low voltage at the electromechanical relay. If contact chatter is occurring on a relay connected to one of the output board electromechanical relays, it is possible that a faulty connection exists on the power supply terminals on the Output Board. Contact chatter can also be caused by a faulty electromechanical relay. Perform the following procedure to isolate the problem:

1. Verify that the voltage at the load's power supply and at the electromechanical relay contact is adequate.
2. Remove power from the controller by opening system switch S1. Swap the suspect relay with a known good relay. Try to choose a relay that will not affect unit operation; for example, K0. Restore power by closing S1.
   If the chatter does not stop, go to step 3.
   If the chatter stops, the suspect relay is bad. Replace the relay.
3. Remove power from the controller by opening system switch S1. Try to improve the connections at the proper power supply terminals on the Output Board. Restore power by closing S1.
   If the chatter does not stop, the electromechanical relay is probably defective.

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Troubleshooting Analog Input Problems

The controller receives its analog inputs through terminal strip H2 on the Input Board. Following are procedures that can be used to isolate analog input problems. Refer to the unit wiring diagrams or Figures 10–13 as you proceed.

Open or Shorted Temperature Sensor Circuits

The cause of a temperature sensor failure type of alarm is usually an open or shorted sensor circuit. If this type of alarm occurs, the specific temperature sensor that failed will be displayed on menu 26 of the keypad/display. The controller can assist in the diagnosis by displaying either "open" or "short" instead of a temperature value on menu 2 of the keypad/display. (See any of the operation manuals for information on using the keypad/display.)

If a sensor failure alarm occurs, check menu 2, and then check the sensor circuit wiring for shorts or disconnections. If the sensor circuit wiring and connections are intact, the sensor is probably defective. Verify this by performing the following "Erroneous Temperature Readings" procedure.

Erroneous Temperature Readings

If it is suspected that the controller is operating using erroneous temperature data, the following procedure can be used to check for problems:

1. Verify that the MCB1-to-Input Board and MCB1-to-keypad/display ribbon cable connections are proper. Look for bent pins.
2. Measure the temperature at the suspect sensor using an accurate thermometer.
3. Determine the sensor's analog input number and associated Input Board terminals. Refer to the unit wiring diagrams.
4. Remove power from the controller by opening system switch S1. Remove the sensor connectors from Input Board and measure the resistance of the sensor (through the plug connector terminals). Using the thermistor chart (Table 14), compare this value with the measured temperature.
   If the measured resistance and temperature match, Input Board or MCB1 may be defective. Go to step 5.
   If the measured resistance and temperature do not match, either there is a wiring problem or the sensor is defective. Check the sensor circuit wiring and connections for defects.
5. Replace the sensor connector and then restore power to the controller by closing system switch S1. Measure the DC voltage across the sensor terminals. Using the thermistor chart, compare this value with the measured temperature.

   If the measured voltage and temperature match, MCB1 is probably defective.

   If the measured voltage and temperature do not match, Input Board is probably defective (this assumes sensor and circuit are intact).

Table 14. Thermistor Chart

°F	Ohms	Volts	°F	Ohms	Volts	°F	Ohms	Volts
15	16,104	4.145	77	3000	2.373	139	761	0.932
16	15,627	4.124	78	2927	2.343	140	746	0.917
17	15,166	4.102	79	2857	2.313	141	731	0.902
18	14,720	4.080	80	2789	2.283	142	717	0.888
19	14,288	4.057	81	2723	2.253	143	703	0.874
20	13,871	4.034	82	2658	2.223	144	689	0.859
21	13,467	4.011	83	2595	2.194	145	676	0.846
22	13,076	3.988	84	2534	2.164	146	662	0.831
23	12,698	3.964	85	2474	2.135	147	649	0.818
24	12,333	3.940	86	2416	2.106	148	637	0.805
25	11,979	3.915	87	2360	2.077	149	625	0.792
26	11,636	3.890	88	2305	2.049	150	613	0.779
27	11,304	3.865	89	2251	2.020	151	601	0.766
28	10,983	3.839	90	2199	1.992	152	589	0.753
29	10,672	3.814	91	2149	1.965	153	578	0.741
30	10,371	3.788	92	2099	1.937	154	567	0.729
31	10,079	3.761	93	2051	1.909	155	556	0.717
32	9797	3.734	94	2004	1.882	156	546	0.706
33	9523	3.707	95	1959	1.855	157	535	0.694
34	9258	3.608	96	1914	1.828	158	525	0.683
35	9002	3.653	97	1871	1.802	159	516	0.673
36	8753	3.625	98	1829	1.775	160	506	0.661
37	8512	3.597	99	1788	1.750	161	496	0.650
38	8278	3.569	100	1747	1.724	162	487	0.640
39	8052	3.540	101	1708	1.698	163	478	0.629
40	7832	3.511	102	1670	1.673	164	469	0.619
41	7619	3.482	103	1633	1.648	165	461	0.610
42	7413	3.453	104	1597	1.624	166	452	0.599
43	7213	3.424	105	1562	1.600	167	444	0.590
44	7019	3.394	106	1528	1.576	168	436	0.580
45	6831	3.365	107	1494	1.552	169	428	0.571
46	6648	3.335	108	1461	1.528	170	420	0.561
47	6471	3.305	109	1430	1.505	171	413	0.553
48	6299	3.274	110	1398	1.482	172	405	0.544
49	6133	3.244	111	1368	1.459	173	398	0.535
50	5971	3.213	112	1339	1.437	174	391	0.527
51	5814	3.183	113	1310	1.415	175	384	0.518
52	5662	3.152	114	1282	1.393	176	377	0.510
53	5514	3.121	115	1254	1.371	177	370	0.501
54	5371	3.078	116	1228	1.350	178	364	0.494
55	5231	3.059	117	1201	1.328	179	357	0.485
56	5096	3.028	118	1176	1.308	180	351	0.478
57	4965	2.996	119	1151	1.287	181	345	0.471
58	4838	2.965	120	1127	1.267	182	339	0.463
59	4714	2.934	121	1103	1.247	183	333	0.456
60	4594	2.902	122	1080	1.227	184	327	0.448
61	4477	2.871	123	1058	1.208	185	321	0.441
62	4363	2.839	124	1036	1.189	186	316	0.435
63	4253	2.808	125	1014	1.170	187	310	0.427
64	4146	2.777	126	993	1.151	188	305	0.421
65	4042	2.745	127	973	1.133	189	299	0.413
66	3941	2.714	128	953	1.115	190	294	0.407
67	3842	2.682	129	933	1.097	191	289	0.400
68	3748	2.651	130	914	1.079	192	284	0.394
69	3655	2.620	131	895	1.062	193	280	0.389
70	3565	2.589	132	877	1.045	194	275	0.382
71	3477	2.558	133	859	1.028	195	270	0.376
72	3392	2.527	134	842	1.012	196	266	0.371
73	3309	2.496	135	825	0.995	197	261	0.364
74	3228	2.465	136	809	0.980	198	257	0.359
75	3150	2.434	137	792	0.963	199	252	0.353
76	3074	2.404	138	777	0.948	200	248	0.348

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Erroneous Pressure Readings

If it is suspected that the controller is operating using erroneous pressure data, the following procedure can be used to check for problems:

1. Verify that the MCB1-to-Input Board and MCB1-to-keypad/display ribbon cable connections are proper. Look for bent pins.
2. Verify that there is 24 VAC between the suspect transducer's "In" terminal and ground.
3. Using an accurate manometer or gauge, measure the same pressure that the suspect transducer is sensing. Do this by tapping into the transducer's high and low pressure tubing or by locating the measurement device's taps next to the transducer's taps.
   Caution: The fittings on the pressure transducers are fragile. It is recommended that a tee fitting be spliced into each tap tube instead of removing each tap tube from its transducer fitting. Use an airtight cap to cover the test port after the pressure measurement.
   Note: If the suspect sensor is measuring duct static or building static pressure, verify that the high and low pressure taps have been properly installed. An improper pressure tap installation can cause severe fluctuations in the sensed pressure. Refer to the model-specific installation manual for more information (see Table 2).
4. Determine the transducer's analog input number and associated Input Board terminals. Refer to the unit wiring diagrams.
5. Measure the DC voltage across the transducer. Using Figure 15 or 16, compare this value with the measured pressure.
   If the measured voltage and pressure do not match, there may be a wiring problem or the transducer may be defective. Check the transducer input circuit wiring and connections for defects. Go to step 6.
   If the measured voltage and pressure match, Input Board or MCB1 is probably defective.
6. Remove power from the controller by opening system switch S1. If available, swap a similar good transducer with the suspect transducer; otherwise, try installing a new transducer. Restore power by closing S1, and verify whether the suspect transducer is bad.
   If it is not bad, either MCB1 or Input Board is defective.

Figure 15. Pressure Transducer Voltages: Duct Static

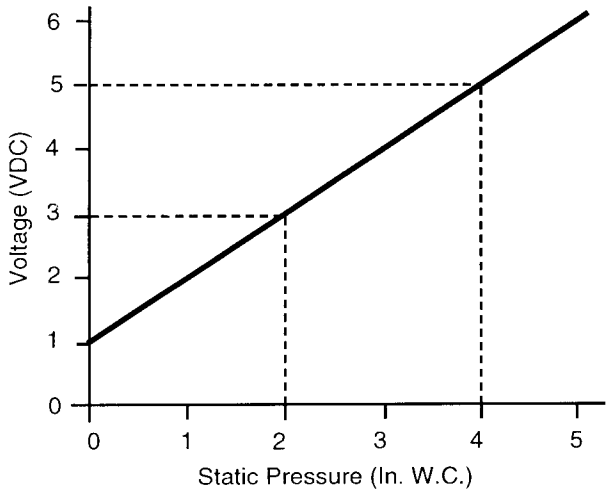
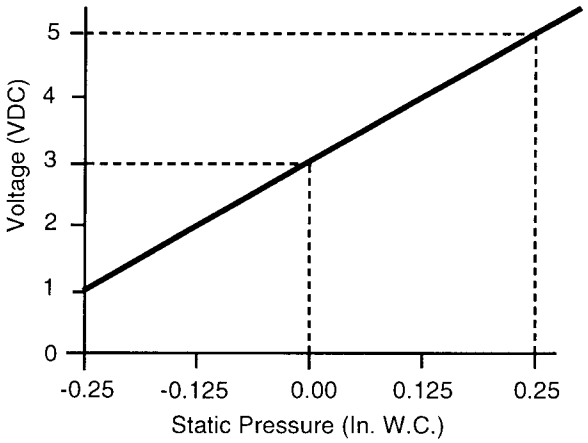


Figure 16. Pressure Transducer Voltages: Building Static



Troubleshooting Nuisance Compressor Alarms

Nuisance alarms from Frost or Low Pressure alarms may be caused by a faulty connection at the sensor. A faulty connection at the Frost switch could cause a Low Pressure Alarm or visa versa.

Procedure for troubleshooting this problem:

1. Remove the LP* and FP* connections on the input board.
2. Take resistance readings across the removed LP* and FP* wires leading to the sensors.
3. If a sensor is tripped the resistance will be close to zero. The alarm for a tripped sensor should be activated.
4. If a sensor is not tripped the resistance reading will be infinite. The alarm for a non-tripped sensor should not be activated.
5. If a sensor has a resistance other than near zero or infinite, the resistance may be caused by a faulty connection at the sensor. The extra resistance from a faulty connection causes the controls to activate the Frost or Low Pressure alarm.
6. Secure the faulty connections to remove the extra resistance from the circuit.

Troubleshooting the Keypad/Display

The keypad/display is connected to MCB1 via a 26-conductor ribbon cable. MCB1 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 temperatures. If the display is difficult to read, adjust the contrast trim pot, which is located on the back of the keypad/display assembly.

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 switch S1 for approximately 10 seconds and then closing system switch S1 (see note below).
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 key-

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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 MCB1. Look for bent pins. Restore power after reconnecting the ribbon cable.
4. Try swapping a known good ribbon cable and keypad/display. (These may come, for example, from another self-contained controller or an RMC Panel.) 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.

Note: The keypad/display and MCB1 must be powered up together; otherwise, the display will be blank. Therefore, if the keypad/display is ever disconnected from MCB1 and then reconnected, power to the controller must be cycled to restore the display. You can cycle power to the controller by opening switch S1 for approximately 10 seconds and then closing system switch S1.

If an MCB1 board is defective and must be replaced, its unit-specific software must be loaded into the replacement controller. This can be done either at the factory or at the building site—if a PC equipped with appropriate Monitor software is available.

MCB1 Replacement

The software part number and software configuration code are recorded and stored at the factory when each unit is built and tested. A replacement MCB1 board can be loaded with this software at the factory before it is shipped, but to do this, the factory needs the unit serial number and any information relating to software changes made since the unit was shipped. (Pertinent software changes include downloads of new programs or changes to memory locations; they do not include normal changes made at the keypad.) This information must be included with the replacement MCB1 part order; otherwise, the MCB1 board will be shipped without software.

Job-specific Monitor software includes each unit and auxiliary controller's program code. Therefore, it is possible to download the proper controller software to a replacement MCB1 at the building site if a PC equipped with that job's Monitor software is available. In addition, if the configuration data was stored on the PC hard drive prior to the MCB1 failure, the exact configuration data (including all keypad programmable setpoints and parameters) can be restored. Refer to the user's manual supplied with the Monitor software for more information.

Parts List

Component Designation	Description	Part No.
MCB1	Microprocessor Control Board	065487306
Input Board	Input Board	073379901
Output Board	Output Board	073379801
	Cable Ribbon 48"	065497703
	Cable Ribbon 42"	067780401
	Cable Ribbon 20"	067780601
	Electromechanical Relay SPST	072504201
	Electromechanical Relay DTDP	072504301
	Fuse: MCB1 Input Power, 2 amp (Bussman No. GDC-2A)	065822001
	Fuse: MCB1 Communication Ports, 0.25 Amp	065821901
MAT	Mixed Air Temperature Sensor	070583002
SAT	Supply Air Temperature Sensor	070583002
OAT	Outdoor Air Temperature Sensor	070583002
EWT	Entering Water Temperature Sensor	070583002
LWT	Leaving Water Temperature Sensor	070583002
RAT	Return Air Temperature Sensor	070583003
SPS1	Static Pressure Sensor	049545005
SPS2	Static Pressure Sensor	049545005
	MicroTech Panel Assembly includes:	072310401
	Panel	072610401
	Keypad	065497202
	Rocker Switch	072402801
	Connector	072405801
	Red Lamp	065810801
	Green Lamp	065810802
T3	Transformer: 24/18 VAC, Center Tap	046738114
	Modem Kit	063585001
	PC Communications Cable Kit	057186802

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