

CONDENSER FAN CONTROL

P/N 339410A EPC-2000 Installation Instruction for Condenser Fan Control March, 1990 Supersedes 339410 Dated September, 1989

EPC-2000

Condenser Fan Control

Correction Sheet—November, 1990

ADDITIONS TO EXISTING TEXT

Page 2-2

Discharge Pressure Transducer—The discharge pressure transducer (Figure 1-8) is mounted on the discharge header. The three conductor cable of the transducer is run to the input terminal board (Figure 1-7). The Red wire is connected to the +15V; the Green wire to IN and the White wire to COM on the input terminal board designated DIS-CHARGE PRESSURE.

Liquid Line Temperature Sensor—When a change from Fixed Head control to Floating Head control is desired, a liquid line sensor must be connected to the LIQUID LINE TEMP terminals of the input terminal board (Figure 1-7). If the SPR option with liquid line sensing is already installed to these terminals, the condenser control modes can be changed without concern. Verify temperature sensor installation.

In order to get sub-cooling affect on liquid line, the A-7 valve must be adjusted to 3 lbs below the minimum head pressure set point.

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Ambient Temperature Sensor—The ambient temperature sensor (Figure 1-9) is mounted on a bracket <u>under</u> the coil slab of the left-hand number one fan. The cable for this sensor is connected to the two screw terminals on the condenser relay board (Figure 1-1) marked AMBIENT TEMPERATURE (non-polarized).

SOFTWARE VERSION 1.09B AND HIGHER

Page 3-3

High And Low Limits—Floating Head Algorithm (Figure 3-2) Current data is for Floating Head Control with Extra Low Head.

Without Extra Low Head the PLL-Low Pressure Alarm Limit is:

R-22 is 55-170 psi with a default of 105 psi

R502 is 75-185 psi with a default of 125 psi

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Fan On/Off Response Time—The fan on/off response time has been cut in half when pressure is 10% above or 5% below the set point.

Also if signal occurs within 4 minutes of the end of a defrost, or during a defrost, the response time is cut an additional half.

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System Menu—When floating head is installed, two new screens now appear after the Cond Temp Offset screen. They are:

Min HD Prs SetPt
XXXPSI

Minimum Head Pressure Set Point is adjustable on systems with no extra low head. R22: 125–160 psi with a default of 135 psi. R502: 140–170 psi with a default of 148 psi.

Min LL Tmp SetPt
XX °F

Adjustable Minimum Liquid Line Temperature Set Point (more liquid sub-cooling). The range is 40–55°F with a default of 55°F.

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REVISION CHANGES ("A")

- 1. New Figures 2-3, 2-4 and 2-5.
- 2. New Wiring Diagrams

INTRODUCTION

GENERAL

This instruction is to be used as an addendum to the EPC-2000 Installation Instruction for Super Plus (P/N 334495). The items contained here are additions to the basic EPC-2000 controller.

The EPC-2000 is the most advanced compressor system controller in the industry today. To further distinguish Hussmann's mark of excellence, this micro-processor based controller offers the advantage of Condenser Fan Cycling control. This option will efficiently cycle up to seven fan banks on the condenser to effectively control the discharge pressure.

The EPC-2000 Condenser Fan Control was engineered to meet the two main variations in systems today: fixed head and floating head. The fixed head control will sequence fans based solely on discharge pressure. While floating head control will sequence fans based on discharge pressure and liquid temperature.

COMPONENTS

Control Circuit Plug Assemblies
Field Wiring Interface Board
Interconnect Cable
Input Terminal Board
Discharge Pressure Transducer
Temperature Sensor (one for ambient and one for liquid temperature)

Condenser Relay Board

This relay board (P/N 0339652) is connected to the EPC-2000 processor assembly via a 15 conductor cable. See Figure 2-1 for proper connection location to the CPU board.

The Condenser Relay Board (Figure 1-1) consists of the following 12 relays:

- 7 Condenser Fans
- 1 Condenser Only Switchback
- 1 Split (Half) Condenser
- 1 Switchback (Parallel to Compressor SWBK)
- 2 Disable Relays

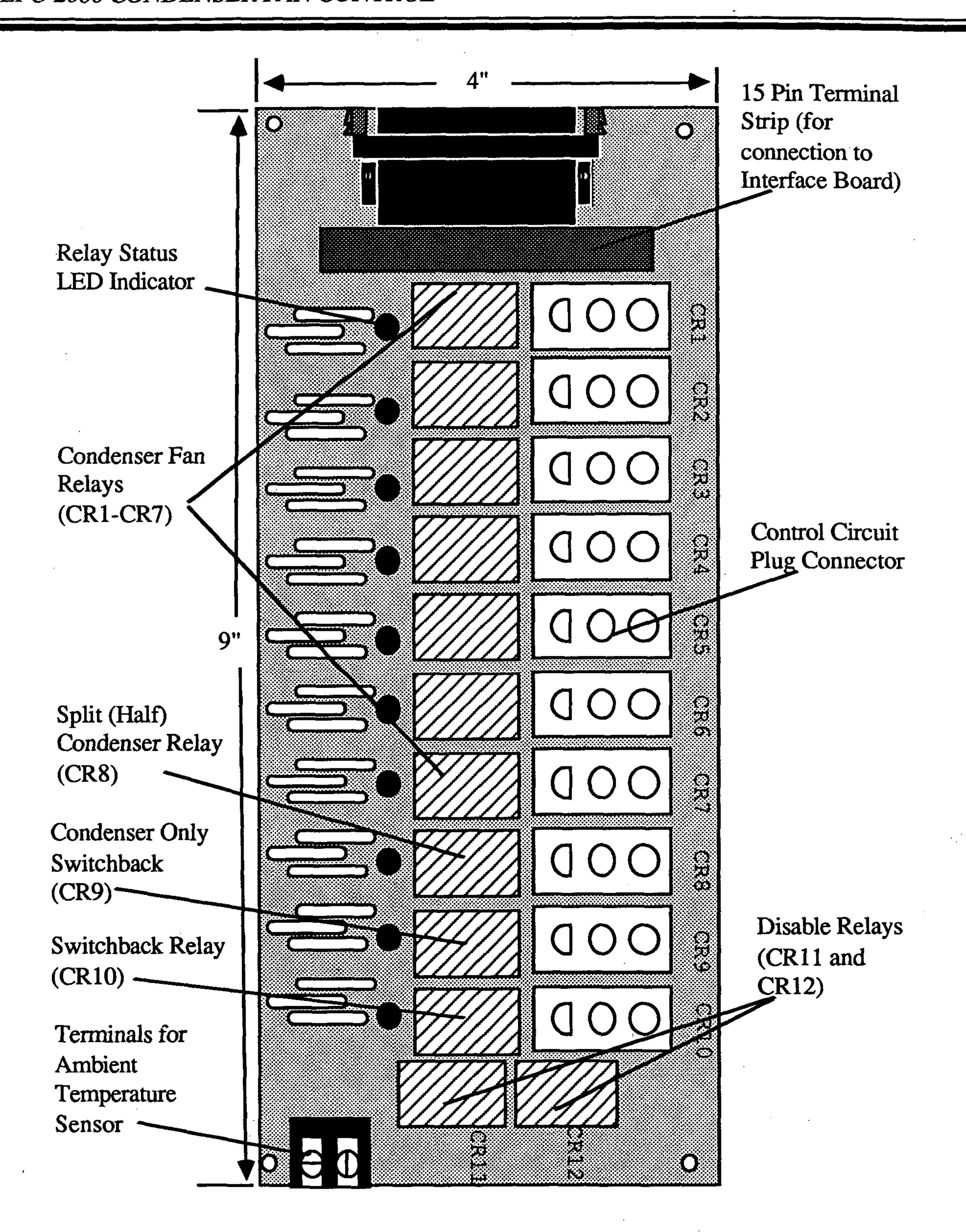


Figure 1-1. Condenser Relay Board

Control Circuit Plug Assemblies

The control circuit plug assemblies (Figures 1-2, 1-3, and 1-4) connect the Condenser Fan Control circuit to the relay board.

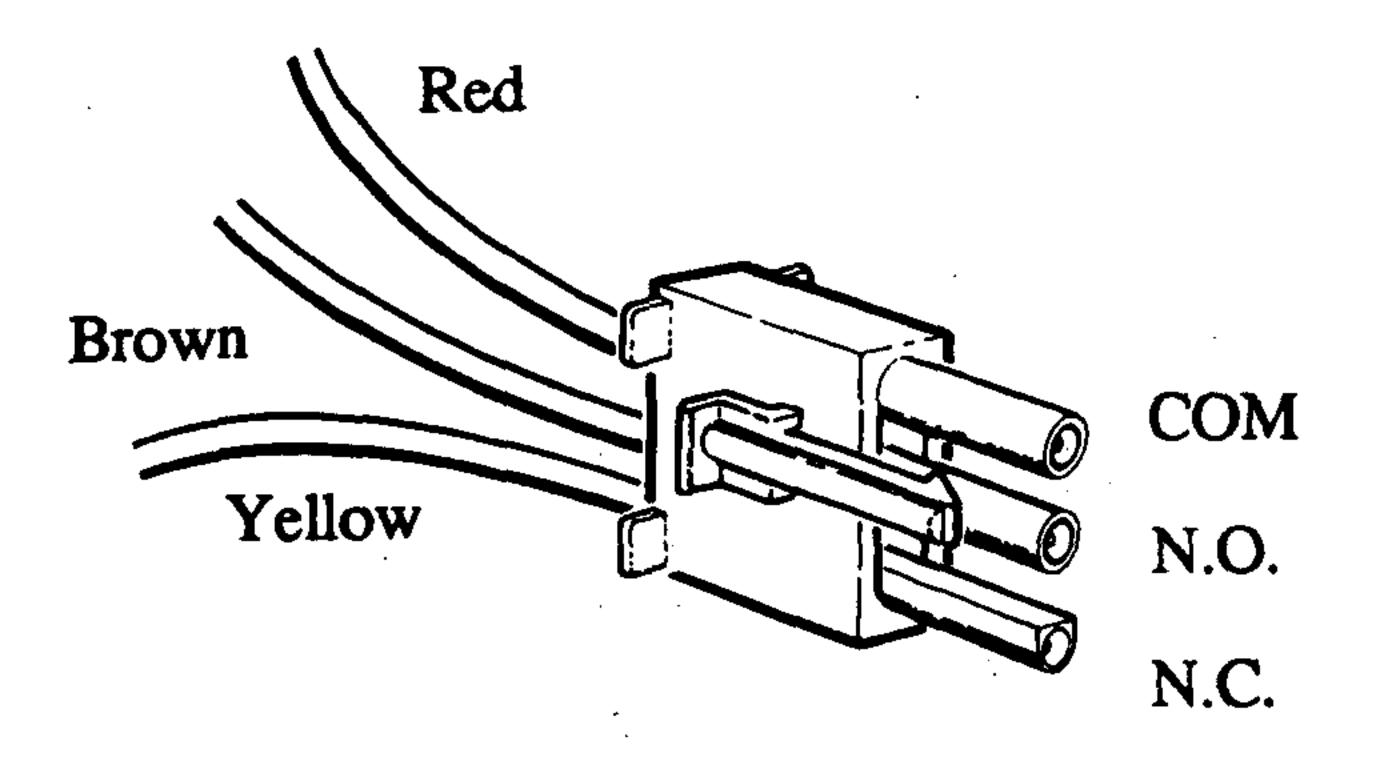


Figure 1-2. Condenser Fan Control Plug Assembly (P/N 334197)

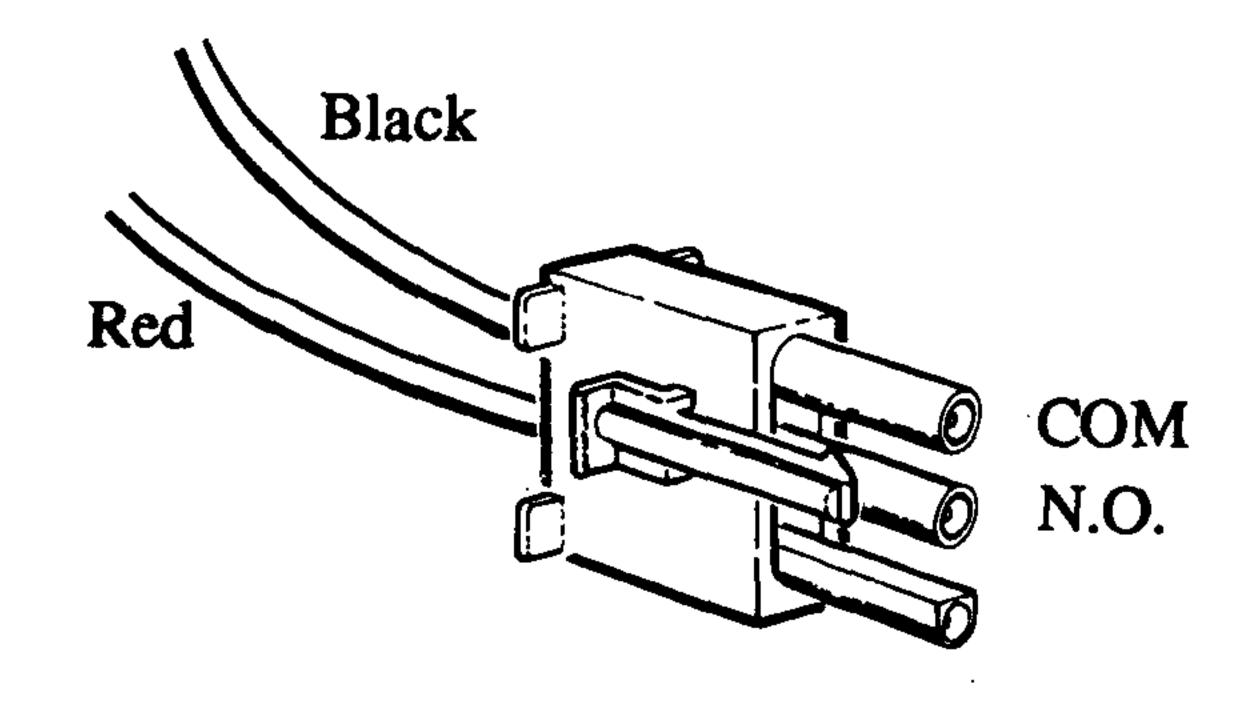


Figure 1-3. Split Condenser Plug Assembly (P/N 339617)

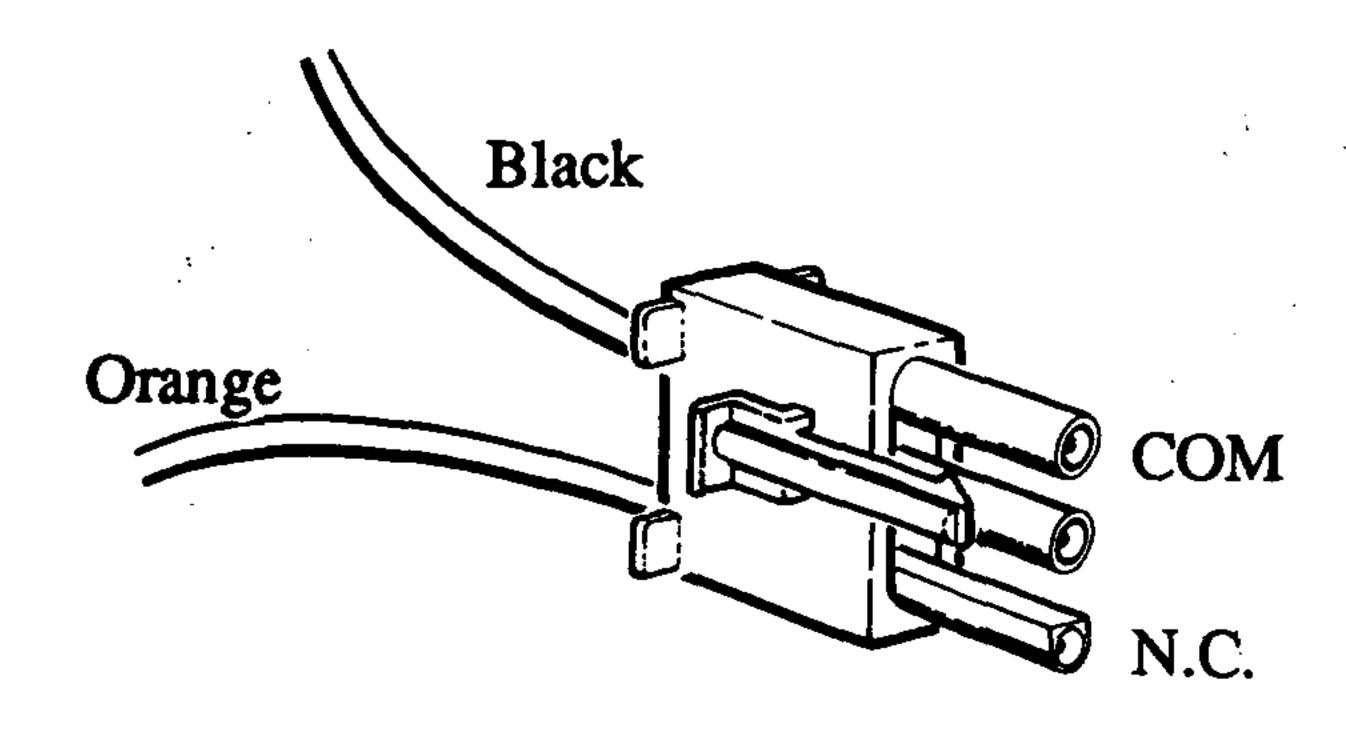


Figure 1-4. Switchback Plug Assembly (P/N 334198)

Field Wiring Interface Board

This board (P/N 335850), as shown in Figure 1-5, simply transfers the 15 pin interconnect cable assembly to a terminal strip for ease of field wiring installation.

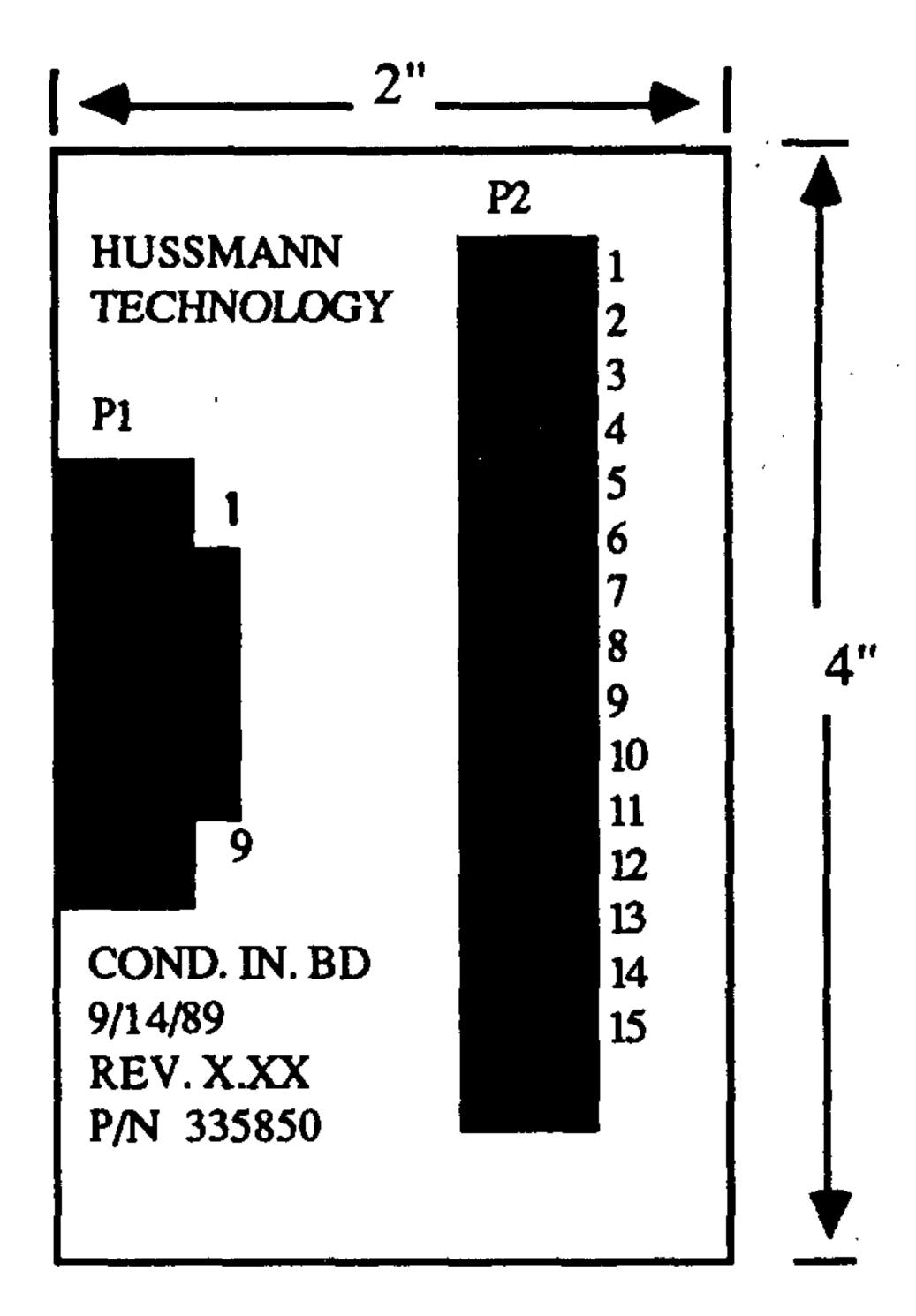


Figure 1-5. Field Wiring Interface Board

Interconnect Cable

The interconnect cable (P/N 335849) provides a signal and power pathway from the EPC-2000 to the field wiring interface board. See Figure 1-6.

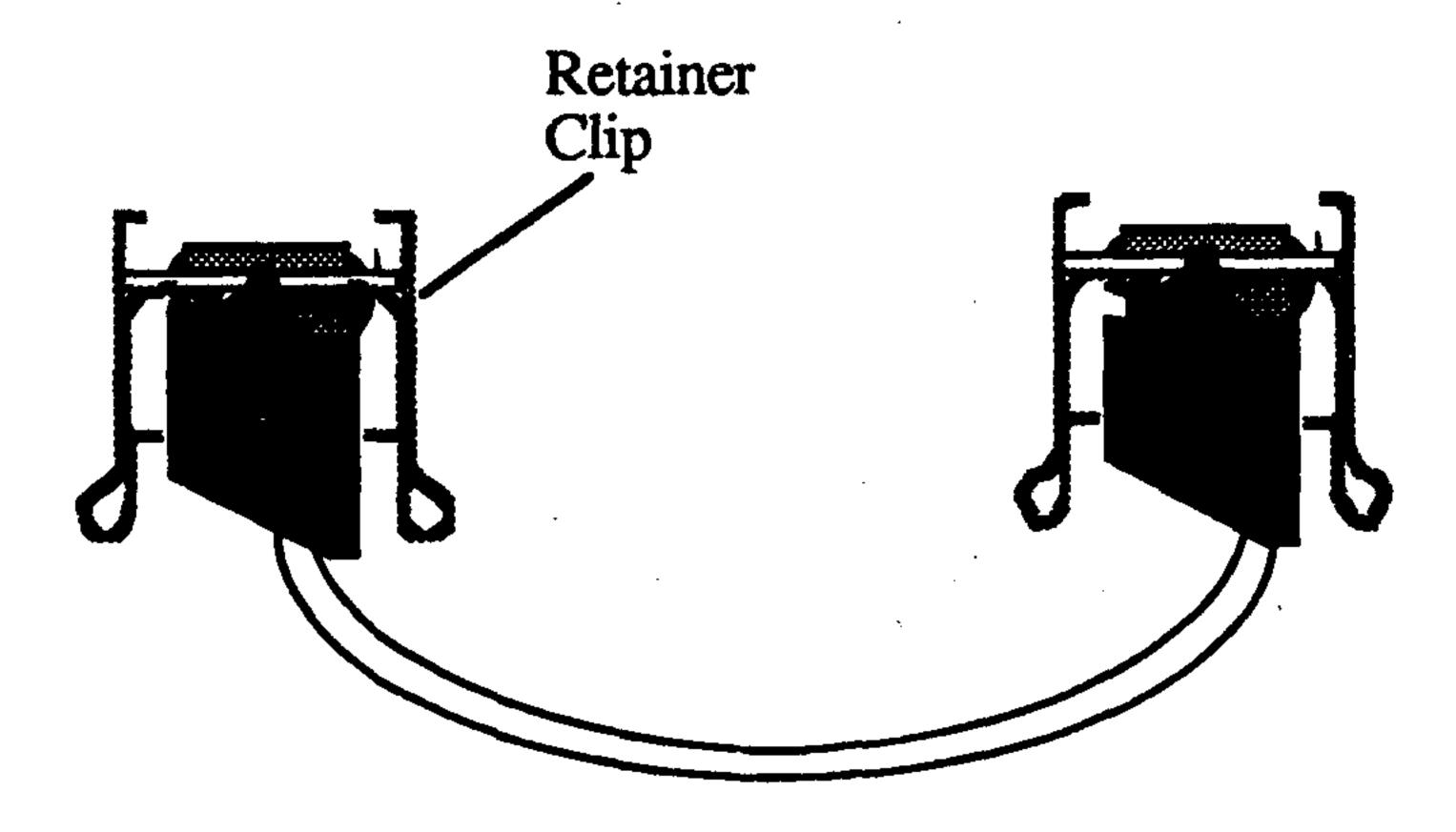


Figure 1-6. Interconnect Cable

Input Terminal Board

The input terminal board (P/N 334492) will accommodate the connections from all required inputs. (See Figure 1-7). The additional inputs used for Condenser Fan Control are:

- 1. Discharge Pressure Transducer
- 2. Liquid Line Temperature
- 3. Heat Reclaim Status

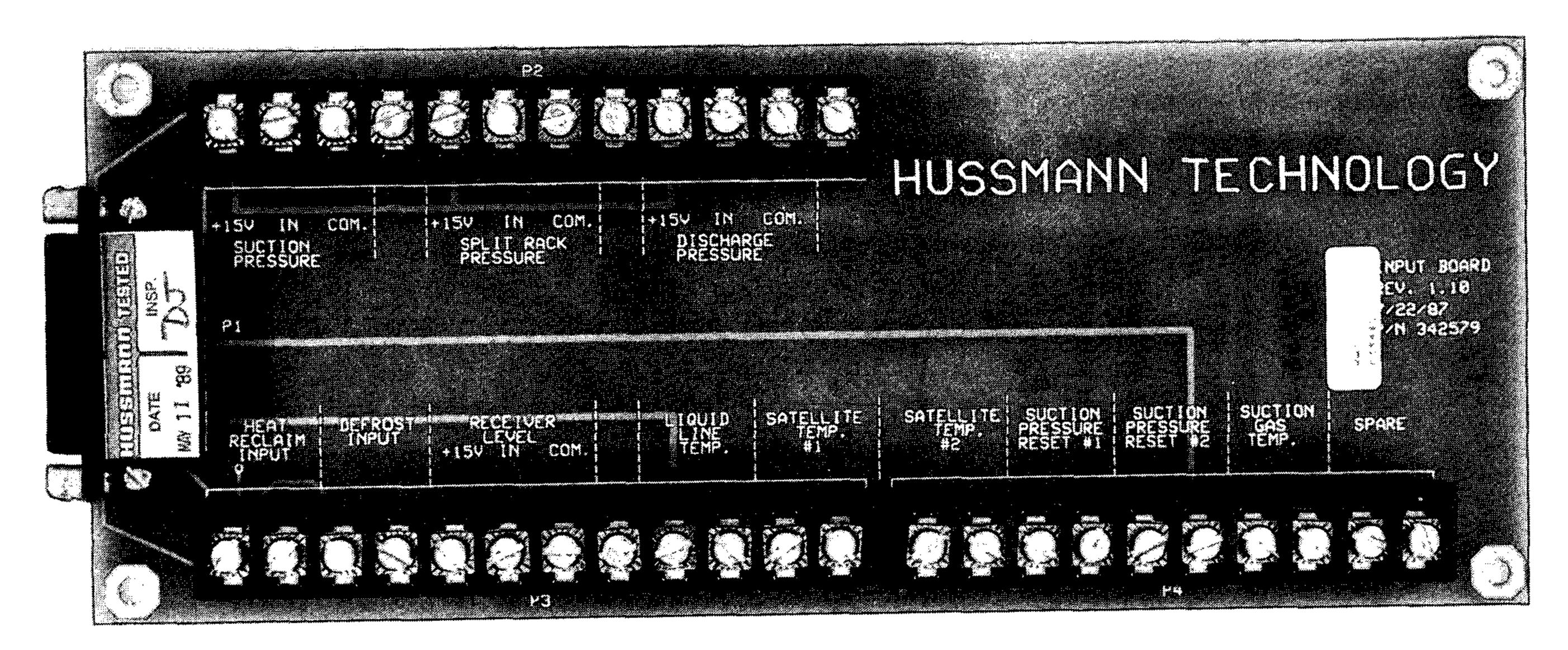


Figure 1-7. Input Terminal Board

Discharge Pressure Transducer

The discharge pressure transducer provides an analog signal to the processor proportional to the pressure detected. This transducer is similar to the type used for monitoring suction pressure. The difference is the discharge pressure transducer operates over a range of 0-500 psig versus 0-100 psig for the suction pressure transducer. See Figure 1-8.

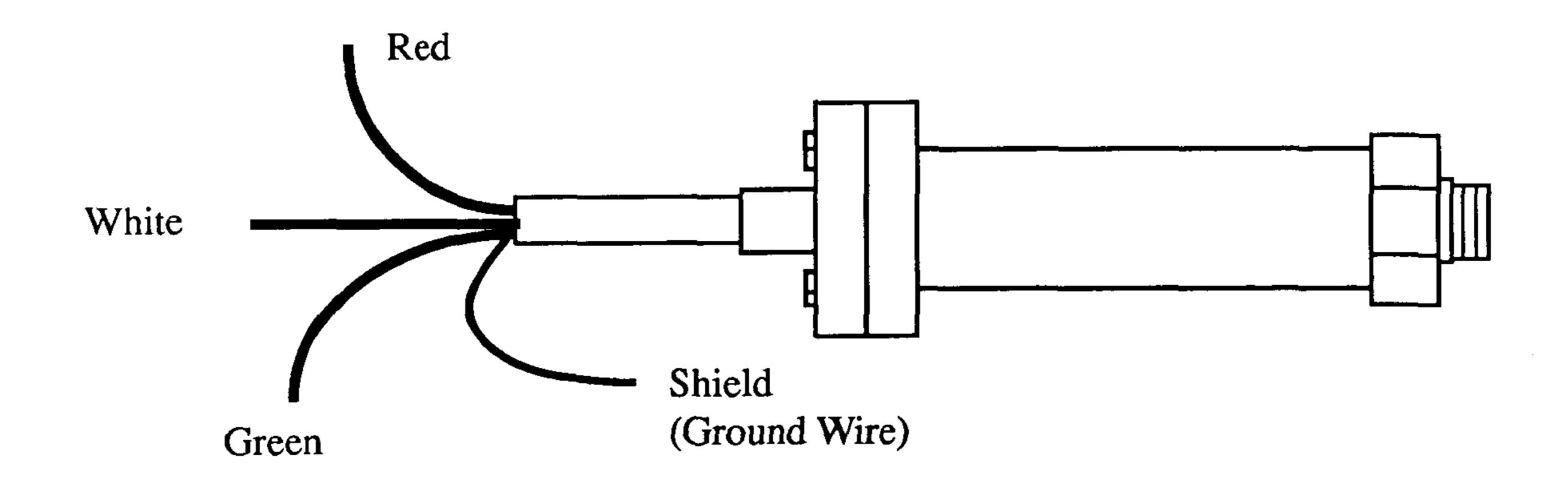


Figure 1-8. Typical Discharge Pressure Transducer

Temperature Sensor

The temperature probe is a fast response, non-polarized, resistive type sensor. A temperature sensor is needed for the ambient and the liquid lines. See Figure 1-9.

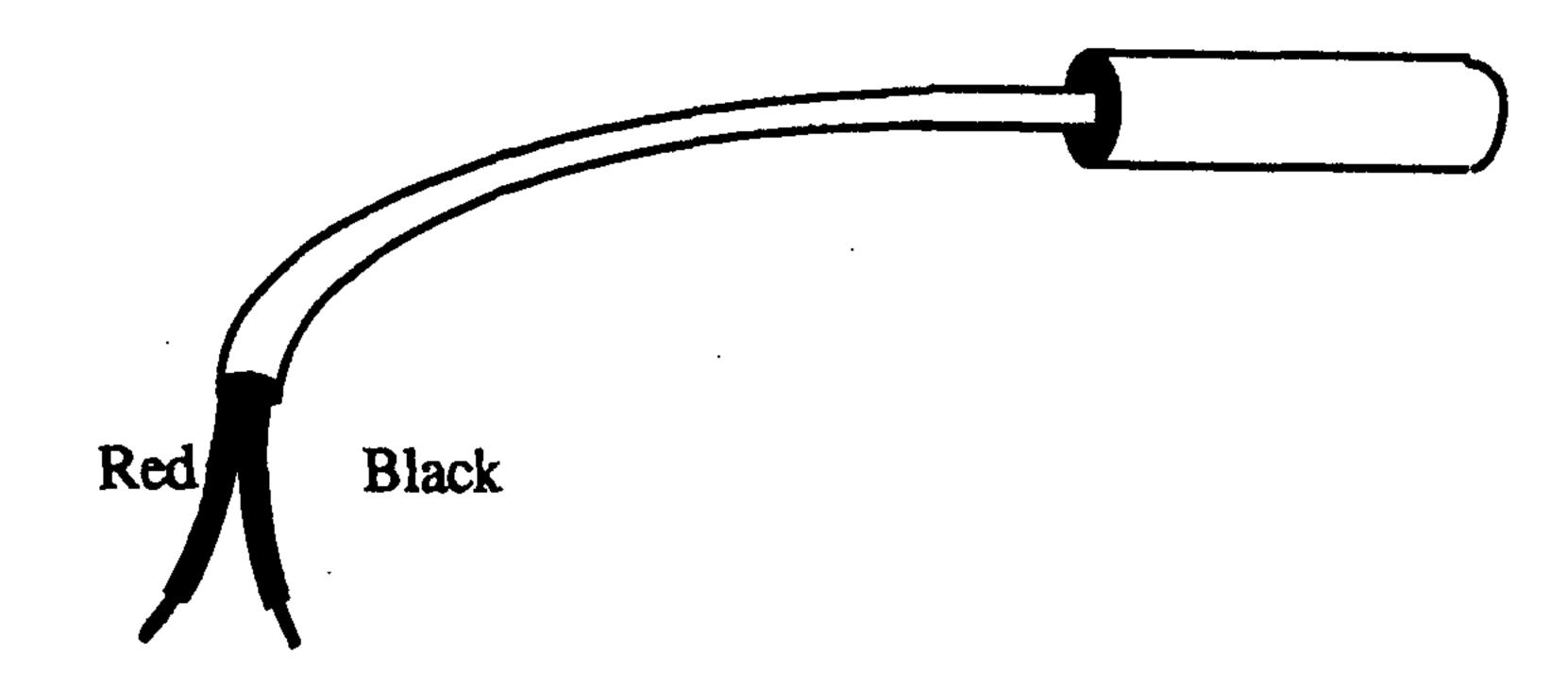


Figure 1-9. Temperature Sensor

Heat Reclaim Status

The heat reclaim status input is a dry contact closure that signals the EPC-2000 that the rack has had its reclaim circuit energized.

INSTALLATION

GENERAL

Installations may be handled in several ways, for example the componentry may be located in various places. The main difference, however, is field installation of power wiring (in conduit) versus low voltage signal wiring (shielded cable). This manual will cover only the following two standard installations:

- 1. All component factory installed with signal wiring field installed.
- 2. All electronic component installed in an enclosure, with all sensors, transducers, and wiring field installed.

FACTORY INSTALLATION — HUSSMANN SUPER PLUS SYSTEM

Please refer to the EPC-2000 manual (P/N 334495) for proper installation of components within the Super Plus System. This instruction will only cover additional componentry for Condenser Fan Control.

Field Wiring Interface Board

The field wiring interface board (Figure 1-5) is mounted inside the left-hand door of the Super Plus System to the panel liner via snaptrack. This board is connected to the EPC-2000 CPU board via the 15 pin plug interconnect cable. See Figure 2-1 for proper location of the 15 pin receptacle on the EPC-2000 processor.

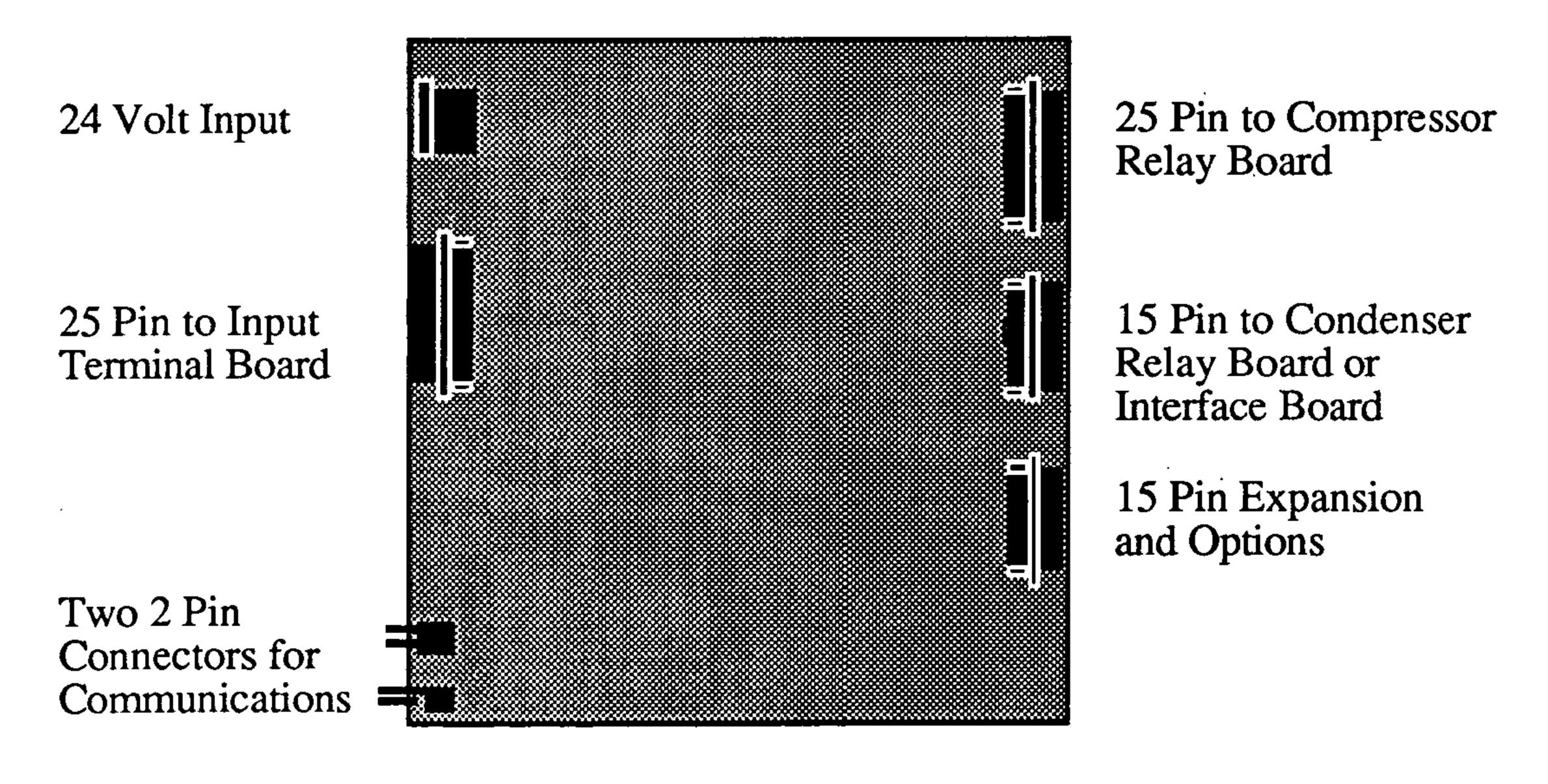


Figure 2-1. CPU Board

The screw terminals of the interface board are numbered 1-15, which connect to numbered terminals 1-15 on the condenser fan relay board mounted in the condenser control panel.

Discharge Pressure Transducer

The discharge pressure transducer (Figure 1-8) is mounted on the discharge header. The three conductor cable of the transducer is run to the input terminal board (Figure 1-7). The Red wire is connected to the "+15V"; the Black wire to COM, and the White wire to IN on the input terminal board designated DISCHARGE PRESSURE.

Liquid Temperature Sensor

The liquid temperature sensor (Figure 1-9) is mounted on the condensate line 6 inches below the condenser flooding valve. The 2-wire sensor cable is connected to the input terminal board to terminals marked LIQUID LINE TEMP. Although polarity does not affect this signal, this cable should be segregated from power wiring (where possible).

Heat Reclaim Status

The heat reclaim status is wired to a normally open set of contactors on the heat reclaim relay and to the terminals marked HEAT RECLAIM INPUT on the input terminal board (see Figure 1-7).

KRACK CONDENSERS

Relay Boards

The condenser relay board is mounted in the condenser control panel via snaptrack. All control circuit wiring will be complete, with the exception of the split condenser portion that interfaces with the Super Plus System. Figure 2-2 shows a typical mounting practice and location.

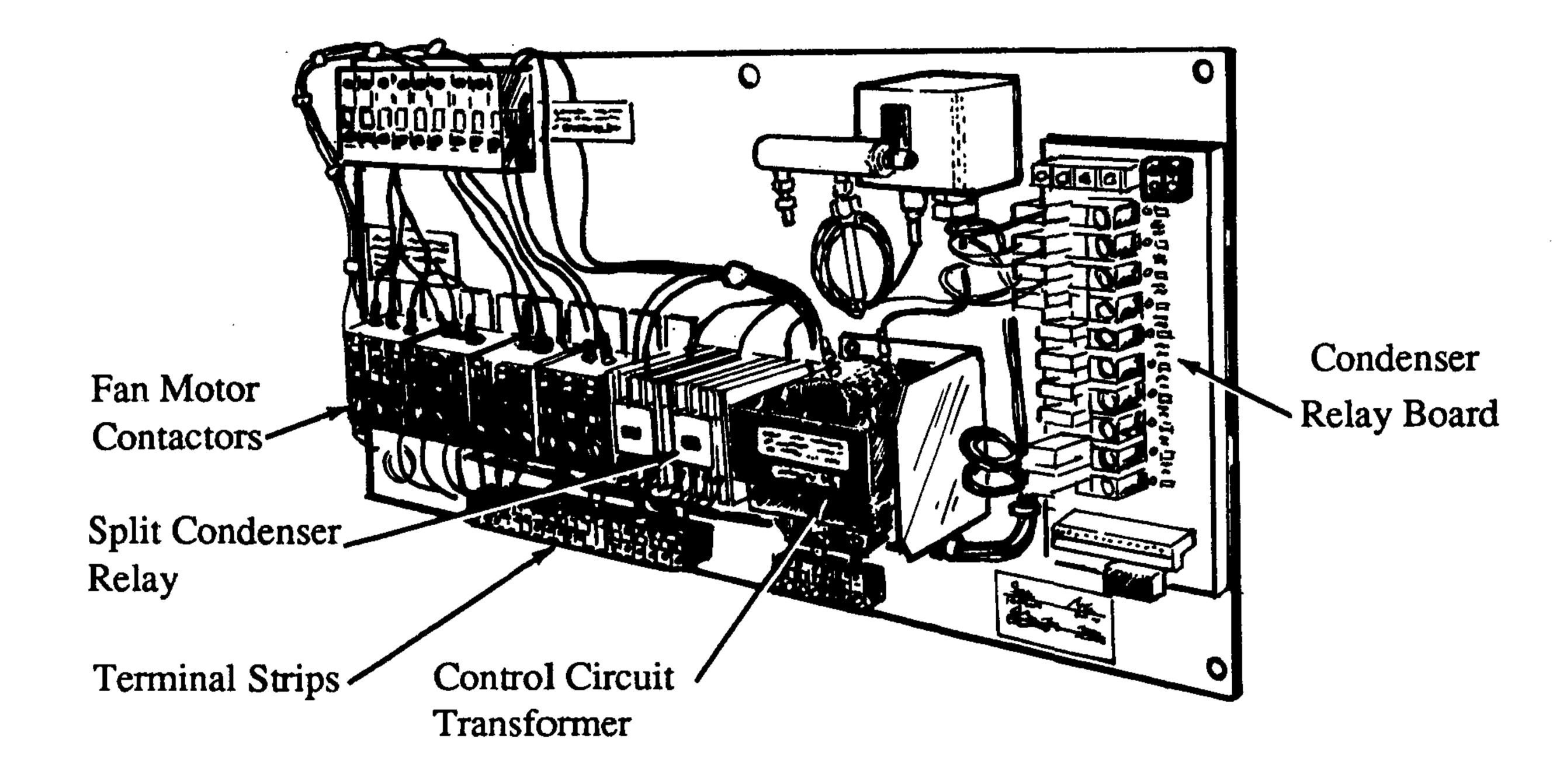


Figure 2-2. Krack Condenser Control Panel

EPC-2000 CONDENSER FAN CONTROL

Fan Relays

The condenser fan control relays (CR1 - CR7) are wired directly into the control circuits for the fan contactors. The common pole of the relay is always connected to the load side. The normally open contact is directly connected to the line side of the condenser control circuit power supply. During normal EPC-2000 operation the normally closed contacts open isolating the switchback circuit from line voltage. During switchback the fans are activated by mechanical controls.

Figure 2-3 shows a typical condenser fan relay control circuit wiring diagram with the minimum number of mechanical controls. The normally closed contacts are either connected to a mechanical control (fans 1, 3 and 5) or jumpered (fans 2, 4, 6 and 7) to a contact that is connected to a mechanical control. To enhance switchback, additional mechanical controls may be used in place of the jumpers.

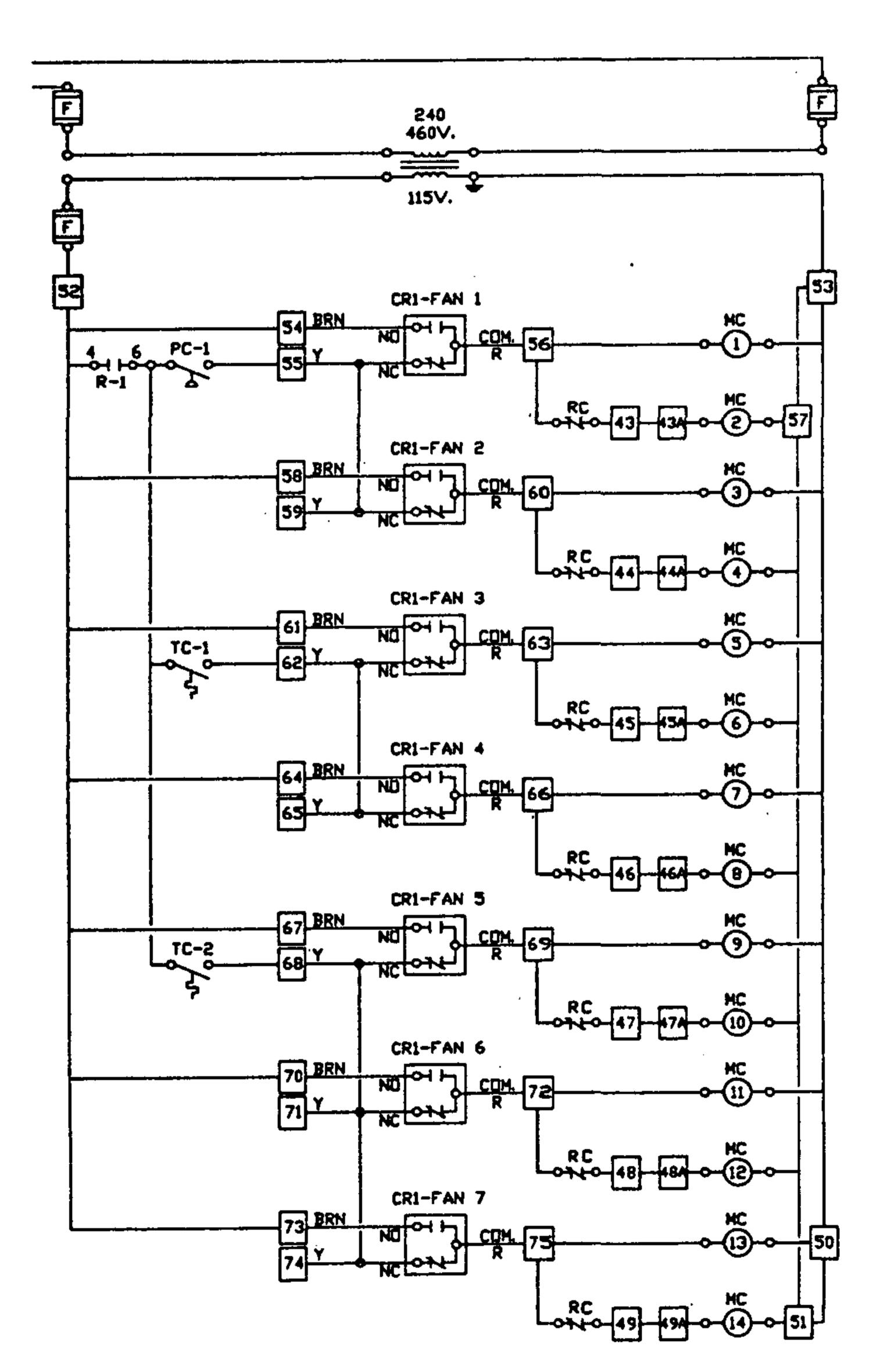


Figure 2-3. Typical Condenser Fan Relay Control Circuit Wiring

Switchback Relays

There are two switchback relays (CR9 and CR10) for activating the mechanical controls circuit. Both of these relays (normally closed contacts) are wired in parallel between terminal SC4 and the R-1 relay coil (pin 8). These relays are powered when the EPC-2000 is in control and drop out when the EPC-2000 is in switchback. See Figure 2-5.

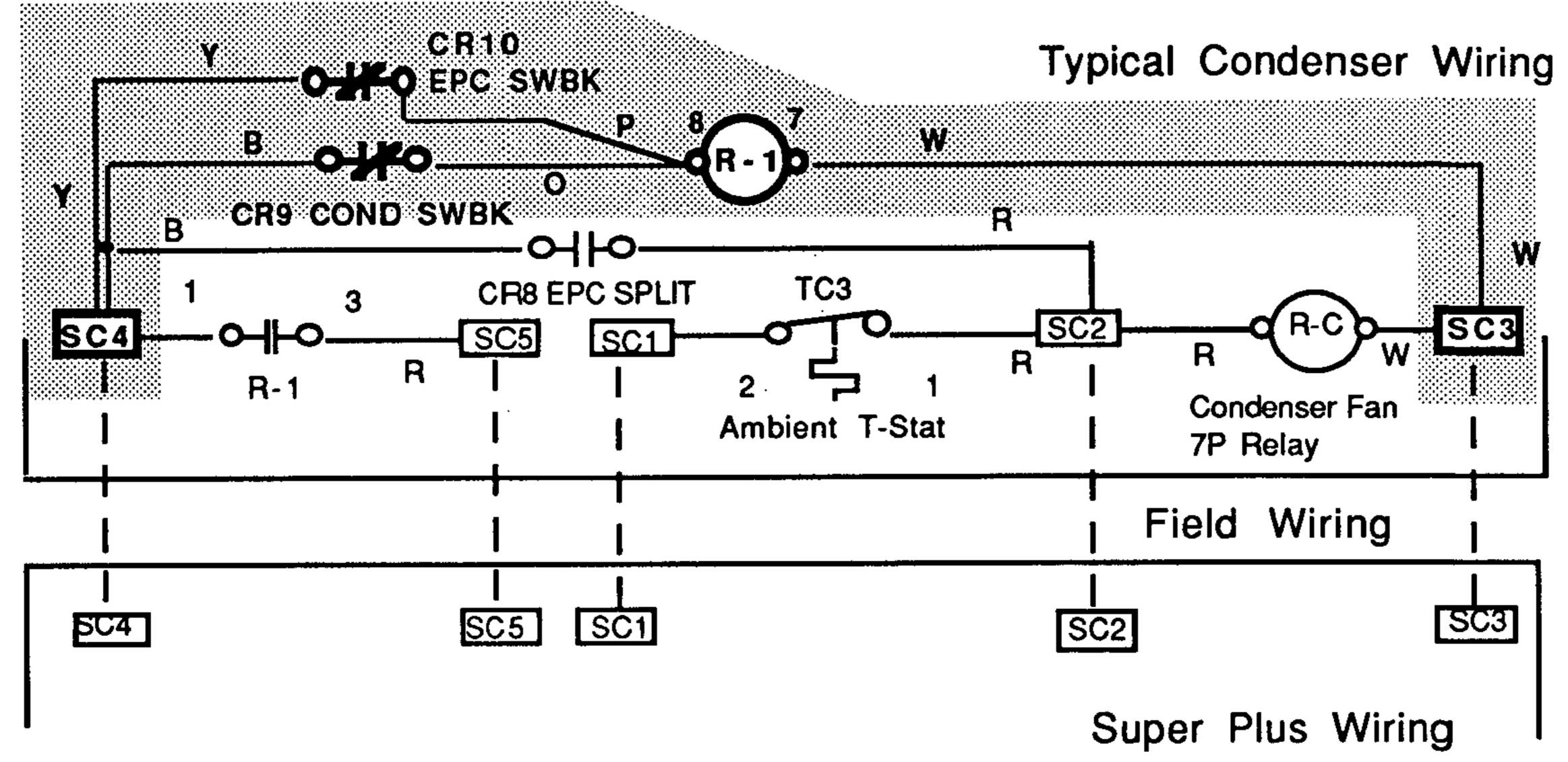


Figure 2-4. Typical Switchback Relays

NOTE: Refer to Super Plus Manual (P/N 328534) for wiring and settings of mechanical controls for switchback operation. This includes fan cycling controls and split condenser controls.

Split Condenser Relay

The split condenser relay (CR8) is factory wired with its normally open contact between terminals SC4 and SC2. See Figure 2-4.

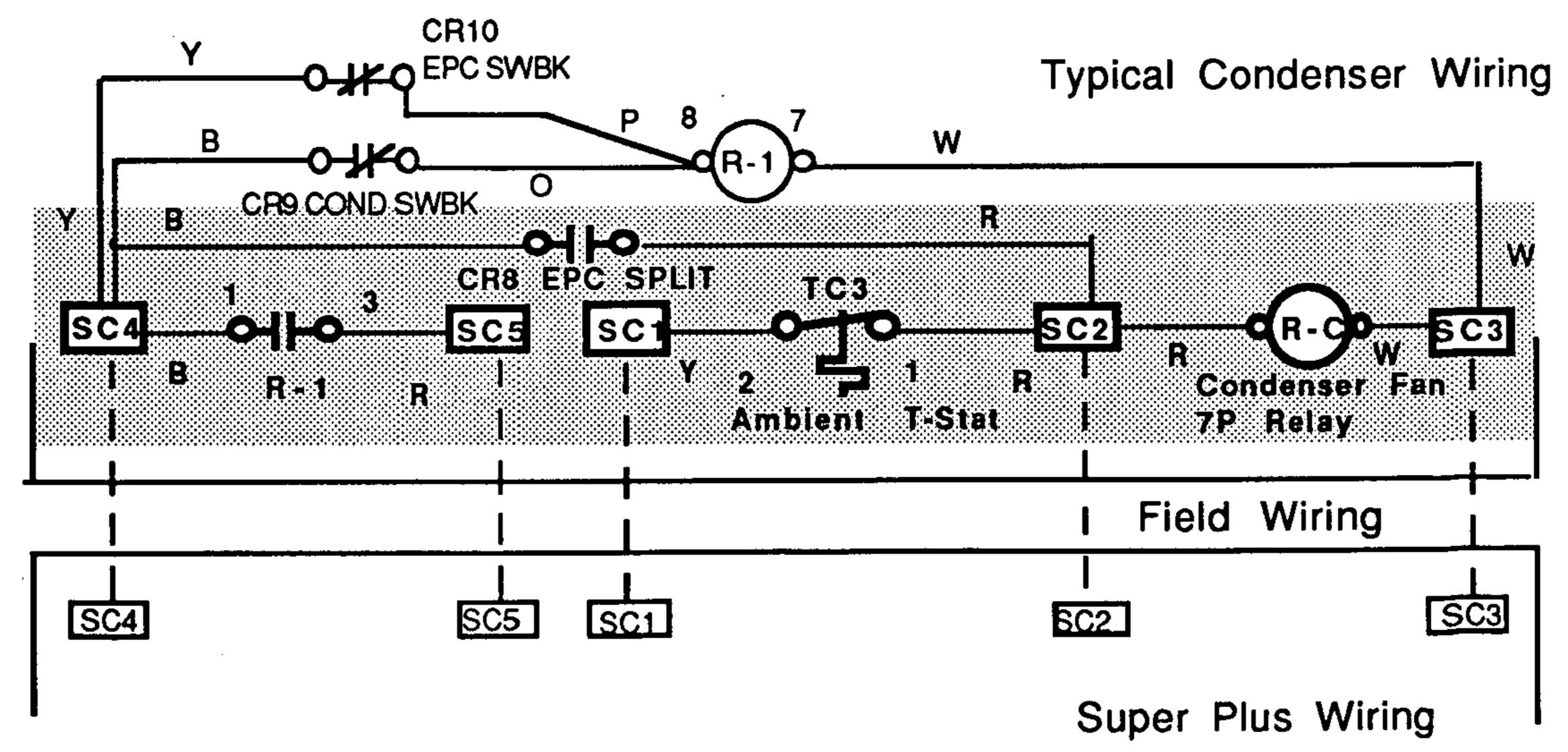


Figure 2-5. Typical Split Condenser Relay

Ambient Temperature Sensor

The ambient temperature sensor (Figure 1-9) is mounted on a bracket under the left-hand number one fan. The cable for this sensor is connected to the two screw terminals on the condenser relay board (Figure 1-1) marked AMBIENT TEMPERATURE (non-polarized).

FIELD WIRING FOR FACTORY INSTALLATION

There are basically two steps for completing the wiring for a typical installation. The first is the low voltage signal wiring between the interface board and the condenser relay board. The second is the control circuit wiring between the Super Plus panel and the condenser panel.

- 1. The low voltage signal wiring will be completed by connecting terminal for terminal between the interface and condenser relay boards, (1-1, 2-2, 3-3, etc.). Use a 15 conductor shielded cable, such as Belden 9541, or equivalent. The cable need not be run in conduit between the two control panels. NOTE: A typical field wiring diagram is enclosed in the envelope at the end of this section.
- 2. Control circuit wiring connects terminals SC1-SC5 in the condenser, to terminals SC1-SC5 in the Super Plus panel. Use 18 gage stranded wire with 600 volt insulation for these connections. This wiring must be in conduit and installed according to local codes.

FIELD WIRING FOR FIELD INSTALLED EPC-2000

The installation procedure for a field installed EPC-2000 is listed in Chapter Two (Installation) of the EPC-2000 manual (P/N 334495). In addition to components listed, there will be one condenser relay board and one 15 pin interconnect cable. Note that for this type of installation, there is no need for the interface board. The relay board will have a mating plug connector for the interconnect cable assembly. See Figure 2-6 for internal layout of this enclosure.

To complete the installation of the Condenser Fan Control, the following number of 18 gage 600 V stranded wires will have to be run in conduit to this enclosure.

- 1. Three (3) per fan bank from condenser
- 2. Four (4) for switchback relay circuitry from condenser
- 3. Two (2) wires for split condenser circuitry from condenser

You must also run one cable (Belden 8760 or equivalent) from the ambient temperature sensor mounted under the condenser to the condenser relay board. A similar cable is required from the liquid temperature sensor on the Super Plus to the input terminal board.

NOTE: A typical field wiring diagram is enclosed in the envelope at the end of this section.

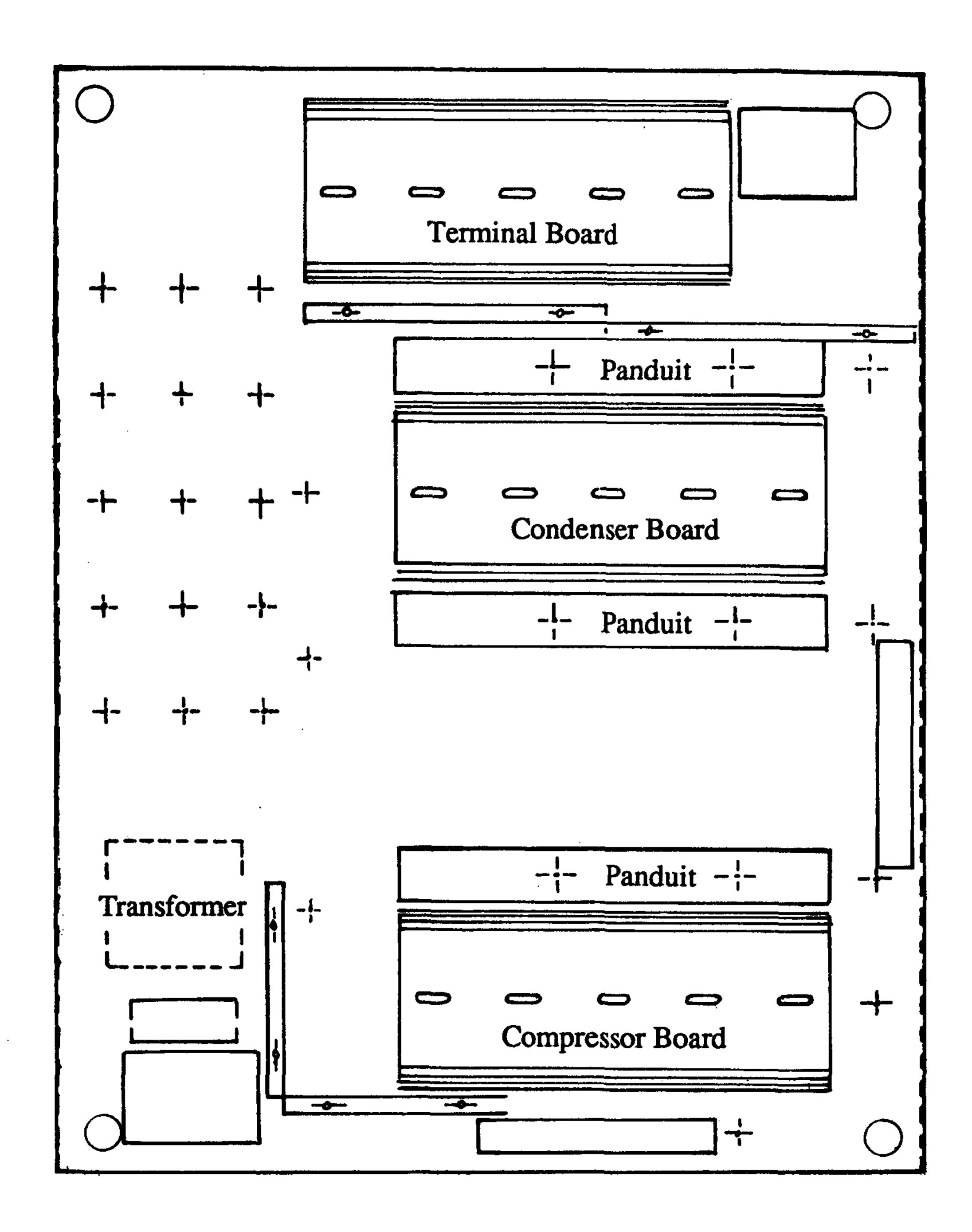


Figure 2-6. Field Installed Enclosure Layout

OPERATION

GENERAL

The EPC-2000 Condenser Fan Control was engineered to meet the two main variations in systems today: fixed head and floating head. The fixed head control will sequence fans based solely on discharge pressure. While floating head control will sequence fans based on discharge pressure and liquid temperature.

DETERMINATION OF SET POINTS

Fixed Head

For fixed head operation, the only controlling parameter is discharge pressure. The set point for discharge pressure is user definable in the system menu. The EPC-2000 condenser fan control will cycle fans on at a point 5% above this set point, and cycle fans off 2.5% below this set point. This will maintain the average discharge pressure at the set point pressure.

Example: Set point = 185 psig

Cut-in = 185 + 5% = 194 psigCut-out = 185 - 2.5% = 180 psig

Floating Head

For floating head control, all set points are internally calculated based on the ambient temperature. The controlling parameters for this method of control are discharge pressure, liquid temperature, and heat reclaim status.

To determine the liquid temperature set point, there is one user defined adjustable setting. It is labeled COND TEMP OFFSET and is located in the SYSTEM menu. The liquid temperature set point is equal to ambient temperature plus the condenser offset temperature. The condenser offset temperature is adjustable from 6 - 20° F. The effect of this setting is the amount of subcooling the EPC-2000 condenser control will maintain. A lower offset value will tend to increase the amount of subcooling.

Example: Ambient Temperature = 80° F

Condenser Offset Temperature = 10° F

Liquid Temperature Set Point = 80 + 10 = 90° F

The range of the liquid temperature set point is 35 - 110° F. If the calculation method had a liquid temperature set point below 35° F, the control will default to 35° F. And if the calculation exceeds 110° F, the control will default to 110° F.

The discharge pressure set point is determined from the saturation curve, shown in Figure 3-1. The X-axis is the liquid temperature set point, as calculated above, from this point a vertical line is drawn until it intersects the curve. Then by drawing a horizontal line from this intersection, it yields the discharge pressure set point along the Y-axis. The range of the discharge pressure set point is 148 psig - 250 psig (R-502).

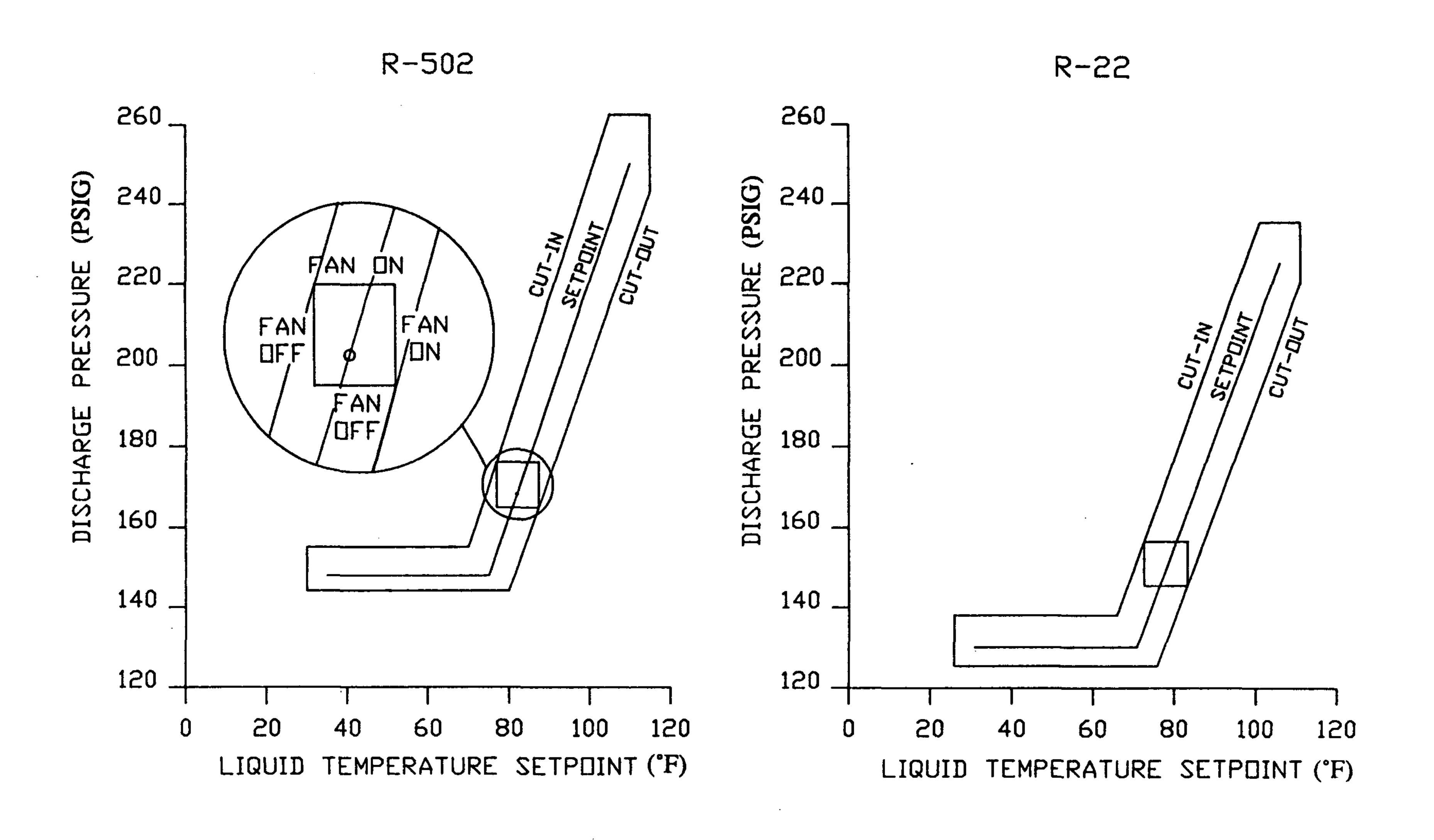


Figure 3-1. Floating Head Operating Curves

OPERATION

The heat reclaim status adjusts the discharge pressure set point up 15 psig if this set point falls below 80° F saturated (161 psig - R-502). If it is above 80° F the set point is not adjusted. The liquid temperature set point is not affected.

HIGH AND LOW LIMITS

The EPC-2000 has built in high and low limits for both liquid line temperature and discharge pressure. The values for these limits are listed in Figure 3-2. If the EPC-2000 Condenser Fan Control is configured for fixed head control, the high and low pressure limits can be changed in the SYSTEM menu. For floating head control all limit values are predetermined.

	Floating Head Control	
	R-22	R-502
PHL-High Pressure Limit	280	285
PLL-Low Pressure Limit	120	140
THL-High Temperature Limit	130	130
TLL-Low Temperature Limit	T AMB-5° F	
H-Heat Reclaim Minimum Pressure	144	161

Figure 3-2. Floating Head Algorithm

When any limit is exceeded, the EPC-2000 will try to take corrective action. For instance, if the high pressure limit is exceeded the EPC-2000 will automatically force full condenser operation with all fans on in an attempt to reduce the operating parameters. If this action corrects the high limit condition, the EPC-2000 will return to normal operation. But if this action does not correct the situation in 4-5 minutes, the condenser switchback relay will be activated to cause operation by mechanical controls, and an alarm signal will be generated.

If the low limit is exceeded, the EPC-2000 will force all fans off (with exception of #1 fan when ambient temperature is greater than 60° F) and go to a half condenser mode. If this action corrects the low limit condition, the EPC-2000 will return to normal operation. But if this action does not correct the situation in 8-10 minutes, the switchback and alarm functions will be generated.

NOTE: The EPC-2000 maintains control of compressor cycling during switchback and alarm caused by both high and low limit conditions

NEXT FAN ON/OFF

The next fan in sequence will be cycled on when either the discharge pressure exceeds the pressure set point by 5%, or with floating head the liquid temperature exceeds its set point by 5° F. There is a minimum time delay between fan-on operations.

This delay is variable and based on ambient temperature. The range of this delay is 20 - 90 seconds. The next fan-on time delay is inversely proportional to ambient temperature, thus an increase in ambient temperature results in a decrease in fan-on delay.

Conversely, the next fan in sequence will be cycled off when either the discharge pressure is below its set point by 2.5% or for floating head the liquid temperature is below its set point by 5° F. The variable fan-on time delay ranges from 45-120 seconds, and is based on ambient temperature. Higher ambient temperatures will have a longer time delay than cooler temperatures. Note that the last fan will not be allowed to cycle off until the ambient temperature drops below 60° F (Fixed Head) or 35° F (Floating Head).

SPLIT CONDENSER

On a dual header condenser, the EPC-2000 Condenser Fan Control will allow half of the circuits to be turned off and on by energizing and de-energizing a 3-way valve located on the Super Plus Rack. The determination of when to split is based on ambient temperature and the number of fans running at any given time. If the number of fans on is less than half the total number of fans, for a duration of 5 - 30 minutes and the ambient temperature is less than 80° F, the EPC-2000 will activate the half condenser mode. At the same time the EPC-2000 will energize fan relay circuits so that the same number of fans (not banks) are operating. The half of the condenser not activated will be pumped out to suction, and the fans on that side will be deactivated by use of an external relay in the condenser control panel.

The condenser will be changed back to full condenser after all fans on one side are on, and the operating conditions are above their set points. This is basically the same function of turning the next fan on. At the same time the EPC-2000 will energize fan relay circuits to activate at least the same number of fans.

SWITCHBACK

There are two possible methods of activating the switchback circuitry.

The first would only allow the condenser control portion to switchback to mechanical controls. This would be enabled by de-energizing CR9 relay on the condenser relay board. There are three causes of this type of switchback.

- 1. High limits exceed pressure (or temperature*)
- 2. Low limits exceed pressure (or temperature*)
- 3. Condenser board failure (Cable Check)

The second possible switchback is enabled by de-energizing CR10. This relay is internally in parallel with the EPC-2000 Compressor Control Switchback Relay. Therefore any condition that would cause switchback of the main processor control, would also cause switchback of the condenser control. Refer to the EPC-2000 manual (P/N 334495) for causes of this event.

Mechanical controls activate the fans during switchback. This is provided to give, what is considered, a minimum amount of control until the EPC-2000 problem can be rectified. Any number of optional additional mechanical controls may be used in place of the jumpers to enhance switchback operation.

MENU DISPLAYS

The following pages reflect the additional messages shown for EPC-2000 condenser fan control. Refer to the EPC-2000 manual (P/N 334495) for complete menus. Only the new messages are shown for the following menus.

- 1. Default Screen
- 2. Status Menu
- 3. System Menu
- 4. Alarm Menu
- 5. Maintenance Menu

^{*}Floating head control only.

Defau	ılt	Scr	eenc
DCIA	. III	DCI	CCH2

Head PRS XXX PSI

Head PRS XXX PSI COND SWBK

STATUS Menu

Ambient Temp
XXX° F

Liquid Line Temp
XXX° F

Liquid Temp SP XXXX° F

Head Prs
XXX PSI

Head Prs Set Pt XXXX PSI

Head Prs HI Alarm
XXX PSI

Head Prs LO Alarm XXXX PSI

Cond Status: FULL 12345...

VER. 1.0XX

Descriptions

This message cycles with the suction pressure default message(s) on three second intervals.

This message appears when the condenser only switchback is activated.

Descriptions

This is the air temperature entering the condenser.

These messages only appear if floating head control is installed.

Actual discharge pressure as read by the transducer.

Set point the control is using for fan cycling determination.

Set points at which the condenser only switchback enters alarm condition.

Indicates current status of full or half (split) condenser and number of fans on.

The EPC-2000 software version.

NOTE: Software versions 1.07A, B or C must upgraded to version 1.08A or higher for field retrofit of the Condenser Fan Control option.

SYSTEM Menu

Head Prs Set Pt XXX PSI

Head Prs HI Alarm XXXX PSI

Head Prs LO Alarm XXXX PSI

Cond Temp Offset XXX° F

ALARM Menu

High Discharge Limits Exceeded

Logged Time at HH:MM MM/DD/YY

Low Discharge Limits Exceeded

Logged Time at HH:MM MM/DD/YY

Condenser Board
Failed Cable Check

Logged Time at HH:MM MM/DD/YY

Descriptions

These messages appear only when fixed head is installed. They allow the user to define all set points.

This message appears when floating head is installed. This is the only user definable point for floating head, and has a range of 6 - 20° F.

Descriptions

These messages appear when associated alarms are generated. Each corresponds to an instant condenser only switchback function.

MAINTENANCE Menu

Force ON: X
Fan Bank #

Force OFF: X
Fan Bank #

Force Split 1=ON 0=OFF

Seq. Fan Banks 1=ON 0=OFF

Force Cond SWBK
1=YES 0=NO

Fan 1 Run Time XXXXX Hours

Fan 2 Run Time XXXXX Hours

Fan 3 Run Time XXXXX Hours

Fan 4 Run Time XXXXX Hours

Fan 5 Run Time XXXXX Hours

Fan 6 Run Time XXXXX Hours

Fan 7 Run Time XXXXX Hours

Half C. Run Time XXX Hours

Clr Fan Meter? 1 = Yes 0 = No

Zero Head Prs 1 = Yes 0 = No

Descriptions

These messages allow the user to force fans on and off. In each case there is a 30 minute time out.

This forces the condenser into HALF mode (on) or FULL mode (off), with a 10 minute time out.

This will sequence fans ON for 20 seconds then OFF until all fans have been sequenced.

This allows activation of the condenser only switchback, there is no time out. The EPC-2000 has to be RESET to allow condenser control again.

These messages record the amount of time each fan bank has been on since startup or last reset of meter.

Records the amount of time spent in split condenser.

Allows clearing of any of the fan run time meters. The fan meters will start again from 0.

Zeros the high pressure transducer.

SERVICE

CHECKOUT AND TROUBLESHOOTING PROCEDURE

This section is designed to assist field technicians in troubleshooting the Condenser Fan Control option of the EPC-2000. A step by step checkout procedure is included to isolate the cause of the malfunction. See Table 4-3 for a brief explanation of rack alarms that could be caused by condenser operation, environment, or failures.

RECORDING INFORMATION

Upon arrival at the refrigeration rack, make a record of the following information for future reference.

- A. Rack model and serial number
- B. EPC-2000 model and serial number
- C. EPC-2000 options installed on the rack

Record the following applicable settings and present readings as shown in the STATUS menu.

Koolgas defrost	on/off
Heat reclaim	on/off
Ambient temperature reading	° F/C
Liquid line temperature reading	° F/C
Liquid temperature set point	* F/C
Head pressure reading	psi
Head pressure set point	psi
Head pressure high alarm set point	psi
Head pressure low alarm set point	psi
Condenser Status	Full/Split
Number of fan banks ON	1 2 3 4 5 6 7 ON

NOTE: Display screens only appear for installed options.

APPARENT MALFUNCTIONS

If there are indications of recurrent problems, then proceed with this instruction and verify the complete EPC-2000 operation or identify the specific component failure. This instruction will cover the condenser fan control part of the EPC-2000 control. Refer to the EPC-2000 Installation Instruction (P/N 334495) for specifics covering the basic EPC-2000 compressor control.

EPC-2000 CONDENSER FAN CONTROL

Check the alarm log for a history of rack alarms. Note the most recent alarm entered and the time and date.

Enter the SYSTEMS menu and check under Factory Setup to verify that the EPC-2000 is configured properly for the number of fans and if split condensers.

Based on your observations, proceed to Table 4-2 to determine the most likely cause. Proceed in order through the checkout procedures listed for the observation until the fault is isolated.

- WARNING

Several parts of this checkout procedure have to be performed with the power applied to the condenser control circuit and the EPC-2000. Use caution when probing any voltages.

NOTE: When performing continuity and resistance checks in this procedure, make sure the circuit being tested is disconnected from any other circuits or unplugged from the EPC-2000.

Condenser Fan Control Relay Board LED Test

During the course of checking operation of the relay board if a LED does not light when the associated relay is energized that LED is bad. Replace the relay board to correct the condition.

Condenser Fan Control Circuit Test

By using the MAINTENANCE menu force ON each of the condenser's fan banks. Next, force OFF each of the fans which was forced on in the above test. Also by using the MAINTENANCE menu force the condenser IN or OUT of half condenser depending on its current status.

After completing any forcing function, go to the screen in the MAINTENANCE menu KILL FORCED FANS and answer YES. All fans will turn OFF, then slowly cycle ON depending on the discharge pressure and/or liquid line temperature.

If one or more fans do not respond then perform the following checks.

Verify that all control wiring and any backup controls are correctly wired and set.

Fan Will NOT Turn ON

Using the MAINTENANCE menu, force ON the suspect fan bank.

Using an AC voltmeter, measure the voltage from the common connection of the relay board plug for the suspect fan to X2 of the condenser control circuit. Full control circuit voltage should be measured at this time, 120, 208 or 240V AC for example. (See Condenser Wiring Diagram in the envelope at the end of Section 2).

If the proper voltage is not measured, unplug the condenser fan control plug assembly from the condenser relay board and check continuity with an ohmmeter between the COM and N.O. positions of the relay board plug socket. See Figure 4-1. There should be 0 ohms resistance between these contacts.

If there was continuity, next verify continuity of the condenser fan control plug assembly. See Figure 1-2. The fan banks should be running if the above steps check OK. Recheck the control circuit and all safety controls. Retest.

If continuity does not exist use a DC voltmeter to measure voltage between G1 and PS1 on the relay board.

If the voltage reads 20 - 30V DC, proceed to measuring voltage between G1 and the particular diode associated with the relay, as given below. If no voltage is measured, go to the cable continuity check. In the event the voltage is below this value, go to the power supply test. If the cable and power supply are satisfactory, replace the EPC processor assembly.

Measure the voltage between G1 (-) and the diode (+) for the particular relay being tested. The diodes are labeled D1 through D10. D1 through D7 correspond to fan bank relays #1 through #7 respectively. D8 corresponds to split condenser, D9 to condenser switchback and D10 to system switchback.

The + probe of the voltmeter must be placed on the diode lead nearest the edge of the board. See Figure 4-1.

NOTE: Do not short voltmeter probe between diode and adjacent resistors.

If the measured voltage is greater than 3V DC then proceed with relay board and cable continuity test. If the relay board and the cable continuity checkout OK, replace the EPC processor assembly. If the measured voltage is 0 - 3V DC then replace the relay board.

Fan will not turn OFF

Using the MAINTENANCE menu, force the suspect fan bank OFF.

Unplug the appropriate condenser fan control plug assembly from the EPC-2000 relay board and check continuity with the ohmmeter between the COM and N.O. positions of the relay board plug socket. See Figure 4-1. There should be an open circuit between these contacts.

If an open circuit exists, check the condenser fan control plug assembly and control panel wiring for shorts. Make sure all power to the rack is turned off.

If continuity exists between COM and N.O. above, use a DC voltmeter to measure the voltage between G1 (-) and the diode (+) for the particular relay being tested above.

Figure 4-1. Condenser Relay Board

If the voltage is 20 - 30V DC, then replace the relay board.

If the voltage is 0 - 3V DC, proceed with the relay board and cable continuity test. If the relay board and cable checkout OK, replace the EPC processor assembly.

Split Condenser Relay Test

By use of the MAINTENANCE menu force split condenser OFF and then ON. Observe the half condenser relay and the condenser control circuits work properly. If the operation was not correct conduct the following tests. After completing any forcing function answer YES to KILL FORCED FANS message at top of the MAINTENANCE menu.

Condenser Stuck in Full

Using the MAINTENANCE menu, force on split condenser.

Using a AC voltmeter measure the voltage from the common connection of CR8 to SC3 of the condenser control circuit. Full control circuit voltage should be measured, 120, 208, or 240V. See condenser wiring diagram at the end of Section 2.

If the proper voltage was not measured unplug the half condenser plug assembly from the relay board. Check the continuity through the N.O. and COM terminals and socket S8. If 0 ohms resistance was measured check the continuity of the plug assembly. See Figure 4-1. The problem exists in the control circuit wiring and not the EPC-2000, correct and reset.

If continuity does not exist use a DC voltmeter to measure voltage between G1 (-) and D8 (+) on the relay board. If 0 - 3V DC is measured but the CR8 relay is not energized replace the relay board.

If the voltage is 20 - 30V DC Conduct the relay board and cable continuity checks. Replace the processor if the problem is not found.

Condenser Stuck in Split

Using the MAINTENANCE menu force OFF split condenser.

Unplug split condenser plug assembly, see Figure 1-3, from socket S8. Using an ohmmeter check for continuity through the N.O. and COM terminals. If an open exists, check out the condenser control circuit wiring. The problem is in the wiring. If 0 ohms was measured use a DC voltmeter and measure voltage across G1 (-) to D8 (+). If the measured voltage is 20 - 30V DC replace the relay board. If the voltage is 0 - 3V DC conduct the relay board and cable continuity tests. Replace the processor if the problem is not found.

Switchback Mode Test

If the condenser appears to be stuck in either the auto mode (under EPC-2000 control) or the switchback mode (under mechanical pressure control), perform the following steps. Note this test applies to the condenser switchback only, not to the total system switchback. For test procedure for total system switchback refer to EPC-2000 Installation Instruction (P/N 334495).

Stuck in Automatic (EPC-2000)

Force condenser switchback using the MAINTENANCE menu.

Using a DC voltmeter, measure the voltage between G1 (-) and D9 (+), see Figure 4-1. The voltage measured should be 20 - 30V DC. The switchback LED and relay will be OFF.

If the measured voltage 0 - 3V DC, go to the relay board and cable continuity tests. Replace the processor if no problem is seen with the relay board or cable.

If the voltage measured is correct above, then check for continuity through the switchback COM and N.C. contacts of the relay board switchback socket S9. See Figure 4-1. Replace the relay board if an open is measured.

If an open is measured check the switchback plug assembly, see Figure 1-4, for continuity and proper connections in the condenser control circuit. The problem is in the control wiring if no faults are located above.

Stuck in Switchback (Mechanical Pressure Controls)

Force condenser out of switchback using the MAINTENANCE menu.

Using a voltmeter, measure the voltage between G1 (-) and G9 (+). The voltage measured should be 0 - 3V DC. The switchback LED and relay should be ON. Proceed to the paragraph below if the voltage is greater than 3V DC. Measure the continuity through the N.C. and COM contacts of switchback socket S9. An open circuit should be measured. Carefully check the switchback plug assembly, see Figure 1-4, for continuity and proper connections to the condenser control circuit. The problem exists in the control panel if no faults have been located above.

If the measured voltage is greater than 3V DC go to the relay board and cable continuity tests. Replace the processor if no problem is seen with the relay board or cable.

Power Supply Test

The EPC-2000 is supplied with power by a multi-tap primary transformer. The primary taps are: 120/208/240V AC with a secondary output of 24V AC at full load. Acceptable secondary voltage limit is 21 - 30V AC.

Using an AC voltmeter, verify the power transformer primary and secondary voltages. Replace the transformer if voltages measured are outside the specified range. If primary voltage is 0V AC, check panel fuse (F10) and replace with similar type rating if blown.

Unplug the 24V AC power plug from the processor and verify the secondary voltages across pins 1 and 3. If voltage is less than 21V AC, replace the power plug assembly. If the voltage is within the specified range but the EPC fails to operate when the 24V AC power plug is connected, replace the EPC processor assembly. Good continuity from pin 2 to ground (panel or box assembly liner) must exist.

Discharge Pressure Transducer and Cable Test

The discharge pressure transducer used by the EPC-2000 is a sealed part with a range of 0 - 500 psi and an output voltage range of 1 - 6V DC maximum.

Using a DC voltmeter, place the positive probe on +15V and the negative probe on COMMON of the discharge pressure terminals on the input terminal board. See Figure 4-2. If the voltage is greater than 15.25V DC, replace the processor. If the voltage measured is less than 14.5V DC, go to the input terminal board and cable continuity tests. Replace the processor if no faults are found in continuity checks.

If the transducer is operating properly, measure the voltage from IN to COMMON. The positive probe should be on IN. The measured voltage will be proportional to the rack discharge pressure. To determine the rack discharge pressure, use the following equation.

Discharge Pressure = (Vin - 1) X 20 ± 5 psi

Using a gage manifold, measure the rack discharge pressure.

If the EPC-2000 readout does not match gage pressure, then compare the calculated discharge pressure to gage pressure. If the two pressures are equal, then conduct the input terminal board and cable assembly continuity test. Replace the processor if the problem is not found in the input terminal board or cable assembly.

If the display matches the calculated discharge pressure but is not within 5 psi of gage, replace the transducer.

Temperature Sensor Checkout

The same temperature sensor (Figure 1-9) is used for both ambient and liquid line temperature inputs. Except for location, the testing and verification of the sensors is identical.

General Check

The most fundamental checkout of the temperature sensor is to make a direct comparison between the reading on the EPC-2000 and the reading on an accurately calibrated thermometer. If the readings are within 3 degrees, the sensors and other components are probably OK. If the readings are unacceptable, check the following items.

Sensor Mounting

Ambient Temperature Sensor — This sensor is mounted on a bracket under the left-hand (facing header end) number one fan. Check the mounting to be sure that the entire sensor is in the air stream. This sensor should NOT touch the metal wall. Clamping the sensor to the metal wall of a flue can adversely affect its temperature reading.

<u>Liquid Line Temperature Sensor</u> — This sensor is mounted on the condensate line 6 inches below the condenser flooding valve. To ensure an accurate reading, this sensor should have good contact with the condensate line. Once attached the sensor should be insulated to prevent the ambient temperature from affecting the reading.

Resistance Check

Remove the EPC-2000 temperature sensor cable from its input terminals (P3 on condenser relay board, if an ambient probe, or the input terminal board if it is the liquid line probe). Using an accurate ohmmeter, measure the resistance of the sensor with the cable leads removed from its terminals. Polarity of the ohmmeter leads will not change the measurement.

Compare the ohmmeter reading to Table 4-1, and find an equivalent temperature value. If the resistance equivalent temperature is more than 3 degrees from the actual thermometer measurements, check the sensor and cable installation. Replace the sensor if installation is found to be correct. If the problem still exists, check input terminal board, condenser relay board and cables continuity check section.

If the problem is not found in the above steps, replace the processor.

Table 4-1

EPC-2000 Probe Checkout Table

Temperature	Resistance	Temperature	Resistance	Temperature	Resistance
• F	Ohms	•F	Ohms	• F	Ohms
-40	1584	5	1750	50	1927
-39	1588	6	1754	51	1931
-38	1591	7	1758	52	1935
-37	1595	8 .	1761	53	1939
-36	1598	9	1765	54	1943
-35	1602	10	1769	55	1947
-34	1606	11	1 7 73	56	1951
-33	1609	12	1777	57	1955
-32	1613	13	1781	58	1959
-31	1616	14	1784	59	1963
-30	1620	15	1788	60	1967
-29	1624	16	1792	61	1971
-28	1627	17	1796	62	1975
-27	1631	18	1800	ഒ	1980
-26	1635	19	1804	64	1984
-25	1638	20	1808	65	1988
-24	1642	21	1811	66	1992
-23	1646	22	1815	67	1996
-22	1649	23	1819	68	2000
-21	1653	24	1823	69	2004
-20	1657	25	1827	70	2008
-19	1660	26	1831	71	2012
-18	1664	27	1835	72	2017
-17	1668	28	1839	73	2021
-16	1671	29 .	1843	74	2025
-15	1675	30	1847	75	2029
-14	1679	31	1851	76	2034
-13	1682	32	1855	77	2038
-12	1686	33	1859	78	2042
-11	1690	34	1863	79	2046
-10	1694	35	1866	80	2050
- 9	1697	36	1870		
- 8	1701	37	1874		•
-7	1705	38	1878		
- 6	1708	39	1882		
- 5	1712	40	1886		
-4	1716	41	1890		
- 3	1720	42	1894		
- 2	1724	43	1898		
- 1	1727	44	1902		
a	1731	45	1906		
1	1735	46	1910		
2	1738	47	1914		
3	1742	48	1918		
4	1746	49	1922		

Heat Reclaim Relay Input Test

To check the operation of the heat reclaim status input, place the system in heat reclaim. Observe the STATUS menu. The heat screen should show ON. Using a DC voltmeter, measure the voltage between the heat reclaim input terminals on the input terminal board. The voltage measured should be 0 - 0.1V DC. If the voltage is greater than this value, check the HR relay in the refrigeration control panel. Insure the proper terminals are connected.

If no voltage was measured in the above step, and the STATUS menu continually shows OFF, go to the input terminal board and cable continuity tests. Replace the processor if the problem is not found.

Next, take the system out of heat reclaim. The STATUS menu screen should now read OFF. Again using a DC voltmeter, measure voltage across the heat reclaim input terminals on the input terminal board. The voltage measured should be 13.8 - 14.5V DC.

If the STATUS screen continues to show ON and the measured voltage is 0.1V DC or less when a system is not in heat reclaim, check the HR relay in the refrigeration control panel to insure the proper terminals are connected and that the HR relay is de-energized.

If the STATUS menu screen shows heat reclaim ON when the system is not in heat reclaim and the measured voltage across the inputs is 13.8 - 14.5V DC, replace the EPC-2000 processor assembly.

Continuity Checks

Condenser Relay Board

This test checks for proper connection of the 15 pin plug assembly P1 or P2 to the appropriate relay drive circuits.

Using an ohmmeter, verify continuity of the labeled test points on the PC board to their corresponding positions on P1 or P2. The resistance should be 0 - 0.1 ohms maximum. No adjacent pins on P1 or P2 with the exception of P8 and P9, should be shorted together. Refer to Figure 4-1 for location of test points on the board and their corresponding pin locations on P1 or P2. Replace the relay board if a problem is seen.

Input Terminal Board

Using an ohmmeter, check the continuity between terminal blocks P2, P3 and P4 to the 25 pin plug P1. Less than 0.1 ohms resistance should be measured between each terminal block and its corresponding P1 pin location. Replace input terminal board if fault is found. Refer to Figure 4-2.

Cable

To check the continuity of the 25 pin input terminal board and 15 pin condenser relay board cable assemblies, each pin must be checked for connection through to the other plug. No more than 0.1 ohms resistance should be measured from one plug pin to the other end. If resistance is greater than 0.1 ohm, then replace the cable. Check for adjacent pins being shorted together. If shorts are measured, replace the cable.

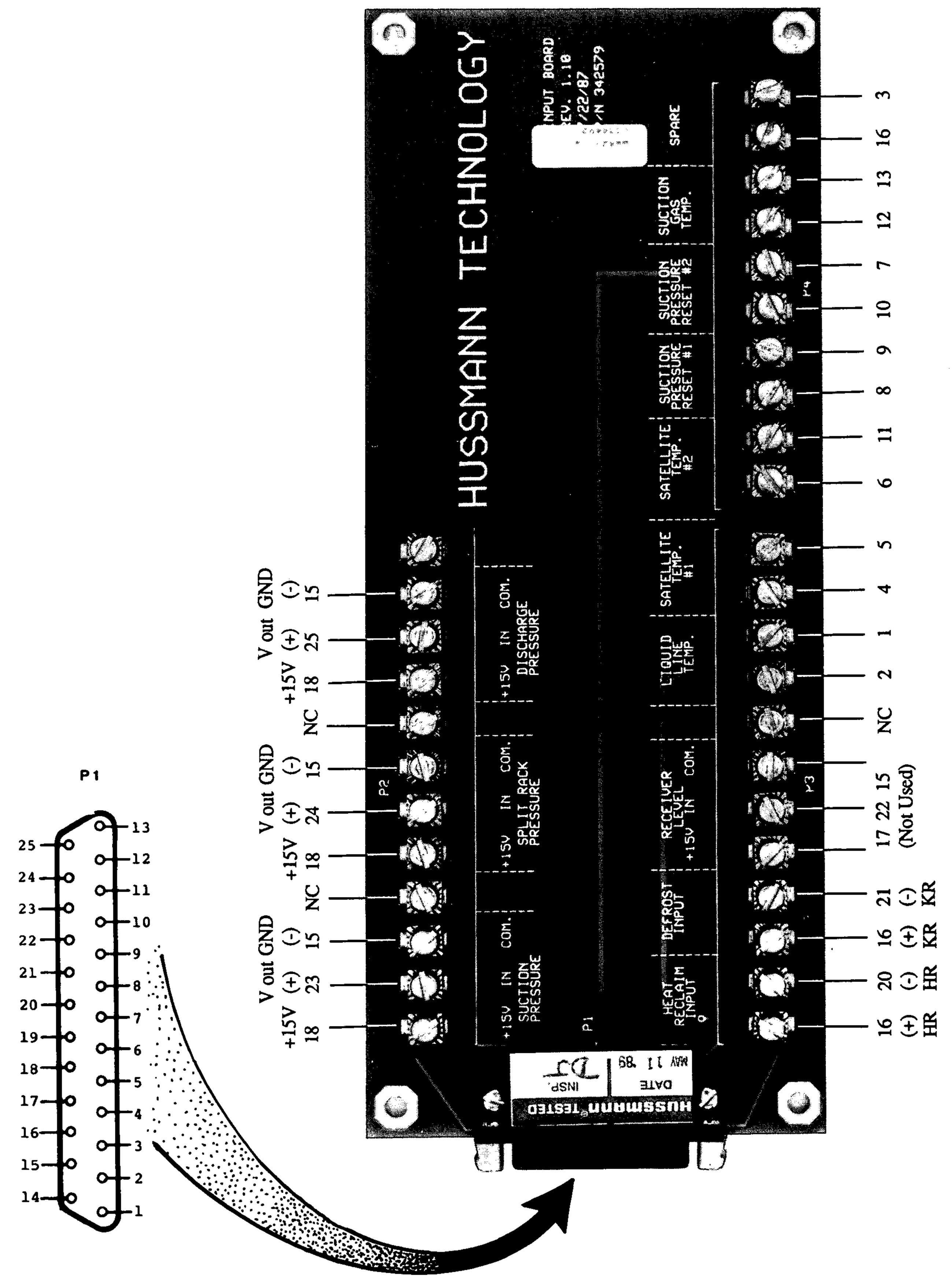


Figure 4-2. Input Terminal Board

TABLE 4-2. CONDENSER FAN CONTROL OPTION —TROUBLESHOOTING CHECKOUT PROCEDURES

Displayed Discharge Pressure does not match gage -Transducer Failure -Input Terminal Board Failure -Processor Failure -Terminal Board Cable Failure -Processor Failure -Terminal Board Cable Failure -Processor Failure -Terminal Board Failure -Cable Continuity Check -Cabl	OBSERVATION	PROBABLE CAUSE	CHECKOUT PROCEDURE	PAGE 4-
displayed temperature -Input Terminal Board Failure -Condenser Relay Board Failure -Terminal/Condenser Board Cable Failure -Processor Failure -Panel Wiring -Relay Board Cable Failure -Processor Failure -Condenser Fan Control Circuit Test, -Fans Will Not Turn ON" steps -Condenser Fan Control Circuit Test, -Fans Will Not Turn OFF" steps -Relay Board Cable Failure -Processor Failure -Condenser Fan Control Circuit Test, -Fans Will Not Turn OFF" steps -Relay Board Continuity Check -Cable Continuity Check -	- · · · · · · · · · · · · · · · · · · ·	-Input Terminal Board Failure -Terminal Board Cable Failure	-Input Terminal Board Continuity Check	
match actual compressor status -Relay Board Cable Failure -Relay Board Cable Failure -Relay Board Cable Failure -Relay Board Cable Failure -Relay Board Continuity Check -Cable Continuity Check -Input Terminal Board -Terminal Board Cable Failure -Input Terminal Board Cable Failure -Processor Failure -Processor Failure -Panel Wiring -Cable Continuity Check	_	-Input Terminal Board Failure -Condenser Relay Board Failure -Terminal/Condenser Board Cable Failure	-Input Terminal Board Continuity Check -Relay Board Continuity Check	10
"Fans ON" status do not match relay board "LED" indication Actual heat reclaim status does not match EPC-2000 indication -Panel Wiring/Terminal Board -Terminal Board Cable Failure -Input Terminal Board Continuity Check -Processor Failure -Processor Failure -Panel Wiring -Cable Continuity Check 10 -Split Condenser Relay Tests -Relay Board Continuity Check 10 -Panel Wiring -Condenser Relay Board Failure -Cable Continuity Check 10 -Cable Continuity Check 10 -Cable Continuity Check 10		-Relay Board Failure -Relay Board Cable Failure	"Fans Will Not Turn ON" steps -Condenser Fan Control Circuit Test, "Fans Will Not Turn OFF" steps -Relay Board Continuity Check	3 10
EPC-2000 indication -Terminal Board Cable Failure -Input Terminal Board Failure -Processor Failure -Panel Wiring -Condenser Relay Board Failure -Panel Wiring -Condenser Relay Board Failure -Relay Board Continuity Check -Split Condenser Relay Tests -Relay Board Continuity Check 10 -Split Condenser Relay Tests -Relay Board Continuity Check 10 -Cable Continuity Check 10	"Fans ON" status do not match relay board	-Condenser Relay Board Failure	-Condenser Fan Relay Board LED Test	2
full/split, but condenser is not responding -Relay Board Cable Failure -Relay Board Continuity Check -Relay Board Continuity Check -Relay Board Continuity Check 10		-Terminal Board Cable Failure -Input Terminal Board Failure	-Input Terminal Board Continuity Check	j
		-Condenser Relay Board Failure -Relay Board Cable Failure	-Relay Board Continuity Check	ſ

TABLE 4-2. CONDENSER FAN CONTROL OPTION — TROUBLESHOOTING CHECKOUT PROCEDURES (cont.)

OBSERVATION	PROBABLE CAUSE	CHECKOUT PROCEDURE	PAGE 4-
EPC-2000 reports condenser in switchback, but condenser itself is not in switchback	-Condenser Wiring/R2 -Condenser Relay Board Failure -Relay Board Cable Failure -Processor Failure	-Condenser Fan Control Circuit Test, first step -Switchback Mode Test, "Stuck in Automatic" steps, -Relay Board Continuity Check -Cable Continuity Check	2 6 10 10
EPC-2000 reports condenser not in switchback, but condenser is in switchback	-Panel Wiring/TDU -Condenser Relay Board Failure -Relay Board Cable Failure -Processor Failure	-Condenser Fan Control Circuit Test, first step -Switchback Mode Test, "Stuck in Switchback" steps, -Relay Board Continuity Check -Cable Continuity Check	2 6 10 10

TABLE 4-3. SYSTEM ALARMS

ALARM LOG MESSAGE	EPC-2000 ACTIONS	POSSIBLE CAUSE	SOLUTION
High Discharge Limits Exceeded	Rack alarm and condenser switch- back will occur if the discharge pressure or liquid line temperature stay above their alarm limits for approximately 4-5 minutes	-Rack Discharge High -Fans Failed or Fuses Blown -EPC-2000 Condenser Relay Board Failure -Liquid Line Probe Failed Open -Transducer Failure	-Check for Rack or Condenser Problem -Troubleshoot EPC-2000 -Turn OFF Alarm and Reset Processor
Low Discharge Limits Exceeded	Rack alarm and condenser switch- back will occur if the discharge pressure stays below alarm limit for approximately 8-10 minutes	-Rack Discharge Low -Fans Locked ON Bypassing EPC-2000 -EPC-2000 Discharge Transducer Failure -Condenser Relay Board Failure	-Check for Rack or Condenser Problem -Troubleshoot EPC-2000 -Turn OFF Alarm and Reset Processor

REPLACEMENT PARTS LIST

ITEM	PART NUMB	ER DESCRIPTION
1	334495	EPC-2000 Installation Instruction for Super Plus
2	334197	Condenser Fan Plug Assembly
3	339617	Split Condenser Plug Assembly
4	334198	Switchback Plug Assembly
5	335850	Field Wiring Interface Board
6	335849	Interconnect Cable
7	334492	Input Terminal Board
8	328534	Super Plus Installation Instruction
9	0339652	Condenser Fan Relay Board

