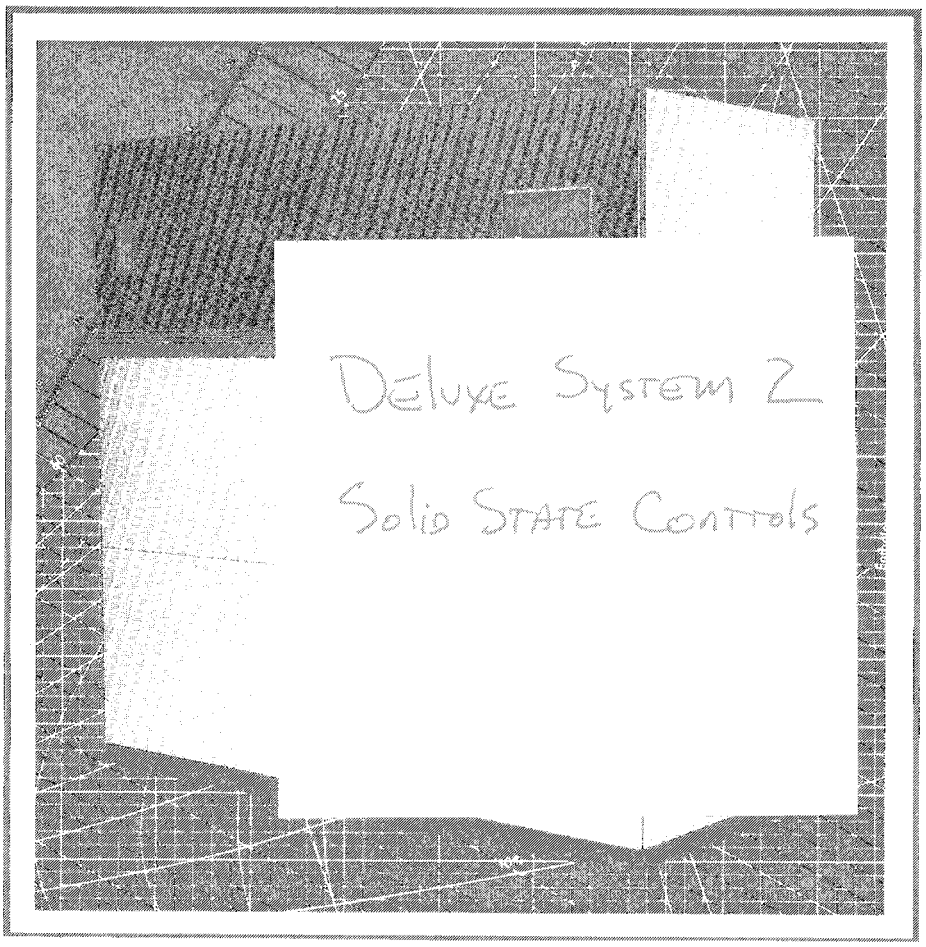
Liebert
Keeping Business in Business™

Deluxe System 2 Solid State Controls

CONTROLS OPERATION MANUAL



Precision environmental control for computer rooms

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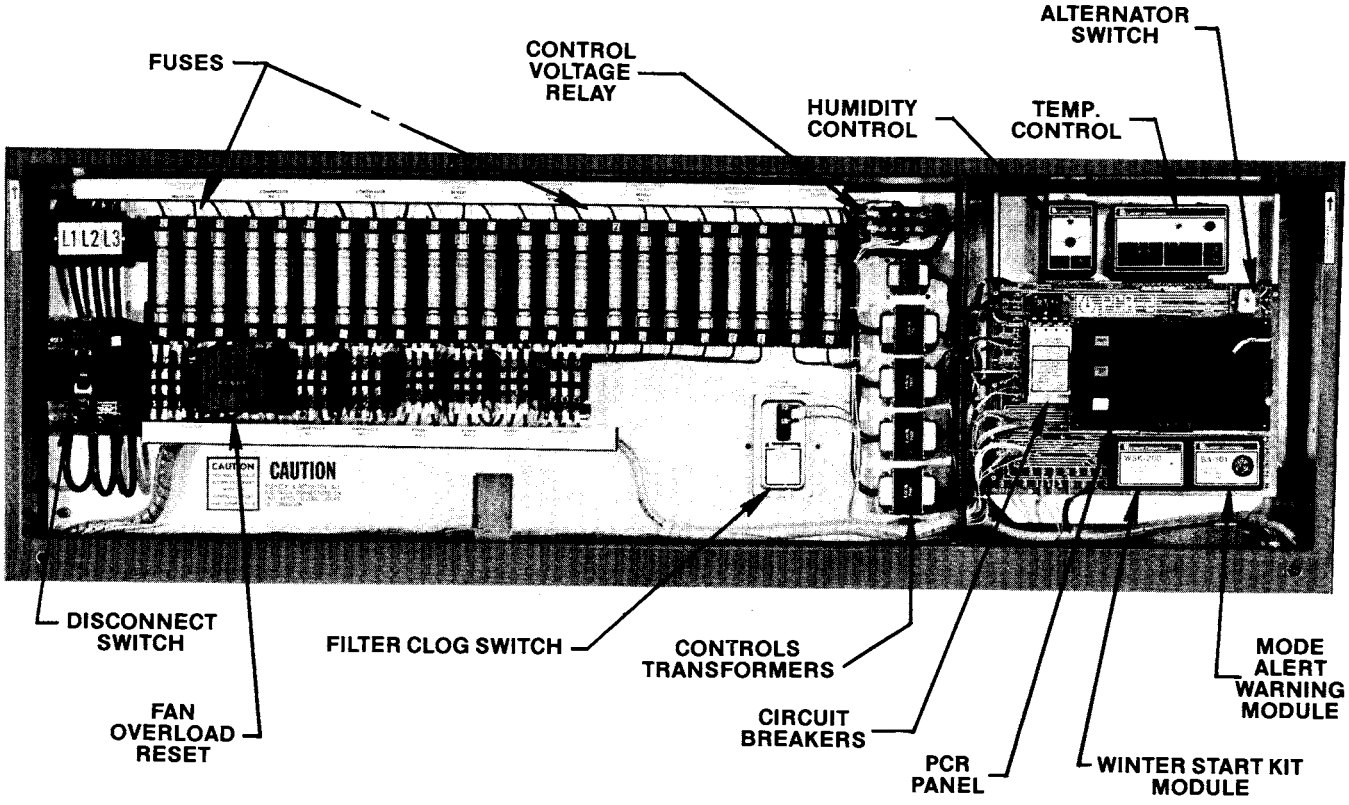


INTRODUCTION

The Precision Control Readout panel is an integrated solid state control system for Liebert computer room air conditioning units. This system utilizes the latest technology in the art of solid state circuitry, packaging, and plug in components.

The "heart" of this system is the large double sided printed circuit board into which all plug-in modules are fastened. All connections, to and from the board, are made through the means of printed circuit board connectors and wiring terminals. Connecting, through solid state circuitry, the various control input and output to valves, contactors, relays, etc. eliminates much of the control circuit wiring thus reducing the possibility of error or poor connections.

PRECISION CONTROL READOUT PANEL

Description

This panel contains three switches. The red STOP switch, when lighted, indicates the main power is on to the unit, but unit is not running. The green START switch, when lighted indicates the unit is in operation. The SILENCE switch, not lighted, turns off the alarm buzzer but leaves any warning lights and the common message on.

A shadow box indicates the mode of operation called for by the controls. These may include: Cooling 1, Cooling 2, Reheat 1, Reheat 2, Reheat 3, Dehumidification or Humidification.

Replace Lights

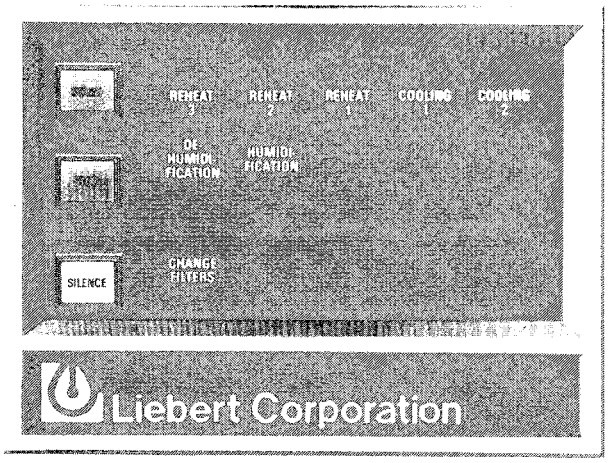
Lights on the switches can be replaced by grasping the individual switch cover and pulling straight out. The plug in bulb will come out with the cover.

To replace other lights, in the readout panel, remove plastic clips and pull panel cover straight out exposing plug-in type bulbs.

The switches S1 and S2 are soldered to the board. Relay R4 is a plug in unit behind board.

TABLE

DESCRIPTION	SYMBOL	PART NO.
LAMPS	ALL	G-1390
START SWITCH	S1	G-1330
STOP SWITCH	S2	G-1340
RELAY (POWER)	R4	G-1360
COVER PLATE	—	Y-003B
CLIPS	—	G-1710
SILENCER SWITCH	SL	G-1350



PCR-2 PANEL STANDARD

P C R 2 PRINTED CIRCUIT BOARD

Description

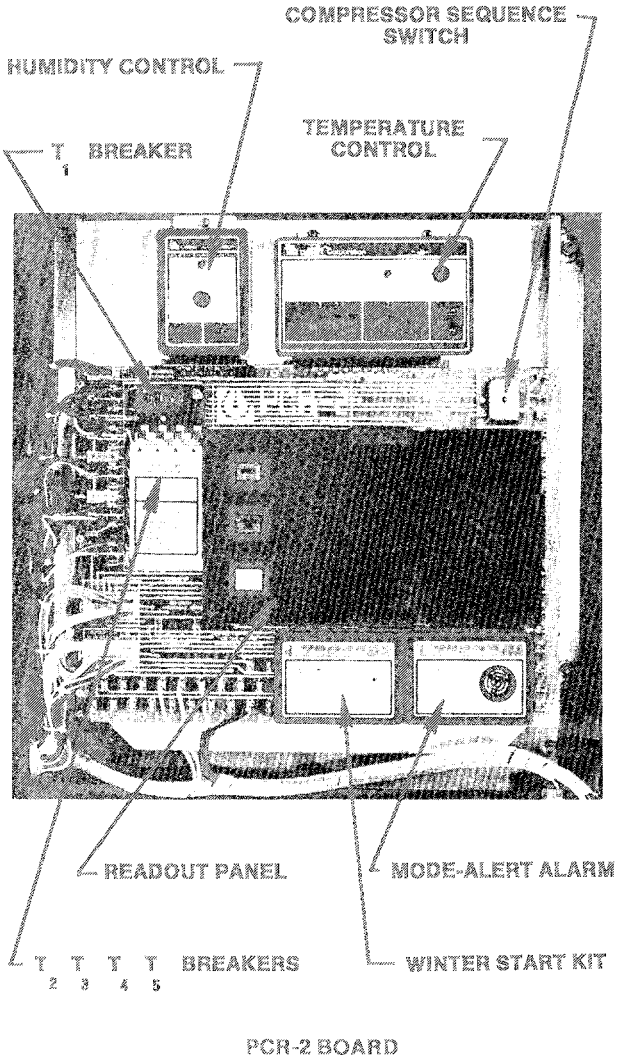
The basic board is a printed circuit carefully designed to accept all necessary and optional controls, indicators and low voltage wiring terminals. This board is arranged to allow the service man to accomplish most of his control circuit trouble shooting from one location.

All controls and wiring utilize plug-in features.

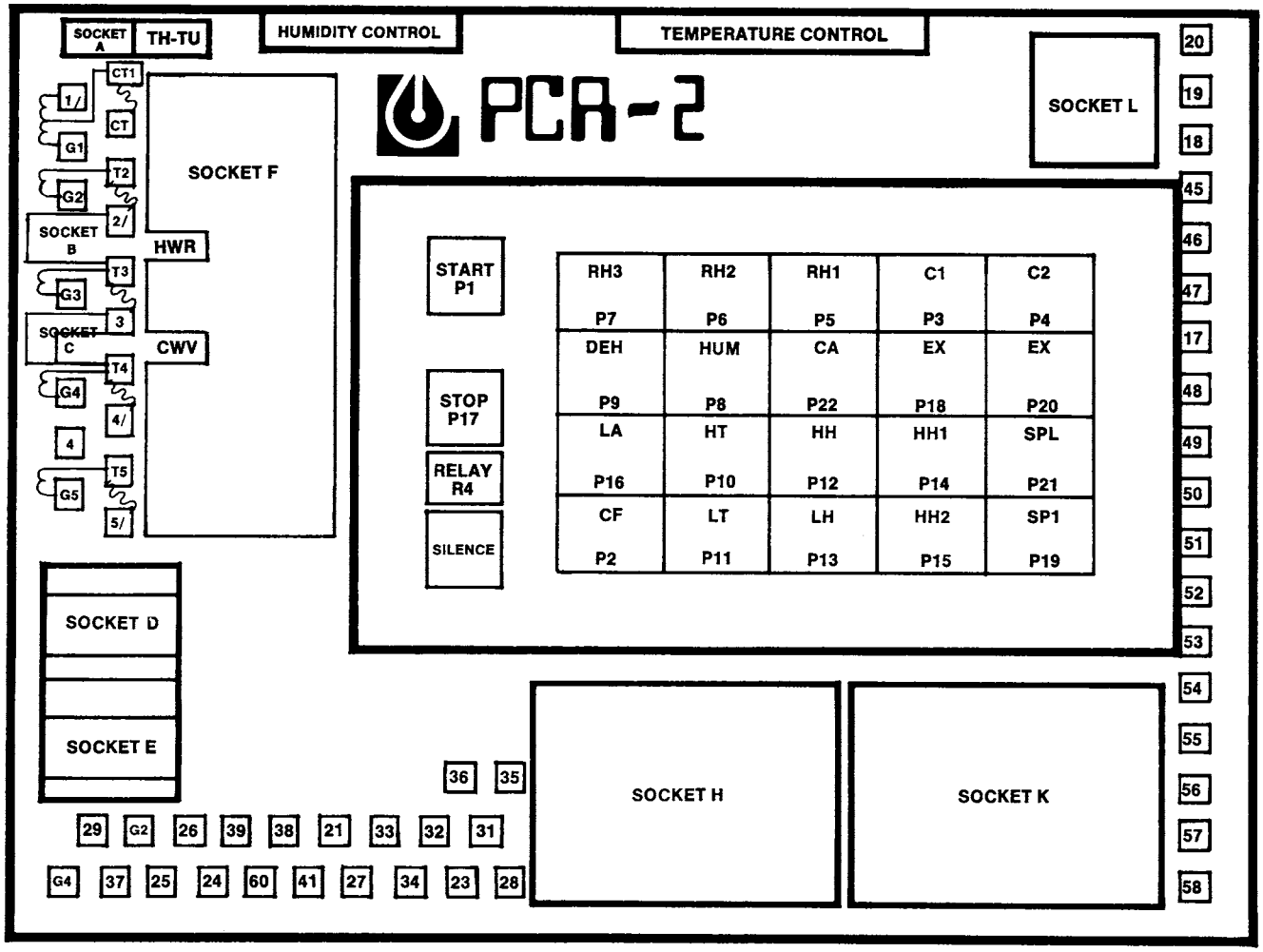
Testing

Testing of the printed circuit is not necessary as this is varified while checking other components.

MODEL	DESCRIPTION	PART NO.
PCR-2	PCR-2 BOARD (WITHOUT MODULES)	T2000 S-A



PCR-2 BOARD



PCR-2 BOARD SOCKET IDENTIFICATION

Socket A

The temperature sensor (TH) and humidity sensor (HU) are connected to the PCR-2 board through a wiring harness plugged into Socket A.

Socket B

The hot water/steam motor is connected to the PCR-2 by a harness at Socket B. The temperature control, Model TU-22M1 or Model TU-M1M1 must be used in conjunction with modulating hot water reheat models.

Socket C

The chilled water modulating motor is connected to the PCR-2 by the wiring harness at Socket C. The temperature control Model TU-M13 or Model TU-M1M1 must be used in conjunction with chilled water models.

Socket D

The contactor section wiring harness plugs into Socket D. All 18-gauge wires of indicated color, which connect the PCR-2 panel to 24-volt coils, contactors, etc. . . . in the contactor section of the electrical panel are in the harness assembly.

Socket E

The compressor section wiring harness plugs into Socket E. All 18-gauge wires, of indicated color, which connect the PCR-2 panel to 24-volt coils, contactors, switches etc. . . . in the areas of the unit other than the contactor section are in this harness assembly.

SOCKET IDENTIFICATION (Continued)

Socket F

The transformer circuit breaker module plugs into Socket F. All transformer secondaries (T1, T2,T3,T4 and T5) are protected in this module.

Socket H

The Winter Start Kit plugs into Socket H. This module is used on air cooled, fan speed control units only.

Socket K

The mode alert warning system plugs into Socket K. Individual sensors for the system are plugged into separate terminals on the PCR-2 board.

Socket L

Socket L is used on DX systems only and either the Jumper board or the compressor sequence switch may be plugged in. Terminals 70, 71, and 72 are located in junction box on wire raceway. These are field connections used to interlock the fan speed control on air cooled units. Matching terminals are provided in fan speed control box on condenser.

Terminals 48 and 49 on the PCR/2 directly connect to parallel lamps on the PCR/2 mode-alert panel. These can be factory wired for special features.

The optional steam humidifier is wired between posts 17 and 26 connected directly to the solenoid.

The optional hot gas reheat is connected directly to terminals G2 and C2 auxiliary contact. See unit wiring diagram for special wiring.

The optional hot gas bypass on one compressor is connected between terminals 33 and 32. It is energized whenever the liquid line solenoid valve is energized.

The optional hot gas bypass for two compressors includes an additional relay, R2. This is connected between terminals 31 and 34, such that when dehumidification is required, the hot gas solenoid valve on compressor 2 is de-energized.

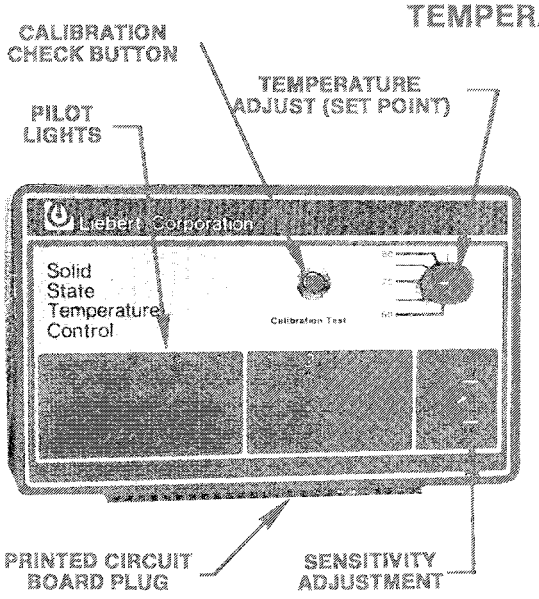
The customer connection between terminals 37 and 38 are located on the side of the wire raceway in the left side piping compartment. Replace the jumper between these terminals with any number of series wired normally closed contacts, such as: Panic Button, remote fire and smoke detection systems, etc. to shut down the unit from a remote source.

The optional factory wired Firestat is wired between terminals 39 and 37. The firestat will shut the unit off when actuated.

The optional infrared humidifier auto flush (LFC) system is connected between terminals 17 and G4.

Remote alarm for sentinel system connects to wires 75 and 76 in junction box on wire raceway in compressor compartment.

TEMPERATURE CONTROL



Description

The temperature controller is a solid state device designed to electronically compare its set point with a signal from the thermistor mounted in the return air stream. A deviation between set point and the air temperature will result in electronic switches closing in sequence to provide power to the control circuits for heating or cooling. A sensitivity selector changes the width of the dead band and temperature change required between functions. "HI" sensitivity produces approximately 2°F dead band (±1°F) and "LO" approximately (±5°F).

When a chilled water or hot water/steam valve is used; the temperature control TUM13, TU22M1, or TUM1M1 emit a modulating D.C. voltage to operate a proportional motor.

TEMPERATURE CONTROL (Continued)

One small box contains all the necessary signal conditioning and switching circuitry. The face of the control displays a CALIBRATION CHECK BUTTON, up to eight pilot lights, a SENSITIVITY ADJUSTMENT KNOB, and a set point TEMPERATURE ADJUSTMENT KNOB.

Their functions are as follows:

1. The pilot lights indicate whether the demand is for heating or cooling and the number of stages called for.
2. The CALIBRATION CHECK BUTTON serves two purposes:
   a. It verifies that the control is calibrated to read to the correct temperature.
   b. It determines if the control is functioning correctly.
3. The TEMPERATURE KNOB adjusts the desired temperature for the conditioned atmosphere.
4. The SENSITIVITY KNOB sets the width of the deadband and the stepping increment between stages.

The sensor is mounted apart from the control in a plug-in cylinder which is easily inserted or removed from a mating socket. The socket can be located either in a conditioned room on a remote panel, or in a return air stream. Two types of sensors are available. One has a perforated cover and the other is totally enclosed. The perforated type is used in conditioned space applications, and the enclosed sensor is used in an air stream application, such as a return air plenum.

The control mates with the mounting bracket via a 25-contact edge connector. The bracket interfaces the control to the air conditioning electrical circuit via a screw terminal or quick disconnect strip.

Check Out Procedure — Control TU-223

CAUTION: *ALWAYS* turn all power to the control "OFF" before inserting or removing the control from its socket. The control can be permanently damaged if the power remains on while plugging it in or removing it.

I. Wiring

Input voltage to the control's solid-state logic network is regulated so that the control functions properly only when used with a center tapped supply voltage from a minimum of 22 VAC to a maximum of 28 VAC. The center tap must vary with the supply voltage at a perfect 2:1 ratio (22 volt supply, 11 volt center tap; 26 volt supply, 13 volt center tap).

Other input voltages come into the control to power the output to the electrical control circuit of the air conditioning unit. These voltages come in at separate terminals and are isolated from the solid-state circuit which contains the logic. Thus, when the logic portion of the control circuit triggers the triacs, they in turn switch the power coming in between the various output terminals.

NOTE: Before installing the Temperature Control or sensor element, refer to pages 29 and 30 and perform the following checks with the power on.

NOTE: All readings should be made with a Simpson 260 or equivalent. The ground lead of the test instrument must not be connected to the instrument chassis. Line operated meters should not be used.

1. The voltage from terminal (G1) (ground) to terminal (11) should read 24 VAC.
2. The voltage from terminal (G1) (ground) to terminal (CT) should read 12 VAC.
3. The voltage from terminal (11) to terminal (CT) should read 12 VAC.
4. The power should be OFF for check #4. The resistance from terminals [11] to [12], [11] to (G1) (ground), and [12] to (G1) (ground) should read infinity (no continuity). (sensor element is unplugged)

NOTE: Refer to Diagram — Pages 29 and 30

   a. The voltage from terminal (2) to the ground line of the transformer which supplies terminal (G2) should be 24 volts.
   b. The voltage from terminal (3) to the ground line of the transformer which supplies terminal (G3) should be 24 volts.

Once the above checks have been performed and power turned "OFF", the control and sensor may be plugged into their mating sockets.

Power may now be reapplied to the control circuitry.

Checkout Procedure
TU-22MI or TU-MIMI Temperature Control:
Heating

1. Only the output voltage from the ramp heat side can be checked at "HWV" socket [Pin #18 (+) and Pin #CT (-)]. Voltage will vary from 0.0 VDC to approximately 5.4 VDC as the temperature knob is turned clockwise.
2. No adjustments can be made to the ramp heat side of a ramp control. If voltage is not present at the pins of the "HWV" socket, the control should be sent in for repairs or replacement.

Checkout Procedure
TU-M13 or TU-MIMI Temperature Control:
Cooling

1. Only the output voltage from the ramp cool side can be checked at "CWV" socket [Pin #59 (+) and Pin #CT (-)]. Voltage will vary from 0.0 VDC to approximately 5.4 VDC as the temperature knob is turned counterclockwise.
2. No adjustments can be made to the ramp cool side of a ramp control. If there is no voltage at "CWV" socket pins, the control should be returned for repair or replacement.

Checkout Procedure
TU-M13 or TU-MIMI Temperature Control: Dehumidification

1. Temperature control *must be* calling for heat and humidity control *must be* calling for dehumidification to make this check.
2. A call for dehumidification on humidity control is preset (on the ramp control) at the factory to drive the chilled water valve to ½ open, as indicated on attached drawing. The opening of the valve may be increased or decreased according to room conditions.
3. To *decrease* opening of the chilled water valve, turn dehumidification potentiometer on temperature control in a counter-clockwise direction.
4. To *increase* opening of the chilled water valve, turn dehumidification potentiometer on temperature control in a clockwise direction.

II. Calibration and Performance Test

A. Set the SENSITIVITY KNOB fully clockwise for high sensitivity.

B. Depress and hold the CALIBRATION CHECK BUTTON while performing the following checks, 1 through 9.

NOTE: Be sure that the TEMPERATURE KNOB is not loose on the shaft.

NOTE: Depressing the CALIBRATION CHECK BUTTON removes the sensing element from the control circuitry and replaces its input with an equivalent resistor inside the control, which has a value set to balance the control at approximately 70°F. Thus, by holding the CALIBRATION CHECK BUTTON in, a false signal is sent to the control circuit indicating that the room is at 70°F. This means that when the control checks out according to the following procedure with the CALIBRATION CHECK BUTTON depressed, it is functioning properly and is calibrated at approximately 70°F. If the control works properly with the button depressed, but fails to function properly when the button is released, the probable trouble will be found in the sensing element or other parts of the air conditioning system.

1. With the CALIBRATION CHECK BUTTON depressed, slowly rotate the TEMPERATURE KNOB clockwise and observe that each heating pilot lamp sequences on and energizes its respective contactor. Rotate the TEMPERATURE KNOB slowly counterclockwise and notice that each heating pilot light sequences off, and that each cooling pilot light sequences on and energizes its associated liquid line solenoid valve. Rotate the knob clockwise until all pilot lights, liquid line solenoid valves, and contactors are de-energized. The pointer at this time should be at approximately 70°F.

NOTE: The following procedure can be used to check the output stages of the Temperature Controller: (Refer to pages 29 and 30)

2. Slowly rotate the TEMPERATURE KNOB from the 70°F position clockwise until the first stage reheat comes on. Verify that, when the reheat light comes on, power is supplied between terminal (20) and (G2) and that the first reheat contactor is energized.

NOTE: Omit Step 3 if only 1 reheat is supplied.

3. Continue to rotate the TEMPERATURE KNOB clockwise until the second reheat light comes on. Verify that power is now supplied between terminal (19) and (G2) and that the second reheat contactor is energized.
is energized.

NOTE: Omit Step 4 if only 1 or 2 reheats are supplied.

4. Continue to rotate the TEMPERATURE KNOB clockwise until the third reheat light comes on. Verify that power is now supplied between terminal (18) and (G2) and that the third reheat contactor is energized.
energized.
5. All reheats are now on. Next, slowly rotate the knob counterclockwise and verify that each reheat stages off in sequence.
6. Continue to rotate the TEMPERATURE KNOB counterclockwise until the first cooling light comes on. (If compressor sequence switch is supplied, it must be in the 1-2 position.) At this point power should be supplied between terminal (33) and (G2) and terminal (45) and (G2) and the liquid line solenoid valve for the number one compressor should be energized.

NOTE: Omit Step 7 on 1 compressor models.

7. Continue to rotate the TEMPERATURE KNOB counterclockwise until the second cooling light comes on. Power should now be supplied between terminal (34) and (G3) and the liquid line solenoid valve for the number two compressor should be energized, plus (46) and (G3).
8. Rotate the knob clockwise to the 70°F position. As you rotate the knob back to the 70°F position the compressor liquid line solenoid valves should stage off in sequence.
9. Release the CALIBRATION CHECK BUTTON and set the desired sensitivity and operating temperature.

NOTE: SENSITIVITY ADJUSTMENT (See Page 10)

Higher sensitivity is selected by rotating the SENSITIVITY KNOB clockwise, and lower sensitivity is called for by rotating the knob counterclockwise. The SENSITIVITY KNOB performs two adjustments simultaneously. First, it adjusts the width of the deadband at the set point position. For example, if a 70°F set point is desired, and high sensitivity is dialed in, the first call for cooling will come at 71°F, and the first call for heating will come at 69°F. This provides a 2°F nominal deadband, or 2°F total temperature difference between heating 1 and cooling 1. If the SENSITIVITY KNOB is completely rotated counterclockwise to a low sensitivity position, the first call for cooling at a set point of 70°F will occur at approximately 75°F, and the first call for reheat will occur at 65°F. This provides a 10° nominal deadband. Any sensitivity between these two extremes can be dialed in, depending on the application.

As the sensitivity is being adjusted, the inter-switch staging between cooling and reheat stages is also changing. Thus, with a high sensitivity, a 1°F band exists between cooling 1 and cooling 2, whereas a 5°F difference exists with low sensitivity. The same is true between reheat stages; as the sensitivity is adjusted from high to low, the temperature differential required to bring on additional stages is increased.

III. In System Performance

With the desired temperature of the conditioned space set by the TEMPERATURE KNOB, the Liebert Temperature Control will function as follows:

A. Cooling — When the conditioned space temperature exceeds the set point by an amount determined by the SENSITIVITY KNOB (1° to 5°F) the first stage of cooling will be called and the cooling 1 pilot light will be energized. Should the temperature continue to rise, the second stage of cooling (large systems) would be called and that pilot light lighted. As the conditioned space returns to the set point the cooling stages sequence off in reverse order.

B. Heating — When the conditioned space temperature drops below the set point by an amount determined by the SENSITIVITY KNOB (1° to 5°F) the heating stages sequence in the same manner as the cooling.

Replacement

Remove two screws from upper bracket and pull control straight up. (**CAUTION:** Turn off power before removing or replacing control or permanent damage may result).

TEMPERATURE SENSOR

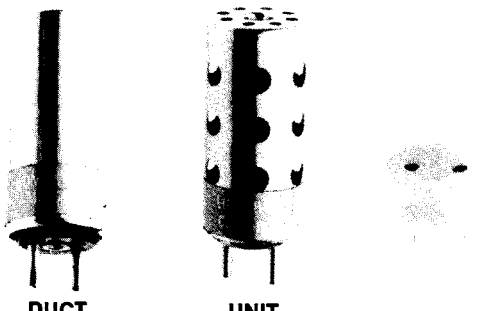
Test

The temperature sensor can be checked with an OHM meter. The resistance should be approximately 1100 OHM's at 70°F — 1030 OHM's at 77°F.

Replacement

The sensor is located in the return air and plug into a mating socket.

DESCRIPTION	MODEL	PART NO.
Temperature Sensor	TH	TS002



SENSORS

Maintenance

No periodic maintenance is required. Do not attempt to clean the temperature sensor element by submerging it in water or other solutions as this may damage the sensor.

Before using the trouble shooting chart, consult Section I "Wiring" and Section II "Calibration and Performance Checkout Steps." These steps verify that the control is functioning properly. If the control functions as described in Section II, the only other related problem can be the sensor. The following chart will aid in further checks and tests to locate a problem.

PROBLEM	PROBABLE CAUSE	REMEDY
Simultaneous call for heating and cooling	Grounded sensor	Repair ground, replace sensor and control
Continuous call for heating	Open sensor circuit	Find open sensor circuit and repair. Replace sensor if necessary
Continuous call for cooling	Leads to sensor shorted together (not to ground) causing low resistance	Find short and repair. Replace sensor if necessary

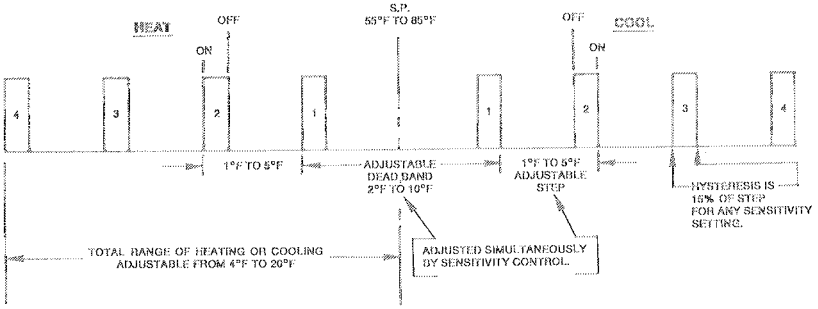
NOTE 1: This trouble shooting chart is for use only when the temperature control checks out properly in accordance with Section II Calibration and Performance Tests. This means that the control works properly when the CALIBRATION BUTTON is depressed and checks out completely, but, when trying to operate with the sensor, a malfunction is occurring.

NOTE 2: Check the room conditions with another temperature sensing device. Continuous calls for cooling or heating, when the room conditions are beyond the range of the temperature scale, are correct. For example, if the room conditions are 90°F, the controller will continuously call for cooling regardless of the temperature control knob setting. The control has a maximum setting of 85°F, and cannot call for heating when the room itself is at 90°F.

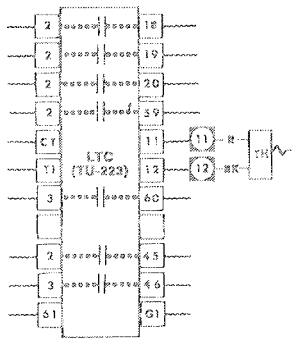
If the wiring checks out according to Section I, the control checks out according to Section II, and the sensing element is not open, shorted, or grounded, the Solid State Control System is functioning properly. If a problem continues to exist, it has to be in the remainder of the air conditioning control circuit or other components.

A CONTROL OR SENSOR THAT CHECKS OUT PROPERLY SHOULD NOT BE RETURNED TO THE FACTORY.

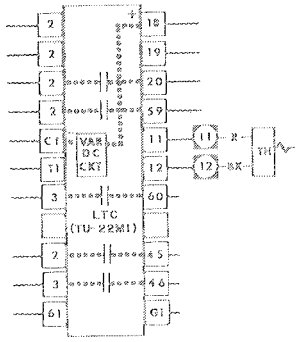
TEMPERATURE CONTROL STEPPING ACTION



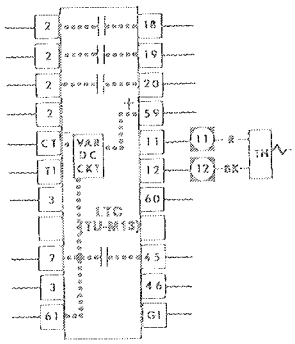
1. All Stepping (heat and cool) is linear.
2. Any combination of the above staging is available.
3. Front panel pilot light for each stage is standard.
4. Deadband and stepping differential are simultaneously adjusted (SENSITIVITY KNOB).
   The "LO" setting gives a wide band. The "HI" setting gives a narrow band.
5. Proper performance of the above stepping may be tested by the built-in calibration/self test.



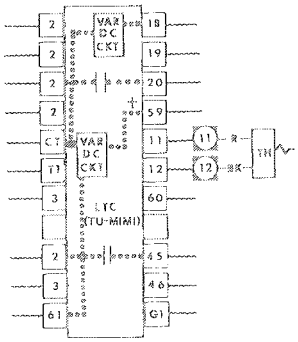
TU-223
(1)



TU-22M1
(2)



TU-M13
(3)



TUM1M1
(4)

HUMIDITY CONTROL

Description

The Liebert Humidity Control is a two-stage, solid state device. The control receives a signal from a humidity element which changes in electrical resistance according to changes in relative humidity conditions. If the relative humidity is 2 to 3% below the set point, the control activates the output signal. Another output signal is activated if the relative humidity is 2 to 3% above the set point. Pilot lights on the face of the control indicate when humidification or dehumidification is called for. Also on the face of the control are a CALIBRATION CHECK BUTTON and a SET POINT KNOB. When humidification or dehumidification is called for, power is supplied to the desired contactor or solenoid valve.

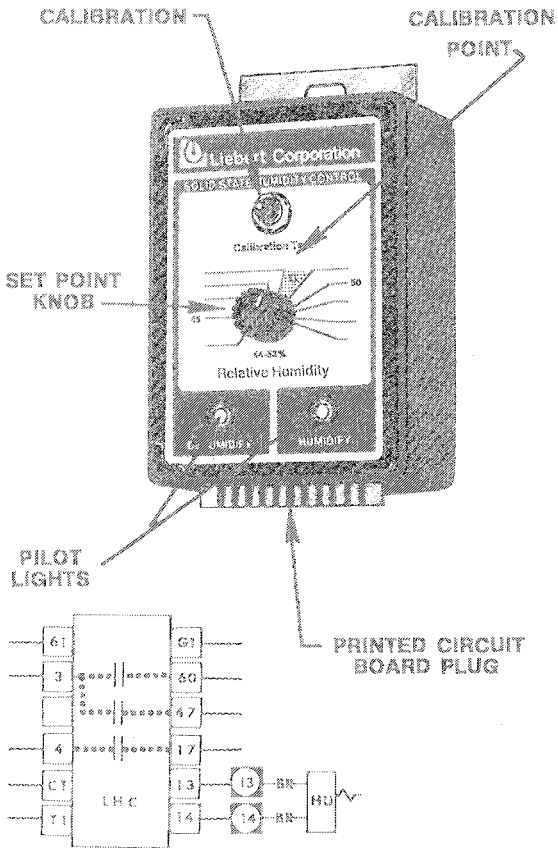
The CALIBRATION CHECK BUTTON serves two purposes:

1. It verifies that the control is calibrated to read the correct % RH.

2. It determines whether or not the control is operating satisfactorily.

The SET POINT KNOB adjusts the level of RH desired. Three convenient ranges are available.

1. STANDARD RANGE. The most popular range (44-53% RH) is designated by a yellow scale behind the knob on the control. The standard range uses a yellow color coded sensor.



2. LOW RANGE. If a lower range is desired (33-41% RH) the existing controller may be used, but the color coded sensor must be changed to the orange type. The yellow calibration and RH point selection face plate on the controller must also be changed to an orange plate. Face plates are self-sticking and easily applied.

3. HIGH RANGE. If a higher range is desired (59-69% RH) the existing controller may be used but the color coded sensor must be changed to the green type. The matching green RH control point selection plate must also be affixed to the face plate for calibration.

The sensor is external to the control. It is mounted in a plug-in tube which is easily inserted or removed from a mating socket. The socket can be located either in a conditioned room on the remote control panel, or in the return air. Two types of sensors are available. One has a perforated cover and the other is enclosed.

The perforated type is used in a conditioned space application, and the enclosed sensor is used in an air stream application such as a return air plenum in Liebert units.

The control has a printed circuit board which protrudes from its bottom and plugs into a 12 terminal socket.

CHECKOUT PROCEDURE

CAUTION: *Always* turn the power to the control OFF before inserting or removing it from its socket. The control can be permanently damaged if the power remains on during insertion or removal.

I. Wiring

A. Input voltage to the control's solid state logic network is regulated so that it functions properly only when used with a center tapped supply voltage from a minimum of 22 VAC to a maximum of 28 VAC. The center tap must vary with the supply voltage at a perfect 2:1 ratio (22 volt supply, 11 volt center tap; 26 volt supply, 13 volt center tap). Other input voltages come into the control to power the output to the electrical control circuit of the air conditioning unit. These voltages come in at separate terminals and are isolated from the solid state circuit which contains the logic. Thus, when the logic portion of the control circuit triggers the solid state switches, they in turn switch the power input between the various output terminals.

B. Before installing the Humidity Control or sensor element the following wiring checks should be made: THE TERMINAL NUMBERS DESCRIBED ARE ON THE CONTROL MOUNTING BRACKET.)

1. Check to be sure that terminal (G1) to (CT) provides approximately 12 VAC.

2. Check to be sure that terminal (G1) to (T1) is exactly twice the voltage measured in the above step, between terminals (G1) and (CT). It should be approximately 24 VAC.

3. Check to be sure that terminal (CT) to (T1) is the same voltage as at terminal (G1) to (CT).

4. Check terminals [13] and [14] to ground to be sure that they are not grounded.

C. After completing the above checks, the supply voltage should be turned OFF. Now the sensor and control can be plugged into their mating sockets. Power may now be reapplied to the unit.

II. Calibration Check and Performance Test

NOTE: Depressing the CALIBRATION CHECK BUTTON removes the sensing element from the control circuitry and sends a false signal to the control circuit indicating that the room is at the specified RH. If the control works properly with the button depressed but fails to function when the button is released, the probable trouble will be found in the sensing element or other parts of the air conditioning system.

A. Set the RELATIVE HUMIDITY KNOB at C. ("C" is the calibration check point) At this calibration check point, the control does not call for humidification or dehumidification if the CALIBRATION CHECK BUTTON is depressed.

B. Depress and hold the CALIBRATION CHECK BUTTON while performing the following steps, 1 through 6.

(Refer to PAGES 29 and 30 while performing these checks.)

1. With the calibration button depressed, slowly rotate the knob until both the DEHUMIDIFY and HUMIDIFY lights are out. The white line on the knob should be aligned with the black area marked C (calibration point) on the face of the control. If this alignment is not correct, the knob must be adjusted. This is done by loosening the set screw on the knob, rotating the knob (without rotating the shaft) until the alignment is correct, and then tightening the set screw.

2. Slowly rotate the knob clockwise until the HUMIDIFY light comes on. This light will come on at 2 to 3% RH above C (calibration point). When the light comes on 24 VAC will be supplied between terminals (17) and (G4) of the humidifier transformer.

3. Slowly rotate the knob counterclockwise until the HUMIDIFY light goes out. This will occur at ½ to 1% RH below the point at which the light came on. When the light goes out, 24 VAC will be removed from terminal (17) to (G4).

4. Continue to slowly rotate the knob counterclockwise until the DEHUMIDIFY light comes on. This will occur at 2 to 3% RH below C. When the DEHUMIDIFY light comes on, 24 VAC will be supplied between terminal (60) and (63) of the dehumidify transformer and terminal (47) and (63) .

NOTE: When the dehumidification cycle check is being performed, the Temperature Control should be placed in the heating cycle. This will eliminate the possibility of the compressor coming on in response to a call for cooling.

5. Slowly rotate the knob clockwise until the DEHUMIDIFY light goes out. This will occur at ½ to 1% RH above the point at which the light came on. When the light goes out, 24 VAC will be removed from terminal (60) to (63) and terminal (47) to (63) .

6. Release the CALIBRATION CHECK BUTTON and select the desired RH control setting with the knob.

NOTE: If steps 1-6 above are satisfied as described, the control is functioning properly, and CANNOT be causing any humidification or dehumidification problems. DO NOT return a control to the factory that is functioning properly.

7. With the CALIBRATION CHECK BUTTON released, the control, which has been proven to be functioning properly, is ready to be checked in conjunction with the sensing element.

III. In-System Performance Check

Set the desired relative humidity with the SET POINT KNOB, and the Liebert Humidity Control will function as follows:

A. When the relative humidity of the room falls 2 to 3% RH below the set point, the control will call for humidification.

The HUMIDIFY light on the control's face will come on and 24 VAC will be supplied between terminal (17) and (64) . This 24 VAC signal is used to begin the humidification process.

B. As the humidification process adds moisture to the conditioned space, the relative humidity will increase. When the RH at the sensor rises to ½ to 1% RH above the point where the control began the humidification process, the control will stop calling for humidification.

The HUMIDIFY light on the control will go out and the 24 VAC signal between terminals (17) and (64) will be removed. The loss of the 24 VAC signal will turn off the humidification process.

C. When the relative humidity of the room rises 2 to 3% above the set point, the control will call for dehumidification.

The DEHUMIDIFY light on the control will come on and 24 VAC will be supplied between terminal (60) and (63) , and terminal (47) and (63) . (refer to FIGURE 3) This 24 VAC signal is used to begin the dehumidification process.

D. As the dehumidification process removes moisture from the conditioned space, the relative humidity will decrease. When the RH at the sensor falls ½ to 1% RH below where the control began the dehumidification process, the control will stop calling for dehumidification.

The DEHUMIDIFY light will go out, and the 24 VAC signal between terminal (60) and (63) and terminal (47) and (63) will be removed. The loss of the 24 VAC signal will stop the dehumidification process.

Replacement

The humidity control may be removed by taking out one screw from the upper bracket and lifting the control straight up. (**CAUTION:** Always turn off power before removing or replacing control or permanent damage may result.)

PART NO.	DESCRIPTION	MODEL
H003L S/A	HUMIDITY CONTROL	HG-U

HUMIDITY SENSOR

Description

The humidity sensor is an electronic device which measures humidity and alters a signal from the HG-U control. This sensor can be supplied in three ranges identified by color bands.

PART NO.	RANGE	DESCRIPTION	
HS006	44% to 53%	YELLOW BAND	NORMAL
HS005	33% to 41%	ORANGE BAND	LOW
HS007	59% to 69%	GREEN BAND	HIGH

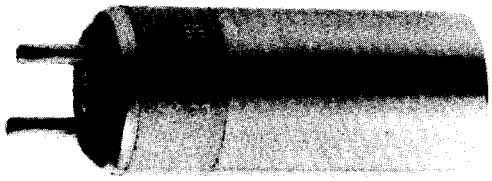
If the sensor range is changed a matching color scale decal must be used on the control set point dial.

Test

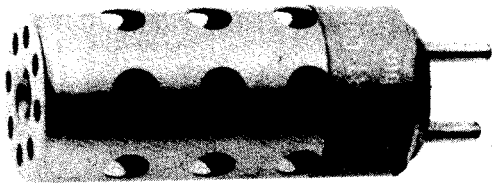
This sensor can NOT be checked in the field. DO NOT PUT AN OHM METER ON IT.

Replacement

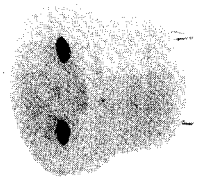
The sensor is located in the return air and plugs into a mating socket.



UNIT SENSOR



ROOM SENSOR



MATING SOCKET

MAINTENANCE

1. No periodic maintenance is required.

2. Do not attempt to clean the humidity sensor by submerging it in water or other solutions as this will ruin the sensor.

3. Do not measure the resistance of the sensor with an ohm meter since a DC potential will polarize the element.

Before using the TROUBLE SHOOTING CHART, consult Section I (Wiring) and Section II (Calibration and Performance Checkout Steps). This will verify that the control is functioning properly. If the control functions as required, the only other control-related problem will be the sensing element. The following chart will aid in checking the sensing element related problems.

TROUBLE SHOOTING CHART

PROBLEM	PROBABLE CAUSE	REMEDY
Continuous Call for Humidification*	Opened Sensor Circuit (Terminals 1 to 2)	Replace Sensor or Find Open Circuit (Loose Wire).
Continuous Call For Dehumidification*	Shorted Sensor Circuit (Terminals 1 to 2)	Replace Sensor or Find Shorted Circuit

**Check the room conditions with a sling psychrometer.*

Continuous calls for humidification or dehumidification when room conditions are beyond the range of the RH scale on the control are correct. If, for example, the room is at 30% RH, and the standard scale of 44% to 53% is being used, the control will call for humidification regardless of the knob setting.

If the wiring checks out according to Section I, the control checks out according to Section II, and the sensing element is neither open or shorted, the solid state control system is functioning properly. If a problem still exists, it has to be in the remainder of the air conditioning unit's control wiring and devices. Check the air conditioning unit for proper wiring and the conditioned space for make up air or improper vapor barrier.

AIR SAIL SWITCH

Description

The device has a snap switch operated by a metal sail inserted in the air stream of the blower scroll. The normally open contacts close at a preset velocity closing relay R1 which applies power to transformers T1, T2, T3, and T4. On a loss of air, the R1 relay will open.

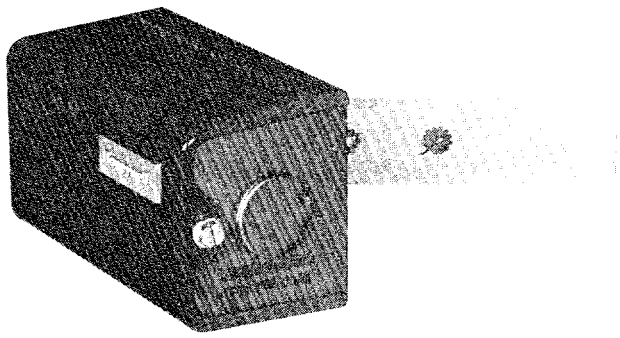
Test

With power on unit, push start switch. Green start light should stay on and red stop light go off.

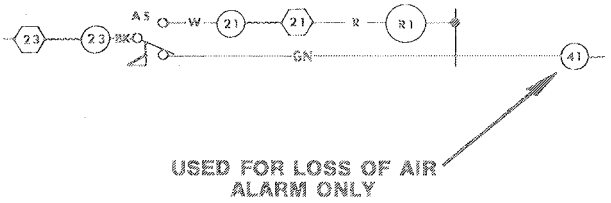
Replacement

Mounted to blower scroll with two screws. Wire common to No. 23, normally open to No. 21, on master board.

DESCRIPTION	SYMBOL	PART NO.
Air Sail Switch	AS	B-0120



AIR SAIL SWITCH



USED FOR LOSS OF AIR ALARM ONLY

TRANSFORMER CIRCUIT BREAKER MODULE

Description

The control voltage circuit is protected by manual reset circuit breakers for each transformer. Circuit breakers are mounted on a module and plugged into socket F. The (1) amp breaker protects the center tap of the 25 VA transformer. The (4) 3.2 amp breakers each protect a 75VA transformer.

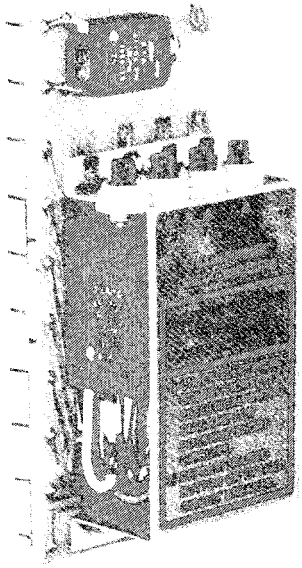
Test

If reset button is in the up or extended position, eliminate possible shorts in that circuit and depress reset button.

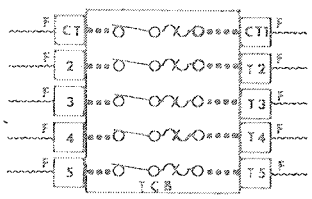
Replacement

Entire module may be pulled straight out. The 3.2 amp breakers can be individually replaced by removing cover plate and disconnecting wires. The (1) amp breaker wires must be unsoldered to replace.

DESCRIPTION	MODEL	PART NO.
COMPLETE MODULE	TCB	T2060 S/A
3.2 AMP BREAKER	—	E-276C
1 AMP BREAKER	—	E-276B



TRANSFORMER CIRCUIT BREAKER MODULE



TRANSFORMERS

Description

Transformers No.'s 2, 3, 4, and 5 are line voltage fused primary with 24 volt 75VA secondary. These transformers are used to operate various relays and contactors in the control circuit. No. 1 transformer is a 24 volt primary with 24 volt - 25VA secondary and a 12 volt center tap. This transformer operates the temperature control and humidity control and is supplied off the secondary of T4.

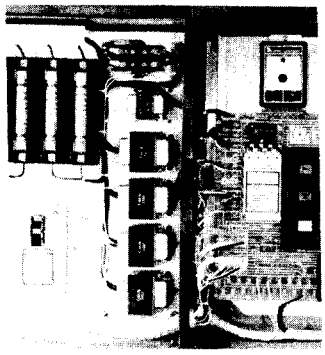
Test

With unit main switch on, check for 24 volt between terminals G5 and T5. Start blower, air switch must close relay R1 to energize other transformers. Check each transformer for 24 volt between its respective G and T terminal. Further check transformer T1 between G1 and C1, then T1 and C1. These two voltages must be within ¼ volt of each other and about 12 volts each.

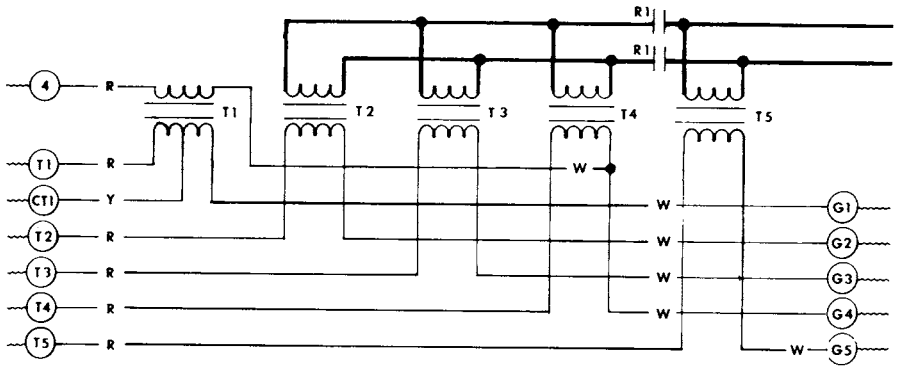
Replacement

Turn off main power.

Screws hold transformers to panel. Be sure new transformer is wired exactly as original.



TRANSFORMERS



TRANSFORMERS

PRIMARY			SECONDARY						
VOLTS/HZ	LEAD COLOR	COMMON	VOLTS	+	GND	12 V CT	VA	SYMBOL	PART NO.
200/50 230/50 245/50	ORANGE YELLOW RED	BROWN	24	RED	WHITE	—	75	T2, T3 T4, T5	E-330A
380/50 400/50 415/50	PURPLE YELLOW BLUE	BROWN	24	RED	WHITE	—	75	T2, T3 T4, T5	E-330B
208/60 230/60 245/60	ORANGE YELLOW GREY	BROWN	24	RED	WHITE	—	75	T2, T3 T4, T5	E-007A
440/60 460/60 490/60	PURPLE BLACK BLUE	BROWN	24	RED	WHITE	—	75	T2, T3 T4, T5	E-007B
550/60 600/60	YELLOW BLUE	BROWN	24	RED	WHITE	—	75	T2, T3 T4, T5	E-007C
416/60	RED	BROWN	24	RED	WHITE	—	75	T2, T3 T4, T5	E-007L
24/60	RED	WHITE	24	RED	WHITE	YELLOW	25	T1	E-007P

CHILLED AND/OR HOT WATER MOTORIZED VALVE

Description

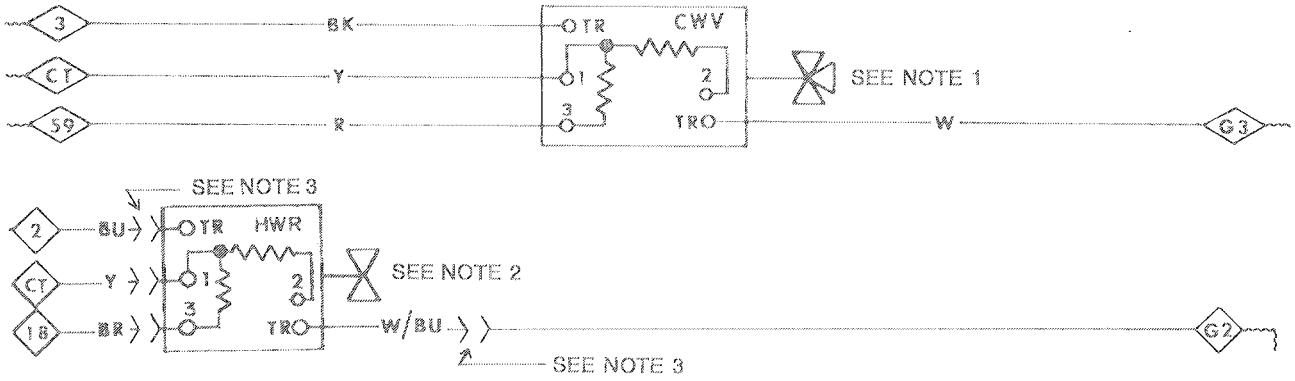
The Chilled or Hot Water System utilizes either a two way or three way valve, activated by a Minneapolis Honeywell M734D proportioning motor. The motor is modified by Liebert to operate in conjunction with Temperature Controls Model TU-M13, Model TU-M1M1, or Model TU-22M1.

Test

With the unit in operation, adjust the Temperature Control to call for cooling or heating and observe the valve operation. If the motor fails to close the cooling valve on a call for heating, check the Humidity Control as a call for dehumidification will hold the valve open about half way.

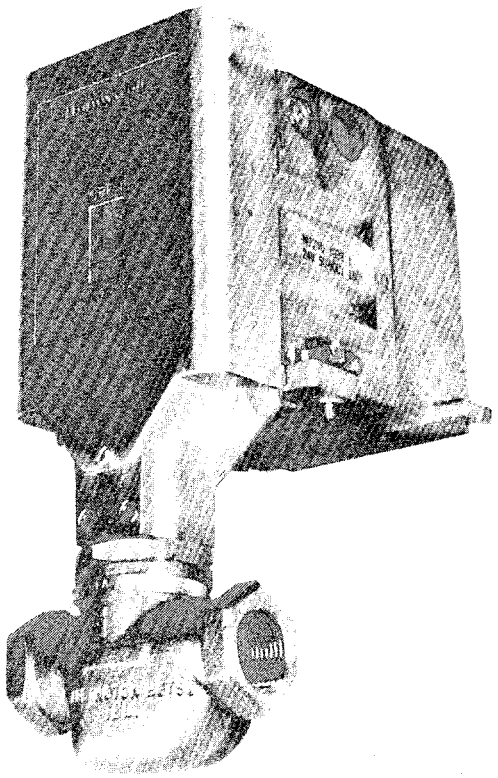
Voltages can be checked at the valve motor terminals. TR to TR should yield 24 VAC terminals 1 and 3 are signal voltage and should vary from 0.8VDC to above 2VDC as the temperature control is changed. Terminal No. 1 is ground and No. 3 is positive DC voltage.

MOTOR TERMINAL BOARDS



◇ SOCKET B HARNESS CONNECTION — HOT WATER/STEAM VALVE MOTOR
◇ SOCKET C HARNESS CONNECTION — CHILLED WATER VALVE MOTOR
)) CABLE CONNECTORS USED ON VERTICAL-FLO UNITS ONLY. PLUG AND RECEPTACLE TO BE FIELD CONNECTED.

1. 3-WAY VALVE IS STANDARD. 2-WAY VALVE CAN BE SUPPLIED AS AN OPTION. SEE SPEC. SHEET FOR PROPER VALVE.
2. 2-WAY VALVE IS STANDARD. 3-WAY VALVE CAN BE SUPPLIED AS AN OPTION. SEE SPEC SHEET FOR PROPER VALVE.
3. CABLE CONNECTORS USED ON VERTICAL-FLO UNITS ONLY. PLUG AND RECEPTACLE TO BE FIELD CONNECTED.



MOTORIZED VALVE

MOTOR OPERATION CHECK

M734D, F

Disconnect leads from terminals 1, 2, 3, 4 on the motor. With the motor powered, jumper terminals 1 and 2 on the motor to drive it open (clockwise rotation as viewed from the power end). Remove the jumper and the motor will drive closed.

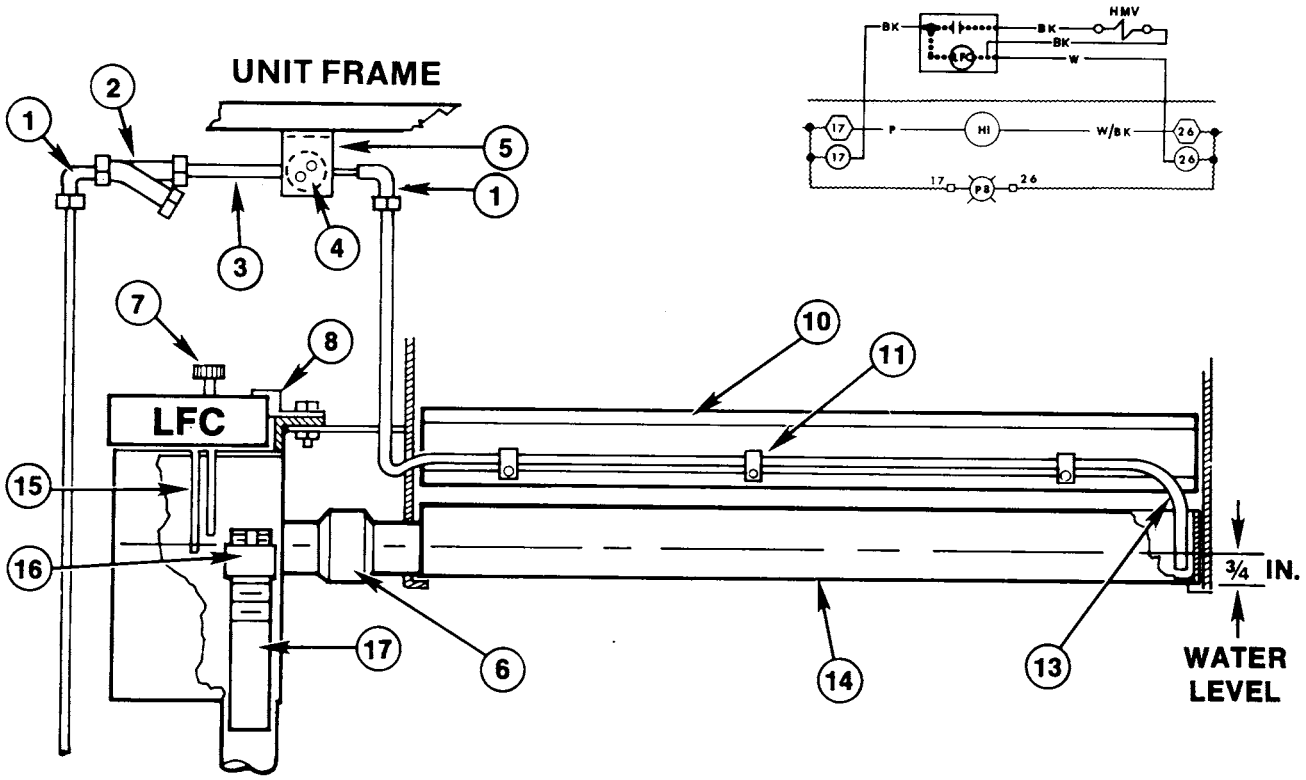
AUTO-FLUSH SYSTEM AF-100 (optional)

Description

The auto-flush system is designed to reduce the concentration of impurities in the humidifier pan. When pure water is evaporated, during humidification, a higher concentration of impurities is left in the remaining water. As the water level drops below the lower sensor rods, the solenoid valve is opened and fresh water introduced into the humidifier pan at the end furthest from the sump. (Humidity control must be calling for humidity.) Water in the pan rises above the run off level, which drains away the impurity saturated water and dilutes the remaining solution. When the water level reaches the upper sensor rods, the solenoid closes.

Adjustment

Adjust the stand pipe ring to maintain about ¾ inch of water in the humidifier pan. Set the auto-flush control upper sensor rods to a point approximately ⅛ inch above this level. If deposits accumulate in the pan after one week, raise the sensor rods, clean the pan and try again. Turning the adjusting knob clockwise raises the sensor rods and increases the flush to evaporation ratio.



1. 90 degree adapter
2. "Y" strainer
3. Nipple
4. Water solenoid valve
5. Solenoid bracket
6. Victaulic coupling
7. Adjusting knob
8. "B" bracket

10. Reflector
11. Clamp
12. Wiring compartment
13. ¼ inch copper tubing
14. Humidifier pan
15. Sensor rods
16. Adjusting ring
17. Stand pipe 4¾ inch or 6¾ inch

LFC Liebert Flush Control
LHC Liebert Humidity Control
HI Humidifier Contactor Coil

MODE ALERT WARNING SYSTEM (OPTIONAL)

Description

The Mode Alert Alarm is a warning system which sounds an audible alarm and lights a read out on the panel at the approach of a possible problem. With the Mode Alert System, standard warning lights might be, high head pressure on either compressor, high or low room humidity, high or low room temperature. Other special alarms may be added on a per job basis. A relay is also available to trigger a remote customer alarm.

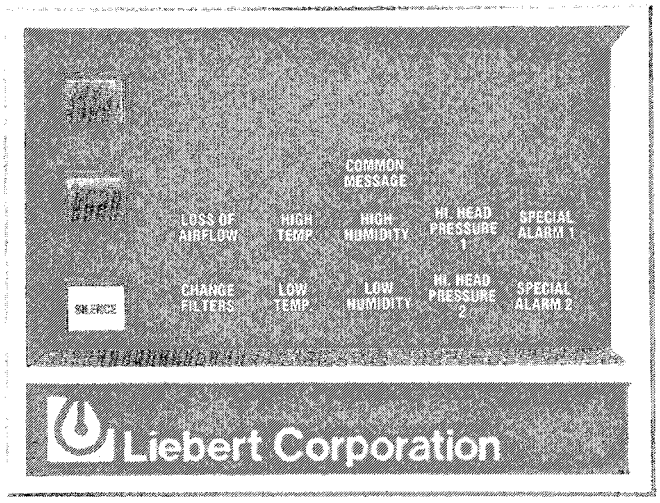
The audible alarm may be turned off by pushing the silence button, but indicator light and common message will remain on until the problem is corrected.

Test

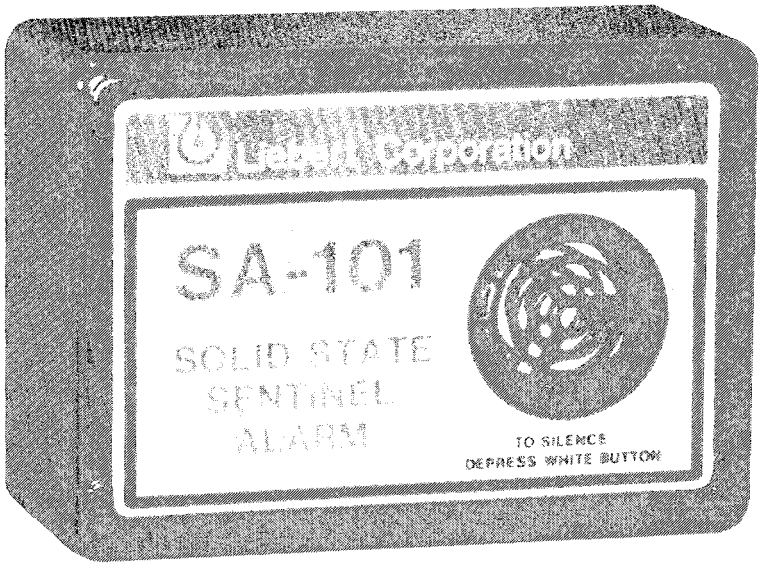
Test the alarm by depressing the green START button. All warning lights should light and the audible alarm sound. Individual sensors may be tested by changing their set point above or below operating conditions thus simulating a problem.

Replacement

The alarm is a plug in module which may be replaced by pulling straight out of the PCR-2 board. Plug replacement into socket "K". (See page 5.)



DISPLAY PANEL – (Alert Conditions)



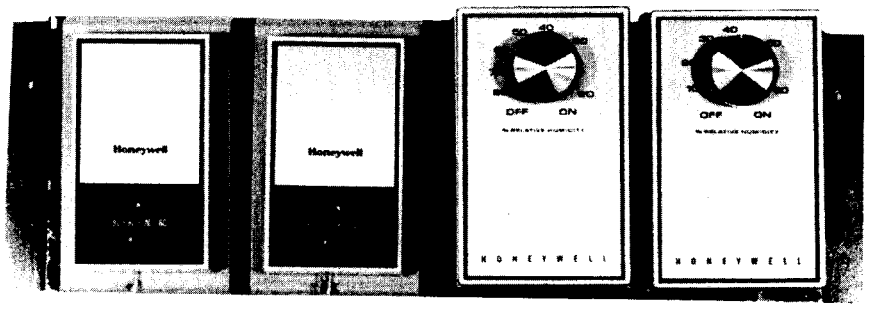
MODE ALERT WARNING MODULE

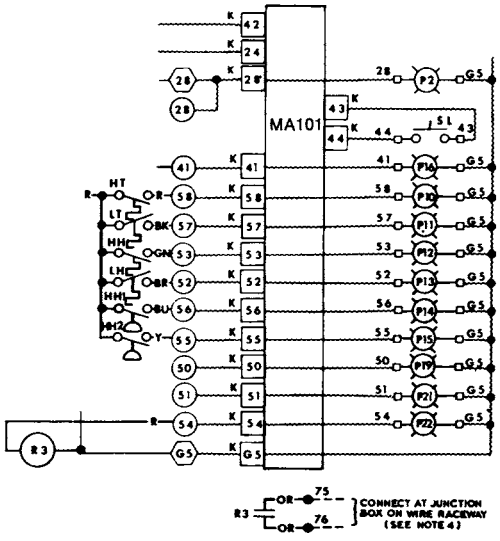
MODE ALERT WARNING SYSTEM (OPTIONAL) (Continued)

ITEM	SYMBOL	PART NUMBER			SIZE
		AIR COOLED	WATER COOLED	GLYCOL COOLED	
High Head Stat	HH1, HH2	P-312A	P-3120	P-312A	6, 8, 15, 20 TON
		P-312C	P-312B	P-312C	10 TON

ITEMS	SYMBOLS	PART NO.
SA-101 Module	SA-101	T203 S/A
Silencer Switch	SL	G-1350
Silencer Switch Cover	NONE	G-1350
High Temperature Stat	HT	E-2030
Low Temperature Stat	LT	E-2040
High Humidity Stat	HH	E-0330
Low Humidity Stat	LH	E-0340
Lamp	P10, P11, P12, P13, *P14, *P15 , P16	G-1390
Relay	R13	G-1360

* DX Only





FILTER CLOG SWITCH

Description

A diaphragm switch switch closes when the pressure differential between atmosphere and a point after the filters reaches set point. Light on readout panel indicates clogged filters.

Adjust

1) Adjust to trip with clean filters.
2) Turn adjusting screw clockwise approximately 2½ turns or to desired filter change point.

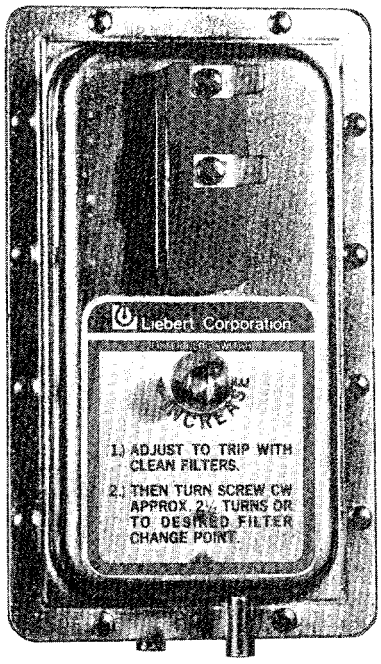
Test

With blower on and filters in place turn adjusting screw CCW to trip. Reset to original setting.

Replacement

Unscrew from panel remove two wires and sample tube — replace.

DESCRIPTION	SYMBOL	PART NO.
FILTER CLOG SWITCH	FC	E-043A



FILTER CLOG SWITCH

WINTER START KIT

(Standard with air cooled fan speed control units only).

Description

The winter start kit electrically bypasses the low pressure cut out to start the compressor regardless of suction pressure. The start kit will keep the compressor on for two minutes, giving the suction pressure time to build up and allowing the low pressure switch to close for normal operation.

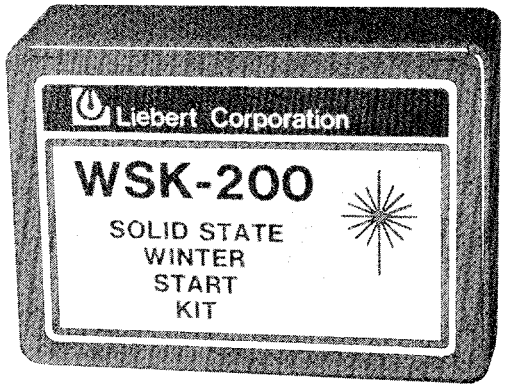
Test

Allow the compressor to pump down and cut off on the low pressure switch. Turn the temperature control knob to start the first compressor. If the compressor starts immediately (no 5 to 10 second delay for low pressure switch to make) the winter start switch is operating.

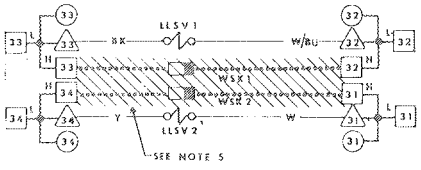
Replacement

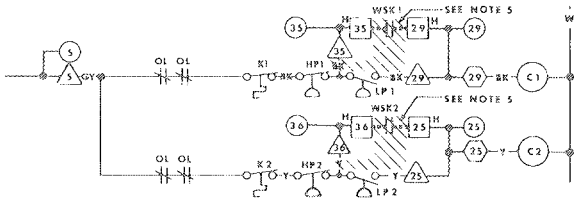
Pull start kit straight out of mother board and plug replacement in to socket "H". See page 5.

DESCRIPTION	SYMBOL	PART NO.
WINTER START KIT	WSK 200	T2050 S/A



WINTER START KIT MODULE





COMPRESSOR SEQUENCE SWITCH (OPTIONAL)

Description

A jumper board is standard equipment on all compressor models. This board sequences the upper compressor as Number 1 and the lower compressor as Number 2 with Number 2 being used for dehumidification.

An optional compressor sequence switch can be ordered on most models. (Not available with hot gas reheat). Compressor lead/lag can be changed with the position of a toggle switch. In the 1/2 (up) position, compressor Number 1 (upper) is the lead with Number 2 (bottom) being used for dehumidification. With the switch in the 2/1 (down) position, compressor Number 2 becomes the lead and Number 1 is used for dehumidification. The compressor indicator lights will not change. **CAUTION:** The toggle switch has a center off position in which neither compressor will operate.

Test

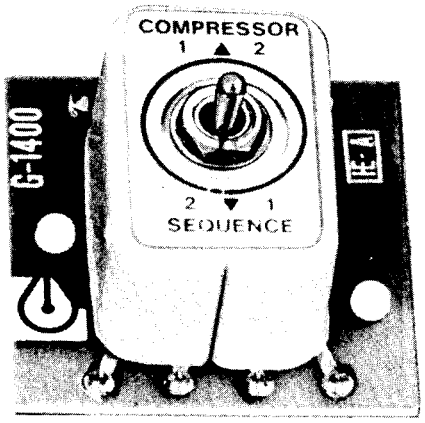
Turn temperature control set point to bring on Number 1 compressor. With the sequence switch in the 1/2 position (up) the top compressor is Number 1 with the switch in the 2/1 position the lower compressor becomes Number 1.

Replacement

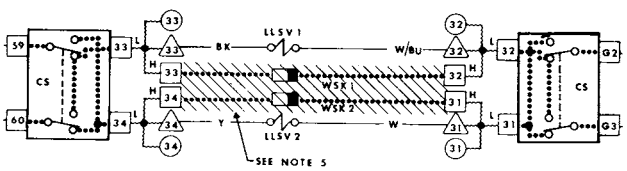
Jumper board or toggle switch are plugged in and pull straight out of board. Plug replacement into socket "C". (See page 5.)

DESCRIPTION	SYMBOL	PART NO.
BLANK JUMPER BOARD	JB	T2020 S/A
SEQUENCE SWITCH	CS	T2010 S/A

Both CS Relays In One Switch



COMPRESSOR SEQUENCE SWITCH



FIRESTAT (OPTIONAL)

Description

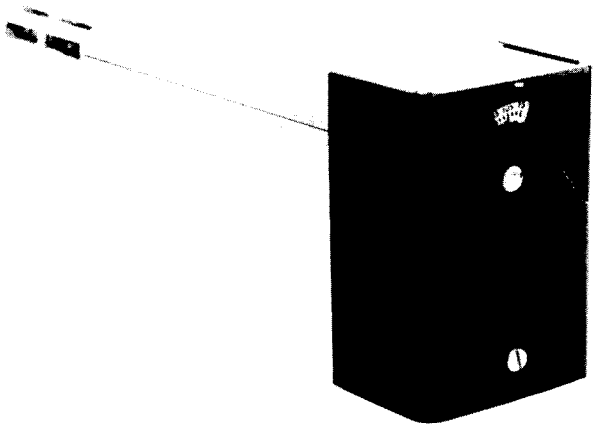
The firestat is a bimetal operated temperature sensing device with a normally closed switch. This device will shut down the entire unit when the inlet air temperature exceeds a preset point. It is connected between terminals 37 and 39, at terminal strip on wire raceway.

Test

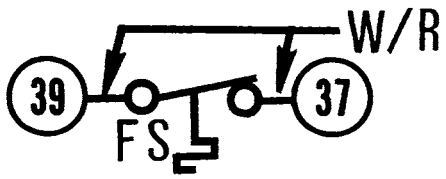
Turn set point to a setting lower than inlet air temperature. Unit should shut down. Reset to desired temperature and push START button to restart unit.

Replacement

Remove cover and screws holding firestat to panel and pull out.



FIRESTAT



LIQUI-TECT WATER SENSOR (OPTIONAL)

Sensor may be mounted under computer room floor or in pipe chases where water may accumulate. When water problems occur, Liqui-Tect's solid state switch closes the circuit, relaying the signal to an alarm system such as the LIEBERT Liqui-Tector, or mode alert system on precision control read-out System 2.

Mount Liqui-Tect to floor, at low spot, using plastic inserts and screws.

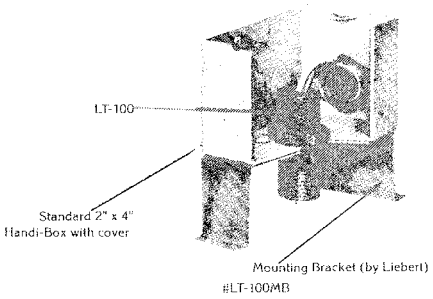
Adjust probes to acceptable water level with two adjusting nuts.

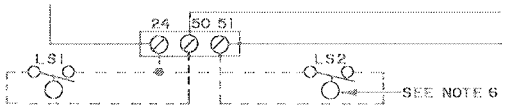
Wire to unit using NEC Class 2, 24 volt wiring. Run wires to terminals on wire raceway in compressor compartment.

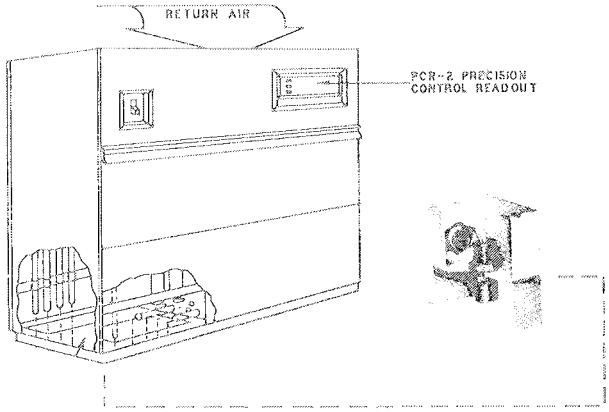
24V. field wiring by others, connect liqui-tect sensor to terminals 24, 50 & 51 at terminal strip on wire raceway.

Typical Mounting Method

Conduit Wiring







REPEATER PANEL "A" (OPTIONAL)

Description

The Repeater Panel is a remote duplicate of the PCR-2 read-out mode alert system. It contains the same operational and warning lights as the main unit, plus the audible alarm. The audible alarm can be silenced from the Repeater Panel but START and STOP buttons will not control the unit. When ordered with unit, the panel is furnished with cable that plugs into the unit.

Test

Test the alarm by depressing the green START button. (Unit must be running, green light lit.) All warning lights and operation lights should be lit and audible alarm sound. Individual sensors may be tested by changing their set points above or below operating conditions, thus simulating a problem.

CONTROL CHECK AND START UP PROCEDURE

NOTE: Before starting control check and start-up procedure; be certain system has been properly dehydrated and charged. (See installation manual.)

STEP

1. Start the procedure with all main power off. Tighten all wiring screws which may have loosened in shipping.
2. Remove all fuses except main fan and two control fuses located at the far right of fuse blocks.
3. Install humidity and temperature sensors.
4. Turn on main breaker and check line voltage to main unit switch.
5. Turn main unit switch to ON position; red OFF switch on readout panel will light.
6. Push green START button. Blower will start, green START light will come on and red STOP light will go out.
7. Air movement over the air flow switch will pull in relay R1 and apply power to transformers T1, T2, T3, and T4. Be sure blower is running in right direction.
8. Set temperature control to room temperature so that all its pilot lights are off.
9. Depress calibration button on humidity control and turn dial to calibrate (C). Both pilot lights will be off.
10. Rotate dial counter clockwise until dehumidification pilot light is on. Compressor No. 2 solenoid will open. When pressure builds up, compressor No. 2 contactor will pull in. Dehumidification light on readout panel should be lit.

10A. On units using chilled water valve, the valve should go to approximately one half stroke.

11. Rotate humidity dial clockwise until humidity pilot light comes on. Humidifier contactor will pull in and indicator light on readout panel indicates humidification.
12. Turn on water humidifier and allow humidifier contactor to remain in until pan is full.
13. Release test button and set humidity control to room humidity if possible. If room humidity is low, humidifier contactor will pull in. If room humidity is high, compressor No. 2 contactor will pull in or chilled water valve will go to one half stroke.
14. Depress calibration button and turn temperature control dial to approximately 70°. No pilot lights should be on.
15. Rotate temperature control dial counter clockwise until cooling No. 1, green pilot light comes on. Compressor No. 1 solenoid will open. No. 1 compressor contactor will pull in and readout panel light will indicate cooing 1.
16. Continue turning temperature dial counter clockwise until No. 2 cooling pilot light comes on. No. 2 solenoid will open and contactor will pull in. Cooling 2 on readout panel will be lit.

NOTE: Compressor No. 2 may already be in due to humidity control calling for de-humidification.

16A. On units with chilled water valve, the valve should open proportionally as set point is moved further below 70° until full open.

17. If compressor sequence switch is used; switch to position 2/1 and repeat steps 17 and 18. Lower compressor solenoid and contactor will now be activated with No. 1 pilot and indicator lights.
18. Turn temperature dial clockwise until both cooling lights go out and reheat 1 pilot comes on. Reheat No. 1 contactor will pull in and readout panel will indicate reheat 1.
19. Continue turning dial clockwise and note reheat contactors 2 and 3 pulling in with readout panel indicating each.

19A. On units using hot water or steam valves, the valve should open proportionally as set point is moved further above 70° until full open.

20. Check temperature control sensitivity; with calibration button depressed, rotate temperature indicator dial to bring on cooling 1 then back to bring on reheat 1. Note degrees dead band. Adjust sensitivity dial and repeat until desired dead band is obtained. "HI" sensitivity position is approximately 2 degrees and "LO" is approximately 10 degrees.
21. Check sentinel system if used; Turn set point dials on high and low humidity, high and low temperature sensors to points above or below room conditions. Audible alarm will sound and warning will show on readout panel. Reset sensors to minimum and maximum desired room conditions. Clogged filter alarm may be checked by turning adjusting screw clockwise then reset. Liqui-tect sensor may be checked by using water over sensors. The high head pressure warning sensors should be checked later with compressors running. Turn the adjusting screw to a point below running head pressure to check alarm then reset. All lights and audible alarm may be tested by depressing the green start button at any time.
22. Turn off main unit switch and circuit breaker.
23. Set humidity and temperature controls at desired room conditions.
24. Replace all fuses.
25. Restore power to unit and push START button. Compressors should pump down and shut off if room is satisfied.
26. In the event any of the preceding checks fail, see Troubleshooting Section.

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Blower will not start	No main power	Check L1, L2, and L3 for rated voltage.
	Blown fuse	Check fuses to main fan. Check control fuses.
	Overloads tripped	Push re-set button on main fan overload. Check amp draw vs. heater amp rating.
	No output voltage from T5 transformer	Check for 24 vac between G5 and T5. If no voltage check primary voltage.
	Circuit breaker T5 tripped	Check for 24 vac between G5 and T5. If no voltage check for short and re-set breaker T5
	Start switch S1 not making	Jumper 5 to 24 momentarily. If unit continues to run after jumper is removed, replace S1.
Blower starts but stops when start switch S1 is released	Relay R4 not closing	Jumper between 5 and 39, push start button. If unit runs off switch S2 is open.
		Jumper 39 to 37 push start button. If unit runs firestat is open or if no firestat, leave jumper on.
		Jumper 37 to 38, push start button. If unit starts, remote shut down is open. If no remote shutdown control is used, jumper has been removed from 37 to 38 on wire raceway in compressor compartment.
	R4 relay defective	Measure voltage between terminal 38 and G5. If 24 vac is present, but R4 is not pulled in R4 is defective. (S-1 switch must be held down for this check.)
Blower runs but controls will not operate	Relay R1 not making	Check for 24 vac between G4 and T4. If voltage is not present R1 may be open.
		Check air switch. Jumper 23 to 21. If R1 makes, air switch is not closing. (Check blower rotation switch contact and loose wires.)
		Check for 24 vac across R1 relay coil. If voltage is present and R1 not pulling in, replace R1.
	Transformer T1 bad	Check for 24 vac between G1 and T1. Check for 12 vac between G1 and CT1.
	Transformer T1 breaker tripped	Check for 12 vac between G1 and CT. Note: voltage between G1 and CT must be equal to voltage between T1 and CT.

TROUBLESHOOTING

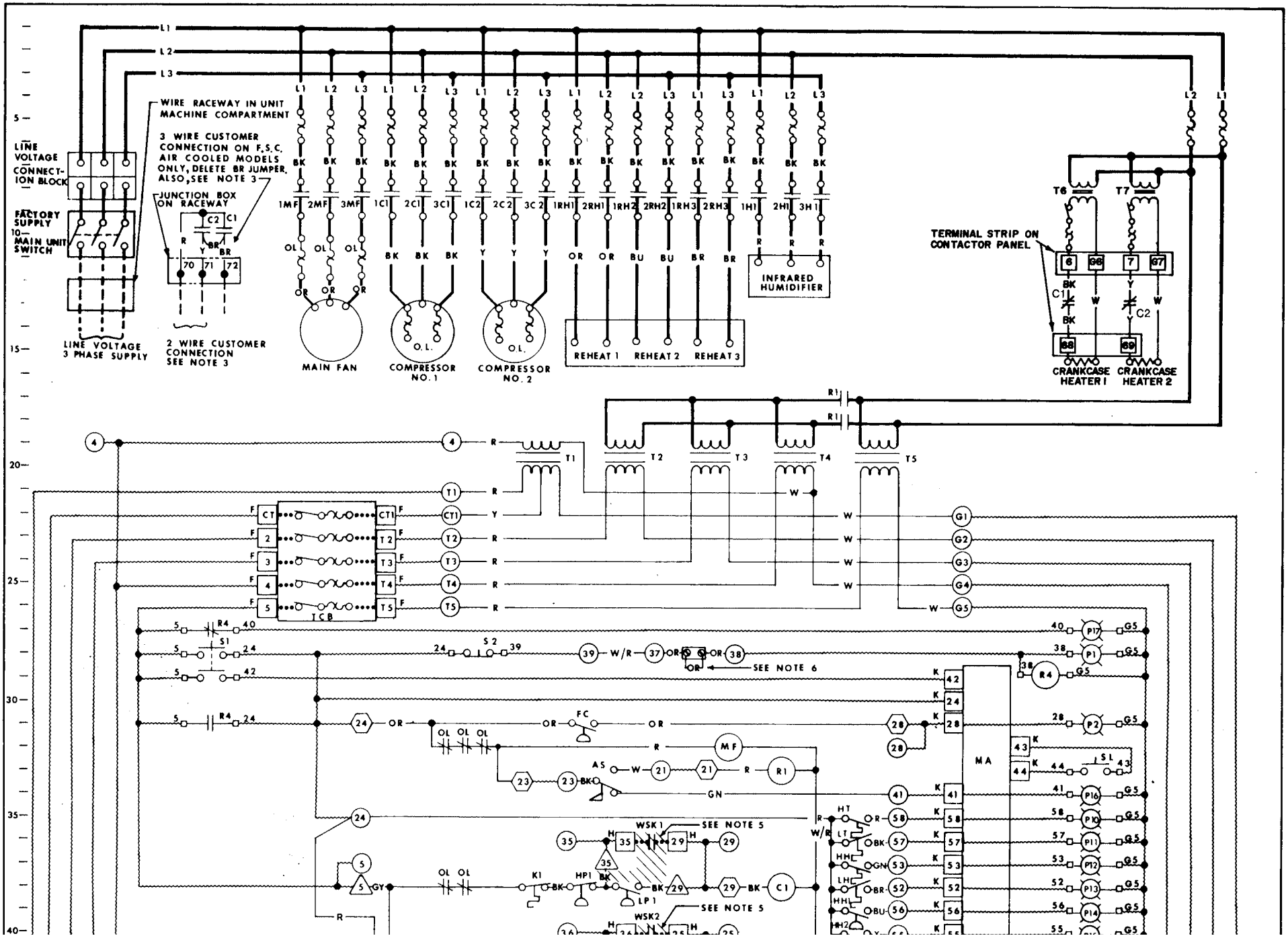
SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Humidity control calibrates but calls for humidity at all settings	Room humidity low	Check with sling psychrometer.
	Wires to sensor open	Check wires 13 and 14. (Caution: remove sensor before using OHM motor.) Further check these wires for short to ground.
	Sensor bad or loose	Check sensor fit in socket. Replace.
Humidity control calibrates but stays on dehumidity at all settings	Room humidity high	Check with sling psychrometer.
	Wires to sensor shorted	Wires 13 and 14 shorted together. (Caution: remove sensor before using OHM meter.) Further check these wires for short to ground.
	Sensor bad	Replace.
No humidification	Humidifier pan not filling	Check water supply.
		Check float valve or auto-flush adjustment.
		Check drain stand pipe adjustment.
		Check for clogged waterline filter.
		Check auto-flush solenoid volve. Note: This valve will open only if humidity contactor is energized (24 vac between terminals 17 and 26) and water level in sump is below lower probes.
	Control not calling for humidity	Check control pilot light. Jumper terminals 4 and 17 bypassing control.
	Humidity contactor not pulling in	Check visually. If contactor is made, check line voltage after contactor and fuses.
		Check for open humidifier safety stat. Jumper between terminals G4 and 26.
	Humidifier bulb burned out	Replace.
No dehumidification	Control not calling for dehumidification	Check control pilot light.
	Control not making circuit	Jumper between terminals 3 and 60 by-passing control.
	Compressor won't run	See compressor section of trouble shooting.

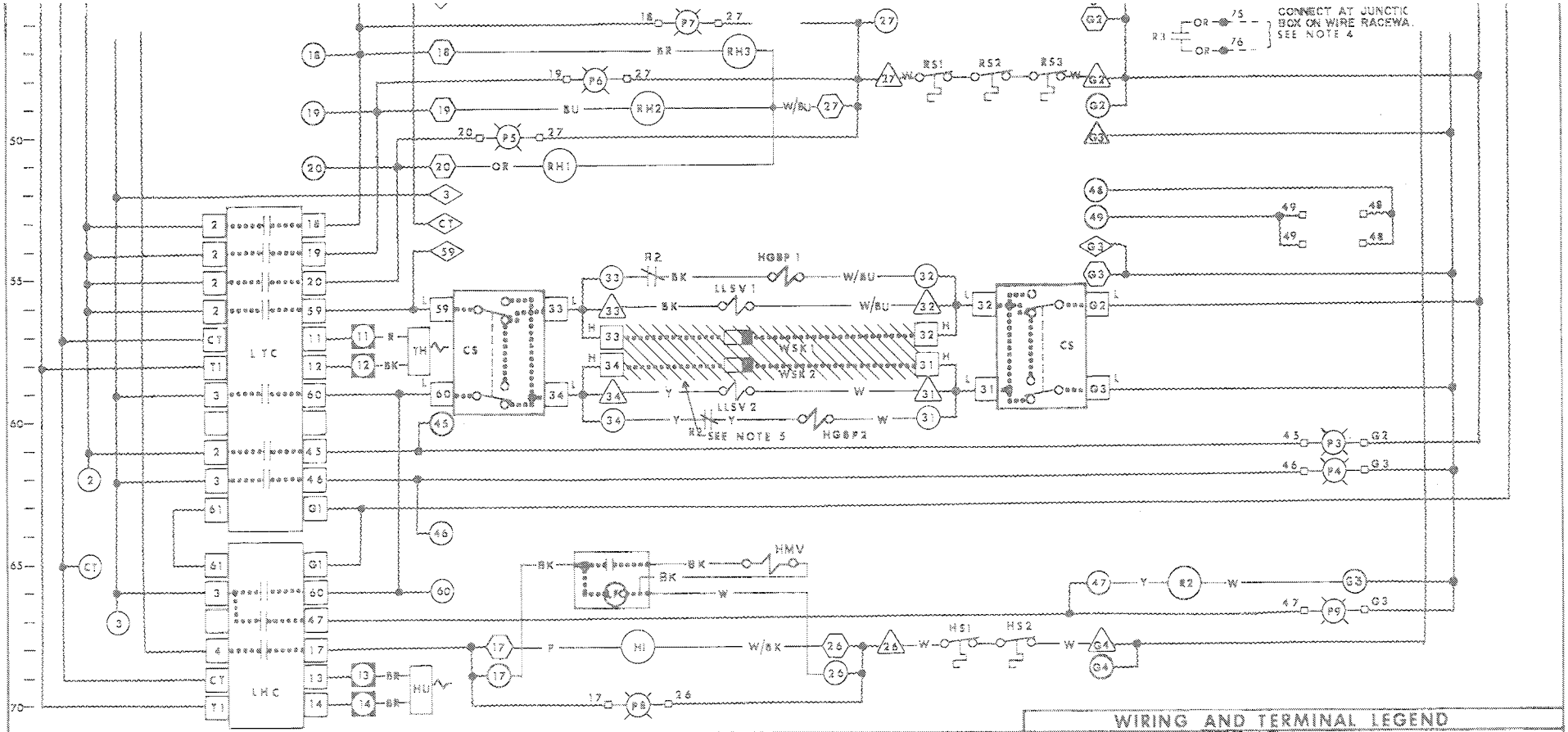
TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Temperature control calibrates but stays on cooling when in operation	Room temperature high	Check temperature of return air.
	Wires to sensor shorted	Remove wire 11 from terminal and take OHM reading between wire and terminal 12. This should read approximately 1100 OHMS at 70°F and go down to 1030 OHM at 77°F. If reading is far below this, check for shorted wires on sensor. Also check for wires shorted to ground.
Temperature control calibrates but stays on heating when in operation	Room temperature low	Check temperature at return air.
	Wires to sensor open	Remove wire 11 from terminal and take OHM reading between wire and terminal 12. If reading is for above 1100 OHM check for open wires on sensor.
Compressor contactor pulled in but compressor will not operate	Blown fuses	Check for line voltage after fuses and after contactors.
Compressor will not operate contactor not pulled in	No call for cooling	Check temperature control to see pilot light is on.
	Control not making	If lead lag switch is used, set in ½ position. Jumper between terminals 2 and 33 for compressor No. 1 or 3 and 34 for compressor No. 2.
	Solenoid valve not energizing	Hold screw driver over solenoid and check for magnetic field. This indicates solenoid is energized.
	Low pressure switch not making	Jumper between terminals 35 and 29 for compressor No. 1 or 36 and 25 for compressor No. 2—check gas pressure.
	High pressure switch open	Reset switch—Check valves and condenser for reason.
	Out on overload or compressor stat	Check voltage between terminals 5 and 35 for compressor No. 1 or 5 and 36 for compressor No. 2. If this shows 24 volts safety is open.
Compressor runs for two minutes then stops. Contactor drops out.	Low pressure switch not closing	Check for low gas pressure. Compressor is running on winter start kit.
	Solenoid not opening	Check magnetic field to see if energized.
Reheat will not operate contactor not pulling in	Control not calling for heat	Check control to see if pilot light is lit.
	Reheat safety stat open	Jumper between terminals 27 and G2.

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CHECK OR REMEDY
Reheat not operating contactor pulling in	Fuses blown	Check line voltage after fuses and after contacts.
	Heater burned out	Turn off power and check heater continuity with OHM meter.
Chilled water or hot water/steam valve not opening	Motor operates but valve won't open	Check linkage for adjustment and be sure it is tight on valve.
	No 24 vac power to motor	Check TR to TR on Motor for 24 vac.
	No signal from control	Check D.C. voltage on printed circuit board in motor. Terminal No. 1 is ground and No. 3 positive D.C. voltage should vary from .8 to above 2 V.D.C. as temperature control is varied below room temperature on cooling valve or above room temperature on heating valve.
	Motor not working	Remve wires from terminals No. 1 and No. 3 from motor (do not short) with 24 vac power on TR to TR, jumper terminals 1 and 2 on motor to drive open. Remove jumper to drive closed.


L1
L2
L3
LINE VOLTAGE CONNECTION BLOCK
FACTORY SUPPLY
MAIN UNIT SWITCH
WIRE RACEWAY IN UNIT MACHINE COMPARTMENT
3 WIRE CUSTOMER CONNECTION ON F,S,C, AIR COOLED MODELS ONLY, DELETE BR JUMPER. ALSO, SEE NOTE 3
JUNCTION BOX ON RACEWAY
LINE VOLTAGE 3 PHASE SUPPLY
2 WIRE CUSTOMER CONNECTION SEE NOTE 3
MAIN FAN
COMPRESSOR NO. 1
COMPRESSOR NO. 2
REHEAT 1
REHEAT 2
REHEAT 3
INFRARED HUMIDIFIER
TERMINAL STRIP ON CONTACTOR PANEL
CRANKCASE HEATER 1
CRANKCASE HEATER 2
T1
T2
T3
T4
T5
T6
T7
TCB
MA
SEE NOTE 5
SEE NOTE 6
WSK1
WSK2
FC
MF
HPI
LPI
K1
HT
LT
HHL
LHL
HH2



TYPICAL NOMENCLATURE LIST FOR ALL AVAILABLE ITEMS. SEE SCHEMATIC ABOVE FOR OPTIONS FURNISHED ON THIS UNIT:

TRANSFORMERS
T1-TEMP&HUMID CONTROL
T2-COOLING STAGE 1
T3-COOLING STAGE 2
T4-HUMIDIFICATION
T5-CONTROL CIRCUIT
T6-CRANKCASE HEATER 1
T7-CRANKCASE HEATER 2
T8-CONDENSATE PUMP

CONTROLLERS
LTC-LIEBERT TEMP CONTROL
LHC-LIEBERT HUMID CONTROL
LFC-LIEBERT FLUSH CONTROL

RELAYS
R1-CONTROL VOLTAGE
R2-DEHUMIDIFICATION
R3-SENTINEL AUX CIRCUIT
R4-START STOP

MISC
MA-MODE ALERT

WSK 200-WINTER STARY KIT
WSK 1-COOLING 1 CIRCUIT
WSK 2-COOLING 2 CIRCUIT
SEE NOTE 5
TCB-TRANFORMER CIRCUITBREAKER
JB-JUMPER BOARD
CCH1-CRANKCASE HEATER 1
CCH2-CRANKCASE HEATER 2

LIGHTS
P1-UNIT STARY
P2-FILTER CLOG
P3-COOLING STAGE 1
P4-COOLING STAGE 2
P5-REHEAT STAGE 1
P6-REHEAT STAGE 2
P7-REHEAT STAGE 3
P8-HUMIDIFICATION
P9-DEHUMIDIFICATION
P10-HI TEMP
P11-LO TEMP
P12-HI HUMID
P13-LO HUMID
P14-HI HEAD PRESS 1
P15-HI HEAD PRESS 2
P16-LOSS OF AIR
P17-UNIT POWER OFF

P19-
P20-
P21-
P22-
} SEE NOTE 8

VALVE COILS
LLSV1-LIQUID LINE SOLENOID 1
LLSV2-LIQUID LINE SOLENOID 2
HGBP1-HOT GAS BYPASS SOLENOID 1
HGBP2-HOT GAS BYPASS SOLENOID 2
HWR-HOT WATER/STRAM VALVE
SR-STEAM REHEAT SOLENOID
SH-STEAM HUMIDIFIER SOLENOID
NGRS-HOT GAS REHEAT SOLENOID
HMV-HUMIDIFIER MAKE UP VALVE

STATS & SWITCHES
SL-SILENCE SWITCH
S1-UNIT START SWITCH
S2-UNIT POWER OFF SWITCH
HP1-HI PRESS SWITCH
LP1-LO PRESS SWITCH
HP2-HI PRESS SWITCH
LP2-LO PRESS SWITCH
AS-AIR SAIL SWITCH
FC-FILTER CLOG SWITCH
HI-HI TEMP STAT
LT-LO TEMP STAT
HH-HI HUMID STAT
LH-LO HUMID STAT
HH1-HI HEAD PRESS 1 STAT
HH2-HI HEAD PRESS 2 STAT
RS1,2,3-REHEAT SAFETY STATS
HS1,2-HUMID SAFETY STATS
FS-FIRE STAT
K1-COMPRESSOR 1 STAT
K2-COMPRESSOR 2 STAT
HU-HUMIDISTAT
CS-COMPRESSOR SEQUENCE SW
TH-THERMISTOR
DS-DISCONNECT SWITCH
LST-LIQUI-TECT SENSOR

CONTACTORS & STARTERS
MF-MAIN FAN
C1-COMPRESSOR NO. 1
C2-COMPRESSOR NO. 2
RH1-REHEAT STAGE 1
RH2-REHEAT STAGE 2
RH3-REHEAT STAGE 3
H1-HUMIDIFIER

NOTES:

1. FOR MAIN SUPPLY WIRE SIZING SEE UNIT NAMEPLATE.
2. THREE PHASE MOTORS PROTECTED FOR PRIMARY SINGLE PHASING CONDITION.
3. 6 IN.(15.2 M.M.) PIGTAILS, FIELD CONNECTED AT THE JUNCTION BOX ON RACEWAY FOR INTERLOCK OF REMOTE CONDENSER, COOLING TOWER, OR PUMP CONTROLS. (550 VA. MAX. AT 120 V.)
4. SIGNAL FROM SA 101 SENTINEL CONNECTED TO CUSTOMERS ALARM. (NON-POWERED)
5. SHADED AREAS PROVIDED ON FAN SPEED CONTROL AIR COOLED MODELS ONLY.
6. FOR REMOTE UNIT SHUT-DOWN REPLACE JUMPER BETWEEN 37 & 38 AT TERMINAL STRIP ON WIRE RACEWAY IN UNIT MACHINE COMPARTMENT W/N.C. SWITCH HAVING MIN. 50 VA. RATING.
7. 24V. FIELD WIRING BY OTHERS, CONNECT LIQUI-TECT SENSOR TO TERMINALS 24,50 & 51 AT TERMINAL STRIP ON WIRE RACEWAY.
8. LIGHT READOUTS, AS THEY WILL READ ON UNIT, ARE SHOWN ON PCR-2 DISPLAY PANEL READOUT DWG.

WIRING AND TERMINAL LEGEND

- FACTORY SUPPLIED LINE VOLTAGE WIRING.
- FIELD SUPPLIED LINE VOLTAGE WIRING.
- FACTORY SUPPLIED 24 V WIRING.
- FIELD SUPPLIED 24 V. WIRING.
- PCR/2 P.C. BOARD INTERNAL WIRING 24 V. MAX.
- PLUG IN MODULE BASIC INTERNAL CIRCUIT 24 V. MAX.

- PLUG IN TERMINALS FOR TEMP & HUMIDITY CONTROLS LTC & LHC
- PLUG IN TERMINALS FOR TRANSFORMER CIRCUIT BREAKER MODULE TCB
- PLUG IN TERMINALS FOR WINTER START KIT MODULE WSK 200
- PLUG IN TERMINALS FOR SENTINEL AUDIBLE ALARM MODULE SA 101
- PLUG IN TERMINALS FOR COMPRESSOR SEQUENCE SWITCH MODULE CS OR JUMPER BOARD MODULE JB
- P.C. BOARD INTERNAL CONNECTIONS
- SOCKET A HARNESS-CONNECTION SENSORS
- SOCKET B HARNESS-CONNECTION HOT WATER/STEAM VALVE MOTOR
- SOCKET C HARNESS-CONNECTION CHILLED WATER VALVE MOTOR
- SOCKET D HARNESS-CONNECTION CONTACTOR PANEL
- SOCKET E HARNESS-CONNECTION COMPRESSOR COMPARTMENT ITEMS
- 1/4 IN.(6.4 M.M.) QUICK CONNECT TERMINALS
- EQUIPMENT (COMPONENT) TERMINALS

DRN/CKD	GAM/PEM	DATE 6-9-76
APPD.	D.B.B.	6-9-76

COLOR CODE

BK-BLACK		
W-WHITE	INSULATION	
Y-YELLOW	COLOR	
R-RED		
OR-ORANGE		
BU-BLUE	BK/BU	
BR-BROWN		
GN-GREEN		
P-PURPLE	TRACER	
GY-GRAY	COLOR	

Liebert Corporation
1040 DEARBORN DRIVE • P.O. BOX 29186 COLUMBUS, OHIO 43229 • PHONE (614) 888-0246 TELEX 246-606

TITLE ELECTRICAL SCHEMATIC
FOR PCR/2
PRECISION CONTROL READOUT

SIZE C | DRAWING NUMBER 2E2357 | REV. 1

161442S12200

Specifications subject to change without notice

Liebert Corporation

1050 DEARBORN DRIVE, P.O. BOX 29186, COLUMBUS, OHIO 43229 • PHONE 614-888-0246 TELEX 246-655

Form No. 76-K-D-COM-S-03

Part No. SL-11080

Litho in U.S.A.