RC-48 SYSTEMS MANUAL
120 VAC MODEL

ENERGY CONTROLS INTERNATIONAL
10946 GOLDEN WEST DRIVE, SUITE 130
HUNT VALLEY, MD 21031

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RC-48 INSTALLATION GUIDE

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I. INTRODUCTION

The RC-48 is a microprocessor-based refrigeration system controller, either Pressure (Suction and Head Pressure) or Temperature, specifically designed to control the refrigeration process on parallel or single compressor systems in supermarkets, warehouses, and other cold storage facilities.

This system has the capacity to control up to 8 compressor systems, with 4 compressors per system and 4 condenser fans per system (optional head pressure controller required). It monitors up to 8 suction pressures, 8 head pressures, and 8 temperatures.

The system is custom designed to meet the individual requirements and objectives of a refrigeration process. The RC-48 is a user-friendly, programmable unit with protective control features.

E.I.L. provides sample layout plans created to yield efficient and accurate RC-48 application and operation (see figures 1-4).

Once the system is installed, the unit is programmed on-site. Setpoints that trigger the various control functions are established and entered into the unit. It is also possible to program the system from a remote site using the optional COM-99 communications unit in conjunction with the RC-48.

A battery provides memory/time backup power for up to 2 weeks in the event of a power loss. An optional external alarm system offers additional flexibility in control and monitoring.

II. SPECIFICATIONS AND FEATURES

A. SPECIFICATIONS

Refrigeration System Control:	8 systems
Compressor Control	4 per system
Analog Temperature Monitors:	8 inputs with a temperature range from -50 to +77 degrees Farenheit
Suction Pressure Monitors:	00 to +117 pounds
Head Pressure Monitors:	00 to +576 pounds
Clock Capabilities:	24 hour, 7 day, 12 month, 1 year programmable clock with automatic Daylight Savings time changeover and 2 week battery backup of program data and timeclock
Defrost Monitor:	One digital monitor per system for use with gas defrost systems
Input:	120 vac, 50/60Hz., single phase, 1 ampere input power. Note: Other voltages available upon request.
Ambient:	40F to 110F, 0-90% relative humidity, noncondensing
Dimensions:	Main Unit (keyboard unit): 20"H x 14"W x 6"D - Wt. 30 lbs. Head Pressure Unit: same as main unit RT-5D Unit: 10.5"H x 3.5"W x 2"D - Wt. 2 lbs RM-4 Unit: same as RT-5D Unit

B. FEATURES

Alpha display of system (rack) designation:	A-H
Alphanumeric display of system description:	Up to 13 characters
Temperature probe identification number:	1-8
Selectable Control mode:	Either pressure or temperature
Control Sequence:	8 pre-programmed, 4 programmable modes
Control Sequence Description:	Up to 13 characters
Control Stages:	From 1 to 12
High/Low Suction Pressure Control Setpoints:	Cut-in/cut-out,00 to 116 pounds
Head Pressure Control Setpoints:	00 to 575 pounds, 4 fan setpoints
Head Differential Pressure Setpoints:	0-99 pounds
Time Delay between Condenser Fan Setpoints:	15,30,45,60 seconds
Temperature Control Setpoints:	Cut-in/cut-out, 49 to 76F
Compressor Interstage Time Delay	0 - 5 minutes
Control Time Delays - Min ON/Min OFF:	0-99 minutes
Temperature Compensation Setpoints:	High and low -49 to +76F
Temperature Alarm High and Low Setpoints:	-49 to +76F
Temperature Alarm Delay:	0-99 minutes

Suction Pressure Alarm High and Low Setpoints:	00 to 116 pounds
Alarm Delay:	0 to 99 minutes
Head Pressure Alarm High and Low Setpoints:	0 to 575 pounds
Differential for High Head Alarm Setpoint:	0 to 575 pounds
Head Pressure Alarm Delay:	0-99 minutes
Transducer Zero Adjust:	Automatic or manual offset

C. OPTIONAL FEATURES

External Alarm panel:	Allows external alarm reporting reporting at remote locations.
Remote Communications:	When linked to the EIL COM-99,phone line communi-cations to a remote location enables off-site programming or interrogation. Present mode of operation and all set points , including alarm logs are available.

III. INSTALLATION GUIDE

This section presents instructional guidelines applicable to the installation of the RC-48 system. Individual system components must be installed in the order in which they are presented. Strict adherence to the outlined procedures and referenced figures must be maintained in order to ensure accurate and efficient performance.

> **NOTE:** All installation procedures must be performed in accordance with National Electric Code NFPA70 and other applicable codes. E.I.L. Instruments does not accept liability resulting from either compliance or noncompliance with the provisions presented in this document.

A. SYSTEM OVERVIEW

A typical EIL energy management and control system would be laid out as illustrated in Figure 1, and wall placement as illustrated in Figure 4.

A typical floor plan illustrating sensor and transducer locations is shown in Figure 3.

EIL component symbols with corresponding definitions and abbreviations are presented in Figure 2.

B. RC-48 UNIT INSTALLATION

1. MOUNTING THE UNIT

The main panel should be mounted as outlined in the following steps and as illustrated in Figure 4 and 5.

A. Mount the main panel on a permanent wall that can support a weight of 30 pounds and encompass dimensions of 20 x 14 x 6 inches. The wall should be free of vibration associated with the compressor systems.

B. Secure the panel to the wall using the 4 prepunched holes.

C. Refer to the wall layout (Figure 4) for mounting all of the components of the system.

NOTE: The ambient temperature of the location chosen for the unit must be within a range of 40F to 100F. A noncondensing humidity level of less than 90% must be maintained.

WARNING: Extreme care must be taken to prevent metal filings and other debris from falling into circuit board sections. Drilling should be avoided. Punches should be used if additional holes are needed.

BELDEN PART NUMBERS FOR SHIELDED WIRE

1. # 8760	18 gauge shielded	1 pair
2. # 9773	18 gauge shielded	3 pair
3. # 9774	18 gauge shielded	6 pair
4. # 9775	18 gauge shielded	9 pair
5. # 9776	18 gauge shielded	12 pair
6. # 9777	18 gauge shielded	15 pair

2. OPTIONAL HEAD PRESSURE CONTROLLER

The Head Pressure Controller (RC-48A) must be mounted as illustrated in Figure 4 and 5 and as outlined in the steps listed above for the main unit. This unit should be mounted in close proximity to the main unit for ease in interrogation and troubleshooting.

3. POWER HOOKUP

Line power must be supplied to both the RC-48 main unit (the unit with the keypad) and the optional RC-48A Head Pressure Controller unit in accordance with Figure 5 and as outlined in the following steps.

Main Unit

A. Remove the grillage in the main unit by removing the screws, nuts and nylon spacers.

B. Remove the fuse located in the upper right section of the unit. Replace only when ready to power-up unit.

C. Connect a 120 volt, 50/60Hz, 15 ampere dedicated circuit containing a ground wire to the terminals located in the upper right section of the unit.

D. Replace the grillage using the nylon spacers (between grill and board), lock washers, and nuts.

Optional Condenser Fan Controller

Use the procedures outlined above for the main unit.

NOTE: Other supply voltages and frequencies for both units will be supplied upon request.

4. UNIT INTERCONNECTION (REMOTE COMMUNICATION)

The RC-48 main unit and the optional RC-48A Head Pressure Controller as well as the optional COM-99 unit must be interconnected to provide for proper operation of communications. Use the following steps (where applicable) and refer to Figure 5.

A. Connect a 2 pair, 4 conductor, 22 gauge shielded cable from the RC-48 main unit to the COM-99 as shown on Figure 5.

B. Connect a 4 conductor, 22 guage shielded cable from the RC-48 main unit to the RC-48A Head Pressure Controller (TS-1), see Figure 5.

5. TEMPERATURE SENSOR INSTALLATION

A. Location

This system has up to 8 sensors that can be used for Temperature Control (rather than Pressure Control), or Temperature Compensated Pressure Control and Temperature Alarming. The location of the sensor (if used), is critical to its intended purpose. Refer to the refrigerated case or box manufacturer's instructions for proper location of the sensors. There can be only one (1) sensor per case for temperature control or two (2) sensors per case for compensated pressure control. Any sensor or sensors can be designated for alarm purposes if desired.

B. Sensors

Sensors must be connected in accordance with Figure 5 and the following points, in order to ensure durability, accuracy, and efficiency.

1. Always locate connections outside of the refrigerated space.
2. Always use a soldering process or its equivalent to secure the connection.
3. Always insulate connections after completion of soldering.
4. Connect the red lead to the appropriate T# terminal that is located on the input/output board TS-7 on the RC-48 unit, refer to Figure 5.
5. Connect the white lead to the appropriate W terminal located on the same terminal strip, TS-7.

CAUTION: Never run sensor wiring in the same conduit as power wiring , avoid fluorescent light ballast, and try to avoid all power wiring.

CAUTION: Never run sensor wiring across the electronics in the cabinet.

CAUTION: Always use 18-gauge shielded cable for wiring.

CAUTION: Ground the shield at the RC-48 unit end only.

6. COMPRESSOR CONTROL MODULES - RT-5D

A. Requirements

One RT-5D unit is required for each compressor system to be controlled.

B. RT-5D Mounting - Refer to Figure 6.

1. Mount the plastic track in the compressor control cabinet box where it is serviceable.

2. Snap the relay board into the track.

3. Hookup 240 volts AC to the input power terminals on the relay board. Remove the power fuse before connecting power, and DO NOT connect it until the startup operation. Be sure that the jumpers that select the proper voltage are correct.

   NOTE :The units are shipped from the factory in the 240 volt mode unless ordered otherwise.

RT-5Ds may be powered from a separate control circuit on a breaker panel, or to a circuit breaker in its appropriate compressor rack. It is important to keep each RT-5D wired separately for ease of maintenance.

C. Wiring Connections for RT Unit

1. Connect a 10 conductor 22-gauge shielded control cable leading from the main unit to each RT unit. Connect as shown on Figures 5 and 6.

   NOTE: TS-2 = System A & B
   TS-3 = System C & D, etc.

2. Break the compressor control circuits (in series with existing controls) through the terminal strips on the RT units labeled Comp.1, Comp.2, Comp.3, Comp.4. Leave the Over-ride switches in Over-ride until installation is complete and system is ready for startup.

7. CONDENSER CONTROL MODULES - RM-4 MODULES

A. Requirements

These units are required for the optional RC-48A Head Pressure Control only. One RM-4 unit is required for each compressor system.

B. RM-4 Mounting

Mount the RM Unit in the Condenser Fan Control box using the same procedure outlined previously for the RT unit as shown in Figure 7.

C. RM Connections for the RM Unit

1. Connect an 8 conductor 22-gauge shielded control cable from the RC-48A Condenser Fan Controller unit to each RM module. Connect as shown in Figure 5 and 7. Power RM modules with 240 VAC.

   NOTE : TS 2 = System A & B
   TS 3 = System C & C etc.

2. Break the condenser fan contactor controls (in series with the existing controls) through the terminal strips on the RM units, Comp. 1, Comp. 2, etc., and leave the switch in Over-ride until installation is complete and system is ready for startup. It is important that each RM-4 is powered separately for ease of maintenance.

8. TRANSDUCERS

Transducers must be installed in accordance with Figure 6 and the following steps, in order to ensure accuracy and efficiency.

1. Install the fittings and shut off valves as shown in Figure 6 on the appropriate suction and/or head manifolds (0-100 PSI suction, 0-500 PSI head pressure).

2. Connect the wiring leading from the transducer to the terminal strip located in the upper left section of the RT-5D board. Connect like terminal to like terminal, as shown in Figure 6.

NOTE: Leave the valve turned off and the transducers disconnected until the startup sequence.

NOTE : DO NOT apply pressure to the transducers until startup. They must be Zero Adjusted with no pressure applied. When connecting the transducer to the valves, backup with a wrench to prevent damage to the transducer.

RC-48 / RT-5D DEFAULT OPERATION

PRESSURE CONTROL MODE

Operation of RT-5D modules when interconnected to the RC-48 control unit under various conditions :

A. Without 208 VAC power to RT-5D : all relays are depowered and therefore, contacts are CLOSED, regardless of program or input status.

B. With 208 VAC power, no transducer input, no program entered: all relays are powered - therefore contacts are OPEN.

C. With 208 VAC power, no transducer input, but with program entered : all relays are powered - therefore contacts are OPEN.

D. With 208 VAC power ,transducer input ,no program entered: all relays are powered - therefore contacts are OPEN.

E. With 208 VAC power, transducer input and program cut-in and cut-out below suction pressure : relays cycle ON and remain ON.

Legitimate values for cut-in and cut-out setpoints are needed to cycle refrigeration on. Default values ARE NOT legitimate values.

After Master Clear - relays are powered and contacts are OPEN.

A Shorted sensor causes STATUS QUO condition - that is, what is ON remains ON, what is OFF remains OFF.

RC-48 / RT-5D DEFAULT OPERATION

TEMPERATURE CONTROL MODE

Only Relay # 1 on RT-5D is controlled. All other relays remain powered - therefore contacts are OPEN.

A. Without 208 VAC power: all relays are depowered and therefore contacts are CLOSED, regardless of program or input status.

B. With 208 VAC power, no sensor input and no program entered: all relays are powered, therefore, contacts are OPEN.

C. With 208 VAC power, no sensor input, but with program entered: all relays are powered, therefore, contacts are OPEN.

D. With 208 VAC power, sensor input, but no program entered: all relays are powered, therefore, contacts are OPEN.

Cut-in and cut-out values must be other than default values to control the relay. Default values are not legitimate control values.

E. With 208 VAC power, sensor input and program cut-in and cut-out values below temperature: relay depowers, therefore closing contact.

After Master Clear, all relays are powered, opening contacts. All temperature probe assignments default to Rack A.

Shorted or Open sensors cause STATUS QUO condition: that is, what is ON remains ON, what is OFF remains OFF.

RC 48 PROGRAMMING GUIDE

I. GENERAL

A. MASTER CLEAR

Once installation is complete and an initial power up done, the RC-48 System should be CLEARED. See Figure 8 .

1. DISCONNECT power by removing the AC power fuse located on the top of the unit for approximately 2 minutes.

2. Pull the CLEAR SWITCH located on the top right side of the CPU board (on the door) to the LEFT and hold it while powering up the unit, reconnect fuse.

3. Push down the PROGRAM SWITCH on the left side of the CPU board and hold it while still holding the CLEAR SWITCH.

4. Release the CLEAR SWITCH.

5. Release the PROGRAM SWITCH.

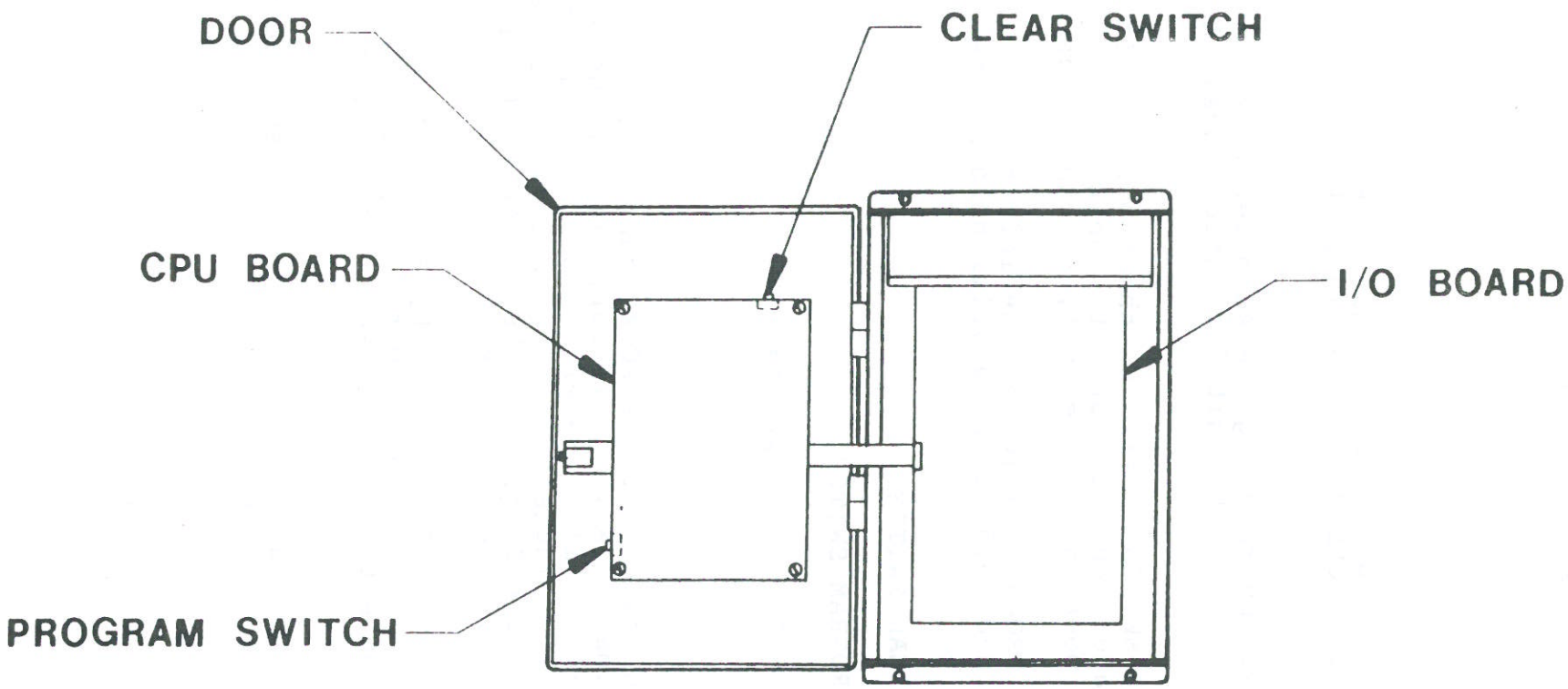
The RC-48 System is now ready for programming.

B. RUN MODE-PROGRAM MODE

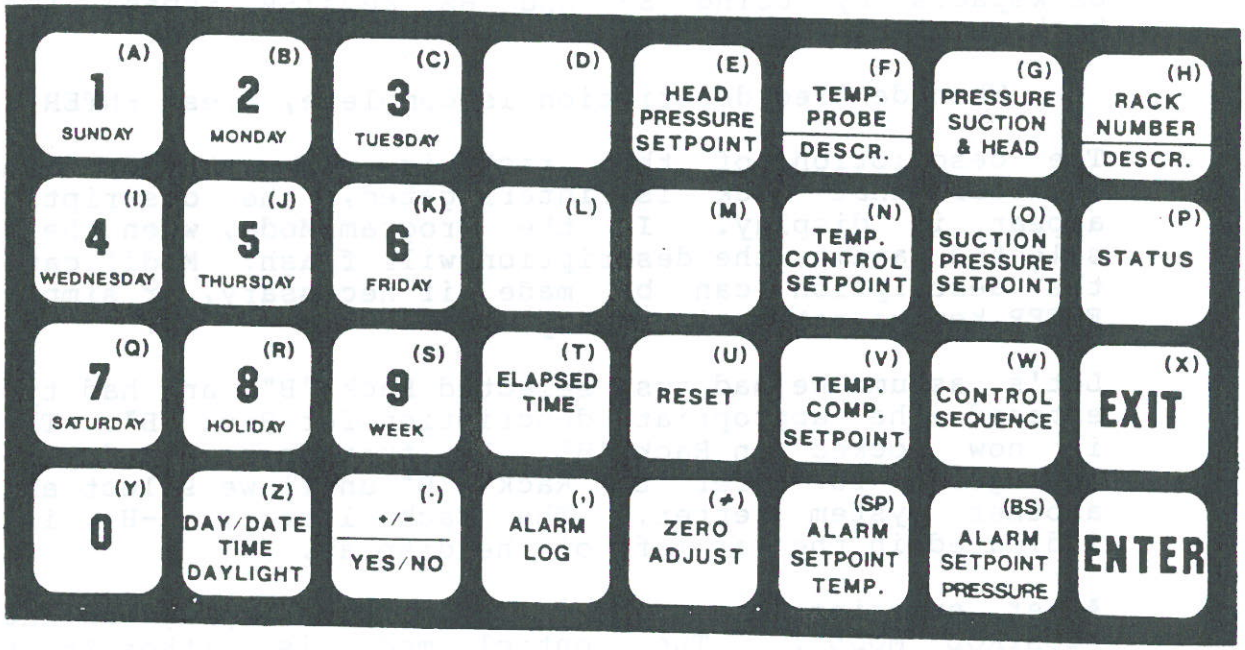
The normal operating mode for the RC-48 control is the Run Mode. The correct time of day, in military time, is normally displayed. The RC-48 will revert to the Run Mode automatically after 15 minutes if the operator fails to switch the unit from the Program to the Run Mode. The RC-48 will run normally while in the Program Mode.

Place the unit in the Program Mode by sliding the spring switch inside the door, on the lower left portion of CPU board. (At least one entry must be made before unit may be returned to the Run Mode).

The RC-48 display will show P R O G as soon as the unit is placed in the Program Mode.



E.I.L. Instruments, Inc. 10 LOVETON CIRCLE SPARKS, MD 21152			
JOB NAME: SYSTEM LAYOUT			
SCALE	DRAWN BY	CHECKED	APPROVED
	NAME	NAME	NAME
	DATE	DATE	DATE
DRAWING NO		SHEET OF	REV


(A)
1
SUNDAY
(B)
2
MONDAY
(C)
3
TUESDAY
(D)
(E)
HEAD PRESSURE SETPOINT
(F)
TEMP. PROBE
DESCR.
(G)
PRESSURE SUCTION & HEAD
(H)
RACK NUMBER
DESCR.
(I)
4
WEDNESDAY
(J)
5
THURSDAY
(K)
6
FRIDAY
(L)
(M)
(N)
TEMP. CONTROL SETPOINT
(O)
SUCTION PRESSURE SETPOINT
(P)
STATUS
(Q)
7
SATURDAY
(R)
8
HOLIDAY
(S)
9
WEEK
(T)
ELAPSED TIME
(U)
RESET
(V)
TEMP. COMP. SETPOINT
(W)
CONTROL SEQUENCE
(X)
EXIT
(Y)
0
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DAY/DATE TIME DAYLIGHT
(·)
+/-
YES/NO
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ALARM LOG
(≠)
ZERO ADJUST
(SP)
ALARM SETPOINT TEMP.
(BS)
ALARM SETPOINT PRESSURE
ENTER

C. SELECTING RACK OR SYSTEM NUMBER - RACK DESCRIPTION

Once in the Program Mode a particular rack must be selected -- A,B,C,...H. The RC-48 has the ability to control up to 8 compressor racks, A-H. A rack may be defined as a single compressor or up to four compressors in parallel.

Begin by pressing RACK NUMBER/DESCR key.

Select proper rack letter, for instance, "B" and press ENTER key.

The letter of the rack you selected will appear in the left side of display, and dashes will be flashing just to the right. A description may now be entered in the display using the Alphabet keys on keypad. Thirteen characters,letters or numbers may be used. Numbers may be typed by pressing the # key and then pressing the appropriate number, spaces and backspaces by using SP and BS keys(SP =space and BS = backspace) .

When desired description is complete, press ENTER key.

The description of that rack is now entered in memory. Whenever that rack is interrogated, the description will appear in display. In the Program Mode, when the rack is selected again, the description will flash. Modifications to the description can be made if necessary, or simply press ENTER key to retain in memory.

Let's assume we had just selected Rack "B", and had typed and entered the appropriate description for Rack "B". The RC-48 is now locked on Rack "B". Any further keyboard parameters are going to refer to Rack "B" until we select and enter another system letter. The rack letter, A-H , is always indicated in the far left of the display.

After entering the description, the display advances to "CONTROL MODE". The control mode is either Pressure or Temperature for a given compressor rack or system. In the Program Mode the +/- key toggles the display from Pressure to Temperature. Single compressor units may be controlled on either Pressure or Temperature; parallel systems must be controlled on Pressure. For each system, select either PRES. or TEMP. After entering description, press ENTER key to retain in memory.

Note : The Control Mode will default to Pres. Mode if unit is Master Cleared. This parameter will not be flashing (which indicates it is changeable) but it can be changed to Temp. control by the + / - key while in the Program Mode.

NOTE #1 --- PROGRAM LOOPS

The RC-48 system uses a series of program loops. The "SYSTEM NUMBER/NAME" selection described above and the "SUCTION PRESSURE SETPOINTS" are two such loops. When the loop is entered the user must step through each part of the loop before another function or loop can be started. In the SYSTEM NUMBER/NAME loop above, we entered a rack letter, then typed a description, and finally selected a control mode before the loop was completed. Stepping through the loop can be accomplished in normal programming by entering values where needed, or by continually pressing either the ENTER or EXIT key until the loop is completed and display reverts to P R O G in the Program Mode or the correct time of day in the Run Mode.

II. PROGRAMMING SYSTEM PARAMETERS--SETPOINTS, TIME DELAYS, ETC.

A. CONTROL SEQUENCE

The RC-48 system has the ability to control parallel compressor systems based on suction pressure. These compressor systems may have up to four compressors in parallel. Sequences for the most common compressor systems in use today (two, three, four compressor parallel, and three compressor uneven) are pre-programmed in the RC-48 system. These systems may be controlled as either alternating or non-alternating systems. The RC-48 also contains four (4) user programmable sequences with up to twelve steps of control for each sequence.

The CONTROL SEQUENCE key acts as both a program function as well as an information function. Control sequences 1-8 are pre-programmed ; that is , those sequences may be assigned to particular compressor racks and cannot be changed. Sequences 9-12 are user programmable. A sequence description may be entered describing the particular sequence, and up to twelve (12) stages may be entered.

Using the CONTROL SEQUENCE key, in either the Run or Program Mode:

Sequence #1--Single compressor unit

Sequence #2--Two compressor non-alternating

Sequence #3--Three compressor non-alternating

Sequence #4--Four compressor non-alternating

Sequence #5--Two compressor alternating

Sequence #6--Three compressor alternating

Sequence #7--Four compressor alternating

Sequence #8--Three compressor uneven (where the combined horsepower of the first two machines is greater than the third).

Sequences #9-12--These are user programmable sequences. There are up to 12 stages possible for each sequence.

Example: In the Program Mode press CONTROL SEQUENCE key.

The display shows:

S E Q U E N C E N O 0 0 (with the 00 flashing).

Press 09 and then ENTER to gain access to sequence number 9. A description of that sequence may now be entered using the alphabet keys on the keyboard. When the appropriate description has been entered , press ENTER to retain in memory.

The display now indicates :

N O . S T A G E S 0 0 with the 00 flashing).

The number of steps or stages in this particular sequence may now be entered. Let's assume this sequence is a three compressor parallel system where the combined horsepower of the first two compressors is less than the third, 3 hp., 5hp., and 10hp. If individual compressor BTU rating is available, the staging can be done on a more accurate basis. Let's also assume that the first stage will always be all compressors OFF. This particular sequence has 8 steps or stages.

See Sample chart and use the blank chart for sequence and staging desired.

Note #2: X = Compressor OFF
O = Compressor ON

Note #3: The maximum number of possible compressors, four, will always be shown in the display.

Press 08 and then ENTER.

Display advances to :

0 9 S t a g e 0 1 X X X X (with the first X flashing)

Since we want stage 1 to have all compressors OFF, press ENTER. Display advances to:

0 9 S t a g e 0 2 X X X X (with the first X flashing).

Use the SP (space) and BS (backspace) keys to advance or go back to proper compressor, and use +/- key to toggle that compressor ON or OFF. When display indicates appropriate compressors are ON or OFF for that stage, press ENTER key to advance to the next stage.

For example: Stage 2 should have only the 3hp. compressor running. Press +/- key to change the X to an O for compressor #1. Press ENTER . Stage 3 should have only the 5hp. compressor running. Press SP (space)key to space over to second compressor, and then press +/- key to toggle that compressor ON.

Press ENTER key to advance to stage 4. Continue until all stages necessary are programmed.

IMPORTANT : Make sure that all stages entered for the sequence have been programmed or the RC-48 WILL LOCK UP.

B. SUCTION PRESSURE SETPOINT

The SUCTION PRESSURE SETPOINT key is active when the rack being interrogated or programmed is in the pressure control mode. That is, this key would be disabled if the rack being programmed or interrogated was in the temperature control mode.

1. Select proper rack using RACK NUMBER/DESCR key. Continue through loop using ENTER or EXIT key. If you are already in the correct rack , it is not necessary to reselect rack letter.

Ex: Rack B

2. Press SUCTION PRESSURE SETPOINT key. The display indicates:

B S E Q U E N C E N O . 0 0 (flashing).

Press appropriate sequence number for compressor rack type: Sequence 09 for a three compressor uneven rack similar to above example.

Press ENTER key.

The description of that sequence now appears in the display.

Press ENTER key.

3. The display now indicates :

B C . I . P R S . - 1 0 - 1 0 (with the right -10 flashing).

The "Cut In " pressure setpoint may now be entered in display.

For example: +20 lbs.

Press +/- key to toggle - sign to + or 0 sign. Press 20 for twenty lbs. Example: -20 = minus twenty lbs., 020 = positive twenty lbs.

Press ENTER key.

NOTE 4: The RC-48 system is pre-programmed with -10 lb. Cut-In and Cut-Out setpoints.

Example: Rack B C . I . P R S . - 1 0 - 1 0

NOTE 5: The first number in the display of both the Cut-In and Cut-Out setpoints is the operating setpoint that the system is working under. If the setpoints were being automatically adjusted by a temperature sensor (temperature compensation), the operating setpoints would be indicated here.

4. The display now indicates :

B C . O . P R S . - 1 0 - 1 0 (with the last -10 flashing).

The number on the Left side is the actual setpoint programmed into the unit. The number on the Right side is the operating setpoint that the system is working under.

The cut-out pressure setpoint may now be typed in display.

For example: +17 lbs. Press +/- key to toggle - sign to 0 sign. Press 17 for seventeen lbs. Press ENTER key .

5. Display advances and now indicates:

M I N C . I . T . D . 0 3 (with 03 flashing.)

This is a minimum Off Time Delay between stages. A three minute preprogrammed value is used and this parameter can be up to a maximum of five minutes. It is important to remember that the Interstage Time Delay must honor the Minimum ON / Minimum OFF Time Delays of each compressor before any sequence can advance to its next stage.

A good " RULE OF THUMB " is to keep the Min ON / Min OFF Time Delays the same or less than the Interstage Time Delay.

NOTE 6 : This parameter will only apply in RC-48 units shipped after January 1, 1988.

If a two (2) minute Interstage Time Delay is desired , press 02 and then ENTER.

6. Display now indicates :

B M I N O F F T . D . 0 0 with 00 flashing

This is a minimum OFF Time Delay . Once a compressor shuts off, it cannot restart for this minimum period. This Time Delay is typically 2 minutes (equal to C.I. T.D. of 2 minutes.) Press 02 and then ENTER.

7. Display now indicates :

B M I N O N T . D . 0 0 with 00 flashing

This is a minimum ON Time Delay . Once a compressor starts, it must remain running for this minimum time period. This Time Delay is typically 1 minute. Press 01 and the ENTER key.

C. HEAD PRESSURE SETPOINT

The Head Pressure setpoints should only be programmed when the optional Head Pressure Control (RC-48A) is used with the RC-48 control.

Each condenser will have an individual Setpoint (up to 4) and an individual Differential.

1. Select proper rack using RACK NUMBER/DESCR key. Continue through loop using ENTER or EXIT key. If you are already in the correct rack, it is not necessary to reselect Rack letter.

   EX : Rack B

2. Press HEAD PRESSURE SETPOINT key.

The display indicates :

B D E L A Y 1 5 S E C .

This is the Time Delay between condensers or Interstage Delay. It can be set for 15 , 30 , 45 , or 60 seconds and will loop around by use of the + / - key.

For example : 30 sec.

Press + / - key one time for 30 second Time Delay.

Press ENTER key.

The display advances and now indicates :

B H E A D S P 1 0 0 0 (with 000 flashing)

The first Condenser Fan Setpoint can now be entered in display.

For example : 180 lbs.

Enter 180 in display and press the ENTER key.

The display advances and now indicates :

B D I F F 1 0 0 0 (with 000 flashing)

The Differential of the first Condenser Fan can now be entered in the display.

For example : 20 lbs.

The Setpoint and Differential operate as follows: Condenser # 1 will turn ON when the Head Pressure goes above 180 lbs. and turn OFF at 180 lbs minus the Differential of 20 lbs. or at 160 lbs.

Enter 20 in display and press ENTER key.

The display will advance and now indicate :

B H E A D S P 2 0 0 0 (with 000 flashing)

Continue to program the other condensers in the same manner as Condenser # 1 .

NOTE : If only 3 condenser fans are being used, program the 4th condenser out of operating range to prevent it from coming on , i.e. 500 lbs.

D. TEMPERATURE SENSOR ASSIGNMENT

Before attempting to program either TEMPERATURE CONTROL SETPOINTS or TEMPERATURE COMPENSATION SETPOINTS, we must first assign temperature probes. Probes must be assigned to particular compressor racks prior to attempting to program any temperature parameters for that rack.

For example: Let's assume Rack A is a single compressor that will be temperature controlled and Rack B is a three compressor uneven parallel using one probe for Temperature Compensation. We have previously designated Rack B as a Pressure Control rack and would now like to designate Rack A as a Temperature Control rack before we actually assign a temperature sensor to it. Select Rack A using RACK NUMBER/DESCR key. Toggle +/- key to TEMP. as the control mode for Rack A. We are now ready to assign a temperature sensor to Rack A.

1. Press TEMP. PROBE/DESCR. key. The display indicates:

S E N S O R 0 1 (with 01 flashing)

Press 01, then ENTER.

Display indicates: S Y S T E M A with the A flashing

Since we do want to assign at least one temperature probe to Rack A, press ENTER.

Probe #1 is now assigned to rack A. We may now type a description of this sensor using the alphabet keys, then press ENTER.

Display now indicates the description and the actual temperature of that probe. Press ENTER. The display indicates:

1 T E M P C O N T R O L N O

If Temperature Control is desired, a YES is needed. The +/- key toggles " Yes / No ". Since we do want this sensor to act as the Temperature Control sensor for Rack A, press +/- key to answer "YES ".

Press ENTER key. At this point the display returns to the P R O G or Program prompt.

2. Press TEMP PROBE/DESCR. key. Display indicates:

S E N S O R 0 1 (with 01 flashing)

Since we would like to assign another temperature probe , press 02 and then ENTER. Display indicates:

S Y S T E M A (with A flashing).

Press "B" since we want to assign probe #2 to Rack B.

Press ENTER key.

We may now type a description of this sensor using the alphabet keys.

Then Press ENTER key.

Display now indicates description and actual temperature of that probe. Press ENTER.

If the rack we have just assigned a temperature sensor to is a Pressure control rack , the display advances to:

T E M P C O M P 1 N O

If this sensor was to act as the Temperature Compensation sensor for that rack, press +/- key to toggle display to "YES". We have now assigned temperature sensor #2 to Rack B as a Temperature Compensation sensor.

Press ENTER key to return to P R O G or PROGRAM prompt.

We have now assigned temperature sensor #01 to Rack A and assigned its function as a Temperature Control sensor. We have assigned temperature #02 to Rack B and its function as a Temperature Compensation probe one. The RC-48 can accept up to two sensors per rack as compensation probes, so another sensor could be assigned to Rack B in this example if desired.

As we can see, the eight temperature sensor inputs may be used for various functions such as Temperature Control, Temperature Compensation of Suction Pressure Setpoints, and Temperature Alarm.

We will now assign Temperature Control setpoints to Rack A (which we have already programmed as a Temperature Control of a single compressor) and Compensation setpoints to Rack B (which we have already programmed as a Suction Pressure Control of a parallel rack).

E. TEMPERATURE CONTROL SETPOINTS

With unit in the PROGRAM mode:

Place the RC-48 in the Rack A loop by pressing RACK NUMBER/NAME key, selecting A, and pressing ENTER three times to step through the loop.

Press TEMP. CONTROL SETPOINT key. Display will now indicate:

C N T R L S E N S 0 1

Sensor #1 is the sensor that has been assigned to Rack A, so press ENTER. The display will indicate:

A C U T I N S . P . - 5 0 (with the -50 flashing)

We are now ready to enter the proper Temperature Cut-In setpoint for Rack A. Let's assume we want a Cut-In of plus twenty (+20) and a Cut-Out of plus seventeen (+17). This means the compressor will run if the temperature climbs above +20 F and will shut off if the temperature falls below +17 F.

Press the +/- key to toggle the minus sign to 0 (plus) and then 20 for plus twenty degrees. Press ENTER key. The display will advance to:

A C U T O U T S . P . - 5 0 (with the -50 flashing)

Press the +/- key to toggle minus to plus, and then 17 for plus seventeen degrees. Press ENTER key. The display will advance to:

A M I N O F F T . D . 0 0 (with the 00 flashing)

Press 03 for a three minute Minimum OFF Time Delay. The display will advance to:

A M I N O N T . D . 0 0 (with the 00 flashing)

Press 01 for a one minute Minimum ON Time delay. This means that whenever the compressor starts, it must remain running for at least one minute.

Press ENTER key. The display will advance to P R O G or Program prompt.

F. TEMPERATURE COMPENSATION SETPOINTS

Temperature Compensation of the Suction Pressure setpoints is the automatic adjustment of the Suction Pressure Cut-In and Cut-Out setpoints based on the case temperature as sensed by 1 or 2 temperature sensors. In order to to use Temperature Compensation, we must (1) assign 1 or 2 temperature sensors to the appropriate rack , and (2) program Temperature Compensate setpoints that will govern the FLOATING of the Suction Pressure setpoints. We have already assigned sensor #02 to Rack B as a Compensation sensor.

With the RC-48 still in the Program Mode, place unit in the Rack B loop by pressing RACK NUMBER/DESCR key, selecting Rack B, and pressing ENTER key three times to step through the loop. Press the TEMP. COMP. SETPOINT key. The display will indicate:

B 1st SENSOR 02

This indicates that we have assigned sensor #02 to Rack B as Compensation sensor #1. Press ENTER. Display will advance to:

B 2nd SENSOR 00

This indicates that we have no second compensation sensor.

If necessary , we could have assigned a second temperature sensor to this rack for Temperature Compensation which would give the average temperature of the two sensors assigned. However, since we only assigned sensor #02 in this example, press ENTER key to advance to next display.

The display will now indicate:

B LO TEMP S.P. -50 (with the -50 flashing)

The LOW TEMPERATURE SETPOINT is the lowest temperature we would allow in the fixture. That is, if the temperature falls below this Low Setpoint ,the RC-48 will begin to adjust the Suction Pressure setpoints upward in one pound increments at each Time Delay period. This would continue until the temperature rose above this Low Temperature Setpoint but not allow the Pressure setpoint to adjust above the maximum setpoint that was programmed.

The HIGH TEMPERATURE SETPOINT is the highest temperature we would allow in the fixture. That is, if the temperature climbs above this High Temperature Setpoint , the RC-48 will begin to adjust the Suction Pressure setpoints downward in one pound increments at each Time Delay period. This would continue until the temperature fell below this High Temperature Setpoint. The RC-48 system will not adjust the setpoints BELOW the original Cut-In and Cut-Out setpoints.

The TIME DELAY PERIOD is the delay before any Compensation action occurs. That is, if the temperature was either above or below the setpoints, no compensation would occur for at least the Time Delay period. After that period the Suction Pressure setpoints would adjust either up or down one pound. Provided the temperature remained above or below the Compensation setpoints for the Time Delay period, the Suction Pressure setpoints would adjust another one pound.

The MAXIMUM CUT-IN PRESSURE is the highest Cut-In pressure allowed by the compensation. We would not allow the Suction Pressure setpoints to be adjusted above this Cut-In setpoint.

NOTE #8: The differential between Cut-In and Cut-Out setpoints will remain constant . This means that if the Cut-In setpoint climbs 2 lbs., the Cut-Out setpoint will also climb 2 lbs.

In the next four steps we can program the LOW TEMPERATURE SETPOINT, the HIGH TEMPERATURE SETPOINT, the TIME DELAY for compensation action and the MAXIMUM CUT-IN PRESSURE we would ever allow for this refrigeration system.

Let's assume we wanted a Low Temperature setpoint of plus twenty (020), a High Temperature setpoint of plus twenty five (025), a Compensation Time Delay of five (5) minutes, and a maximum Cut-In pressure allowed of thirty three pounds (33 lbs.)

The display indicates:

B L O T E M P S . P . - 5 0 (with -50 flashing)

Press +/- key to toggle minus sign to 0. Then press 20 and ENTER key. The display will advance to:

B H I T E M P S . P . - 5 0 (with -50 flashing)

Press +/- key to toggle minus sign to 0. Then press 25 and ENTER key. The display will advance to:

B T I M E D E L A Y 0 1 (with 01 flashing)

Press 05 for a five minute Compensation Time Delay and ENTER key. Display will advance to:

B M A X . C . I . P R E S 0 0 6 (with the 006 flashing)

Press 033 for thirty three pounds and ENTER key. The display will return to the P R O G or Program prompt.

We have in the preceding steps assigned a temperature sensor to Rack B and programmed Temperature Compensation setpoints - High and Low Temperature , Time Delay between floating actions, and a maximum Cut-In pressure we would allow the Suction Pressure setpoints to float to. The procedure for subsequent racks is identical to that outlined above.

G. ALARM SETPOINTS--TEMPERATURE

ALARM TEMPERATURE SETPOINTS may be assigned to any temperature sensor regardless of the function of the sensor. That is, Alarm setpoints are not dependent on whether the sensor is being used as a Temperature Control sensor, a Temperature Compensation sensor, or only as an Alarm sensor.

The alarm parameters associated with temperature sensors are the High Temperature setpoint, Low Temperature setpoint, and Alarm Time Delay. The Temperature Alarm will be activated if the temperature in the fixture is above or below the setpoints for the duration of the Time Delay.

Press ALARM SETPOINT TEMP. key.

The display will indicate:

S E N S O R 0 1 (with 01 flashing)

Press numbers of the appropriate temperature sensor--01,02,03, through 08 . This sensor number will remain in the left character of the display throughout the procedure. In this example, we have selected sensor # 1

Example 01: Press ENTER key. Display will advance to:

1 H I T E M P . S . P . - 5 0 (with -50 flashing)

Press +/- key to toggle from minus sign to 0 .

Press numbers of desired High Temperature setpoint. For example: 035 (for plus thirty five degrees F.).

Press ENTER key. The display will advance to:

1 L O T E M P . S . P . - 5 0 (with -50 flashing)

Press +/- key to toggle from minus sign to 0.

Press numbers of desired Low Temperature setpoint. For example : 020 (for plus twenty degrees F.).

Press ENTER key. The display will advance to:

1 T I M E D E L A Y 0 0 (with 00 flashing)

Press numbers of desired Alarm Time Delay Duration. This time delay period should be sufficiently long enough to account for any defrost periods

Press ENTER key. Display will return to P R O G or Program prompt.

G. ALARM SETPOINTS--PRESSURE

The RC-48 SYSTEM has the ability to alarm on a variety of pressure parameters. For any suction or head pressure input, the RC-48 can alarm on High and Low Pressure setpoints. All pressure alarms have a single ALARM TIME DELAY. The Head Pressure Alarm has an additional Suction Pressure Over-ride feature which allows the RC-48 to cycle compressors OFF if the Head Pressure exceeds the Head Pressure Alarm setpoint. This action also activates the RC-48 alarm while attempting to keep as much refrigeration "ON " without tripping the compressors' internal Head Pressure Safety Control.

In the Program Mode select and enter rack letter, for example " Rack B "

Press ENTER three times to step through loop.

Press ALARM SETPOINT PRESSURE key.

The display will indicate:

B H I S U C T . A L - 1 0 (with -10 flashing)

A desired HIGH SUCTION ALARM pressure setpoint may be programmed by pressing the desired numbers, toggle +/- for positive or negative value, and press ENTER key. The display will advance to:

B L O S U C T . A L - 1 0 (with -10 flashing)

A desired LOW SUCTION ALARM setpoint may be programmed by pressing desired numbers, toggle +/- key for positive or negative value,and press ENTER key.

The display advances to the Time Delay as indicated by:

B T I M E D E L A Y 0 0 (with 00 flashing)

The desired TIME DELAY period for all pressure alarms may be programmed by pressing desired numbers and then pressing ENTER key. The display advances to:

B L O H E A D A L 0 0 0 (with 000 flashing)

The desired LOW HEAD PRESSURE ALARM setpoint may be programmed by pressing desired numbers; then press ENTER key.

The display will advance to:

B H I H E A D A L 0 0 0 (with 000 flashing)

The desired High Pressure Alarm setpoint may be programmed by pressing desired numbers; then press ENTER key .

The display will advance to:

B H E A D D I F F 0 0 0 (with 000 flashing)

The RC-48 system will alarm when the system head pressure exceeds the HIGH HEAD ALARM setpoint for at least the Time Delay period. The system remains in alarm until the head pressure falls below the HIGH HEAD ALARM setpoint <u>minus this Differential.</u>

<u>For example</u>: The HIGH HEAD ALARM setpoint is programmed at 250 lbs. and the DIFFERENTIAL at 25 lbs. If the head pressure exceeds 250 lbs. for the Alarm Time Delay period, the system will alarm. The alarm will not reset until the system head pressure falls below 250 - 25 or 225 lbs.

A desired HEAD DIFFERENTIAL setpoint may be programmed by pressing the desired numbers.

Example: 025 for 25 lbs. and then the ENTER key.

The display will advance to:

B H E A D O V R O F F

The HEAD OVERRIDE function when toggled " ON " allows the RC-48 system to cycle compressors off on a normal Cut-Out sequence if the head pressure exceeds the HIGH HEAD ALARM setpoint for the programmed Time Delay period. This may allow the compressor system

to continue operating at a reduced capacity, as opposed to allowing the head pressure to possibly increase, causing eventual tripping of the mechanical head pressure safety controls. This situation may occur on an abnormally hot day when there is marginal condensing capability. The RC-48 would alarm on HIGH HEAD PRESSURE, cycle compressors OFF until the head pressure fell below the HIGH HEAD ALARM setpoint and eventually allow compressors to cycle on once the head pressure fell to the HIGH HEAD ALARM setpoint minus the DIFFERENTIAL.

I. RESET OF HEAD OVER-RIDE FUNCTION

There are two reset modes available with the RC-48 System - AUTOMATIC and MANUAL. In AUTO MODE, the system automatically resets after the head pressure falls below the HIGH HEAD ALARM setpoint minus the DIFFERENTIAL. In the MANUAL mode, the RESET key on the keyboard of the RC-48 must be pressed before compressors will be allowed to cycle ON.

The MANUAL RESET function serves to reset the HEAD OVER-RIDE when the head pressure falls below the High Head Pressure Alarm setpoint. Pressing the "RESET" key after selecting the correct rack will reset the Head Over-ride function.

The AUTO RESET function serves to reset the HEAD OVER-RIDE when the head pressure falls below the High Head Pressure Alarm setpoint minus the Differential for the Reset Time Delay period.

Example: High Head Alarm Setpoint = 250 lbs.

Differential = 25 lbs.

Reset Time Delay = 5 minutes

If the head pressure exceeded 250 lbs. the RC-48 would:

1. Alarm
2. Cycle compressors OFF in a normal Cut-Out sequence.

When the head pressure falls below 250 - 25 (or 225 lbs.) for at least 5 minutes, the alarm will CANCEL and compressors will be allowed to cycle ON if called for.

If the HEAD OVERRIDE function is not desired, simply toggle "OFF" with the +/- key.

Toggle HEAD OVERRIDE ON or OFF with the +/- key . If OFF, the display will revert to PROG (Program Mode). If ON, the display will advance to :

B R E S E T A U T O

Toggle reset to AUTO or MANUAL with the +/- key.

Then press the ENTER key.

The display will advance to:

B R E S E T T . D . 0 0 (with the 00 flashing)

Press desired numbers to select the TIME DELAY after the head pressure has fallen below the HIGH HEAD ALARM setpoint minus the DIFFERENTIAL before compressors will be allowed to be cycled ON. Press the ENTER key.

The display will advance to P R O G . or Program prompt.

J. ADDRESSING OF UNIT

When two (2) RC-48 control units are installed and they use the same COM-99 for communication, it will be necessary to designate the units as # 1 and # 2 so each unit can be interrogated and/or programmed individually. This is accomplished using the following :

1. Place the unit in Program Mode.

2. Press the unmarked key in the top row that falls between the keys marked " 3/Tuesday " and " Head Pressure Setpoint ".

3. The display will respond " Unit 1 or 2 X " , where " X " will be what the current address is set to . (Most likely "1").

4. Enter "2" to change to address 2 or "1" to change to address 1.

5. Continue programming as usual.

NOTE : This must be the first action taken upon entering the Program Mode or else the key will not respond.

NOTE : This unit number will remain even if the unit is Master Cleared.

III. ZERO ADJUST -- SUCTION AND HEAD PRESSURE TRANSDUCERS

Each transducer, either suction or head pressure, must be ZERO ADJUSTED before the RC-48 System is placed in service. The Zero Adjust procedure, that is adjusting each transducer to read exactly "0" lbs. with no pressure (open to atmosphere) can be done using the keypad. The procedure is performed in the "PROGRAM" mode, with the appropriate transducer or transducers OPEN to atmosphere.

1. Have transducer electrically wired and open to the atmosphere.

2. Place unit in the program mode.

3. Select rack by pressing RACK NUMBER/DESCR key and letter of system (A-H)

Press ENTER key three times to step through the loop (this steps through the loop while still maintaining all previously programmed parameters in memory).

4. Press Zero Adjust key. The display will indicate:

   A A U T O Z E R O S U C T (A on the left indicates Rack A)

   Use +/- key to toggle to Suction or Head Pressure transducer.

5. Press ENTER key. The display will indicate:

   A A U T O Z E R O - - - (three digits)

The three digit number is the OFFSET in pounds. The transducers used are extremely accurate, but require adjustment for the " ZERO OFFSET " when initially placed in service. The display should never indicate MORE THAN plus or minus five (5) pounds for suction transducers or twenty five (25) for head pressure tranducers. If the offset is more than this, the transducer may be damaged and should be replaced. The ZERO OFFSET figure should be recorded for future reference for each transducer, either suction or head.

6. Once offset figure is recorded,press ENTER key. That transducer is now ZERO ADJUSTED. This means the offset figure is subtracted from the transducer signal, giving an accurate pressure reading of 0 lbs.

If it is necessary to ZERO ADJUST the head pressure transducer on that system :

7. Press ZERO ADJUST key. The display will indicate:

A A U T O Z E R O S U C T

Toggle +/- key. Display will indicate:

A A U T O Z E R O H E A D

8. Press ENTER key. Display will indicate offset in pounds (three digits).

Press ENTER key. That transducer is now ZERO ADJUSTED.

Repeat this procedure for each transducer on RC-48 System.

9. Once Zero Adjust procedure is complete, press PROGRAM switch to return RC-48 to "Run" mode.

Press PRESSURE SUCTION & HEAD key to interrogate suction and head pressure for the rack that was Zero Adjusted. This will ensure that the pressure on display reads "0" lbs. before pressurizing transducers on that rack.

IV. MANUAL ZERO ADJUST PROCEDURE

The best method of setting up the RC-48 control unit for accurate suction and head pressure monitoring is to open the appropriate transducer to the atmosphere and use the AUTO ADJUST feature, whereby the RC-48 automatically adjusts itself to the transducer.

If for some reason you cannot open the transducer to the atmosphere, (i.e. no shutoff valve) or it was very recently Zero-Adjusted automatically, you can manually program the proper offset to monitor accurately the suction and head pressures without the need to disconnect the proper transducer. All that is required is an accurate set of refrigeration gauges or a record of the offset when it was recently Zero Adjusted.

A. The offset value for suction pressure is equal to the actual number of pounds that the RC-48 is correcting itself by.

For example : if your suction gauge reads 15.5 lbs. and the RC-48 is displaying a value of 17.5 lbs., the offset needs to be 2.0 -- the RC-48 will then correct by a value of 2 lbs. If the offset for suction pressure is more than 5 lbs., the transducer may be damaged and should be replaced.

B. The offset for head pressure is determined by doing the following calculation :

the # of lbs. that needs to be corrected DIVIDED by 5

For example : if the RC-48 is displaying 190 and the actual head pressure is 170 -- take the difference of 20, divide 20 by 5 = 4 (the offset is 4). If the difference between the display value and the actual value is more than 25 lbs., the transducer should be checked for proper operation.

C. If the RC-48 displays a pressure reading value that is higher than the actual value, the offset will be a positive value. If the RC-48 displays a pressure reading value that is lower than the actual value, the offset will be a negative value. You can then use the + / - key in order to put a negative sign on the offset value.

D. To Program an offset MANUALLY, do the following :

1. Enter the Program Mode.
2. Press the Zero Adjust key . The + / - key will allow you to choose head or suction pressure.
3. Press ENTER .
4. Press Zero Adjust key again .

The display will now read : MAN ADJUST ##.# (the ##.# represents the actual pressure from the transducer for suction pressure or 1/5 the pressure for head pressure. The numbers are non-corrected values and must be ignored when entering the correct offset value.

5. Enter the desired offset. + offset for lowering the display value
- offset for raising the display value

6. Press ENTER .

7. Return to the Operating Mode.

Again check head or suction pressures that are shown on the display against the actual values as measured by your gauge.

If, after completing the Manual Adjustment procedure, the pressure still does not correspond to your gauge, calculate the new offset value and repeat this procedure.

V. INTERROGATION KEYS

A. DAY, DATE, TIME, DAYLIGHT SAVINGS DATES

In the program mode press DAY/DATE/TIME key. Display will indicate:

A D A Y 5 (with day number flashing)

Press number of correct day (Sunday = day 1, Monday = day 2, etc.) and press ENTER to record in memory. Display advances to:

A D A T E 1 2 2 5 (with month and day flashing)

Press numbers of correct month and day (Ex: 1225 = Christmas Day). Display advances to:

A H O U R 1 5 1 0 (with hour in military time flashing)

Press numbers of correct time and then ENTER to start clock. Display advances to:

A Y E A R 0 0 (with year flashing)

Press numbers for correct year (Ex: 85 = 1985). Then press ENTER. Display advances to:

D L S A V O N 0 0 0 0 (with 0000 flashing)

Enter the date that Daylight Savings time takes effect and then ENTER key .

Repeat for Daylight Savings "off" date.

When complete, display will revert to P R O G .

B. SYSTEM STATUS

The SYSTEM STATUS Key operates only in the "RUN" mode.

Select the compressor rack by pressing Rack Number/Description key, then correct rack letter, etc.

Press the SYSTEM STATUS key. The display will indicate if the system is in Defrost or if in a Head Override condition. The display will indicate from left to right, **D E F** (if connected to RT-5D and in Defrost) followed by **H E A D O V R** (if the actual Head Pressure is above the HI Head Alarm setpoint and Head Override is toggled to the ON position in Alarm setpoints.)

NOTE : This information will not appear if the rack being interrogated is not in Defrost or in Override.

Press SYSTEM STATUS key again. Display will indicate from left to right, the rack letter, control sequence, actual stage of sequence, and which compressors are running.

NOTE : X = OFF
0 = ON

Example : A 0 5 0 1 X X X X

This indicates Rack A, Sequence 05 (two compressors alternating) , Stage 1 (all off) , with all compressors OFF.

Press SYSTEM STATUS key again. Display will indicate the condenser status , condenser fans that are ON (0) or OFF(X). This function will only operate if the RC-48A Head Pressure control is connected and operating. Display will indicate from left to right the Rack letter, and C O N D followed by X's and 0's.

Example : A C O N D X X X X

By continuing to press the SYSTEM STATUS key, these three displays will loop around until the ENTER key is pressed.

C. ELAPSED TIME

The ELAPSED TIME Key operates only in the "RUN" mode.

Select appropriate compressor rack. Ex: Rack B

Press ELAPSED TIME key. Display will indicate:

B C O M P . 1 (Run time in hours and minutes)

Press ENTER to advance to next compressor Elapsed Time or EXIT to escape to the Run Mode.

The condensers' Elapsed Times will follow the compressor Elapsed Times showing the hours and minutes for each condenser fan.

Display will indicate :

B F A N 1 (Run time in hours and minutes)

Again press ENTER to advance to next fan Elapsed Time or EXIT to escape to the Run Mode.

D. CLEARING RUN TIMES

Put unit in P R O G Mode and select appropriate compressor rack .

Example : Rack B

Press Elapsed Time Key . Display will indicate :

B C O M P 1 (Run time in hours and minutes)

1. To CLEAR the run time of compressor # 1, press the +/- key at this time.

2. To CLEAR the run time of compressor # 2, press ENTER , display will indicate :

B C O M P 2 (run time in hours and minutes)

Press the + / - key at this time.

Continue to CLEAR compressors and fans on Rack B as stated or press EXIT to escape to P R O G or Program prompt.

Select another Rack on which you wish to clear Run Times or return to the Run Mode by using Program switch.

E. RC-48 ALARM LOG INDICATIONS

Alarm Condition	Alarm Log Indication			
			DATE	TIME
Power Restoration	Power ON		----	----
Power Failure	Power OFF		----	----
		SENSOR #	DATE	TIME
High Temperature Alarm	Hi T.	-	----	----
Low Temperature Alarm	Lo T.	-	----	----
		SYSTEM	DATE	TIME
High Suction Pressure	Hi S.	-	----	----
Low Suction Pressure	Lo S.	-	----	----
		SYSTEM	DATE	TIME
High Head Pressure	Hi H.	-	----	----
Low Head Pressure	Lo H.	-	----	----
		LOAD #	DATE	TIME
Override Switch Engaged	OV EN	--	----	----
Override Switch Disengaged	OV DI	--	----	----

Load numbers refer to specific compressor racks or condensors.

Temperature alarms refer to specific sensors, not compressor racks.

When any parameter in the Temperature or Pressure Alarm setpoints have been exceeded and the Time Delay has elapsed, the RC-48 unit will go into ALARM. An alarm will be indicated in two (2) ways:

1. An " A " will flash in the display just to the right of the System letter.

2. The RC-48 unit will signal the XAL-2 (external alarm output module) to transmit an alarm to a remote location. See Figure 9.

When the alarm condition clears or goes away, the XAL-2 will no longer send out a signal to the remote location, but the display will continue to flash an " A ". This is to alert someone that there was an alarm condition that might need to be checked out.

If the " A " is flashing on the display, press the ENTER key to remove it. If the " A " disappears, the alarm condition is no longer present and it will be stored in the Alarm Log.

If the " A " continues to flash on the display after pressing the ENTER key, then the alarm is still present and again it will be stored in the Alarm Log.

The Alarm Log will give the following information :

Condition, location (system, load etc.) date, and time the alarm occurred.

The Alarm log will not indicate the recovery from the alarm.

Logged alarms begin with the most recent alarm and will page back through 64 alarms. As new alarms occur, the oldest alarms are omitted from the log.

VI. LOAD NUMBERS USED IN ALARM LOGS

RC-48, RC-48A, RC-48B

The RC-48 System has the potential to control 32 compressors (eight racks with up to four compressors each), and 32 condenser fans, or 8 banks of fans. Each compressor output on the RC-48 Main System and the condenser fan output on the RC-48A Slave System, is assigned a LOAD number.

Load numbers occur in the Alarm Log when an Over-ride switch is either engaged or disengaged. For example: Compressor Rack A is designated as LOAD 01 as indicated in the chart below. If any compressor on Rack A is placed in Over-ride, it will be indicated as 01 in the Alarm Log. Individual compressor or condenser fan load numbers occur when using the keyboard over-ride or the keyboard interrogation of an individual load status.

A. Alarm Log of Over-ride Engage or Disengage

1. Compressor Rack — Load #

Rack A	01
Rack B	05
Rack C	09
Rack D	13
Rack E	17
Rack F	21
Rack G	25
Rack H	29

2. Condenser Fan Bank

A	33
B	37
C	41
D	45
E	49
F	53
G	57
H	61

3. Load Override and Status

Load status indicates both compressor or condenser ON - OFF status , as well as an Override condition.

For example : Rack C, Compressor 3

We can now put compressor # 3 on Rack C into Override and check Load Status by completing the following steps.

a. Press the Zero (0) Override key.

b. Display will indicate :

L O A D N O 0 0 (with 00 flashing)

c. Refer to the Load Number chart that follows on Page 46 for the load number that corresponds to Compressor # 3 , Rack C - the CORRECT load number is 11.

d. Enter 11 and press ENTER key .

e. Display will indicate :

L O A D 1 1 O V O N

f. This will bring on the load and keep it on until removed by:

a. Master clearing the unit
b. Repeating the procedure used to activate the Override.

g. Display will indicate :

L O A D 1 1 O V O F F

4. Load Status Interrogation

Leaving Rack C, Compressor # 3 still in Override, do the following to verify the load status.

a. Press the # 9 key.

b. Display will indicate :

L O A D N O 0 0 (with 00 flashing)

c. Refer to the Load Number chart on Page 46 again for the load number that corresponds to Rack C, Compressor # 3 - the CORRECT load number is 11.

d. Enter 11 and press ENTER key.

e. Display will indicate :

L O A D 1 1 O N O (O indicates Override)

f. Other status reports :

L o a d 1 1 O N	Load is ON
L O A D 1 1 O F F	Load is OFF
L O A D 0 1 O N O H	Load is in Hard Override This OH will only appear for the first load of each compressor or condenser system i.e. 1,5,9, 13 , etc. Refer to Load Numbers used in Alarm Logs.

LOAD NUMBER CHART

Listed below are individual compressor and condenser fan output load numbers for the purpose of Load Status inquiry or individual unit keyboard Over-ride:

RC-48,RC-48B			RC-48A		
Rack Load	Compressor	Load	Rack	Compressor	
A	#1	01	A	#1	33
	#2	02		#2	34
	#3	03		#3	35
	#4	04		#4	36
B	#1	05	B	#1	37
	#2	06		#2	38
	#3	07		#3	39
	#4	08		#4	40
C	#1	09	C	#1	41
	#2	10		#2	42
	#3	11		#3	43
	#4	12		#4	44
D	#1	13		#1	45
	#2	14		#2	46
	#3	15		#3	47
	#4	16		#4	48
E	#1	17	E	#1	49
	#2	18		#2	50
	#3	19		#3	51
	#4	20		#4	52
F	#1	21	F	#1	53
	#2	22		#2	54
	#3	23		#3	55
	#4	24		#4	56
G	#1	25	G	#1	57
	#2	26		#2	58
	#3	27		#3	59
	#4	28		#4	60
H	#1	29	H	#1	61
	#2	30		#2	62
	#3	31		#3	63
	#4	32		#4	64

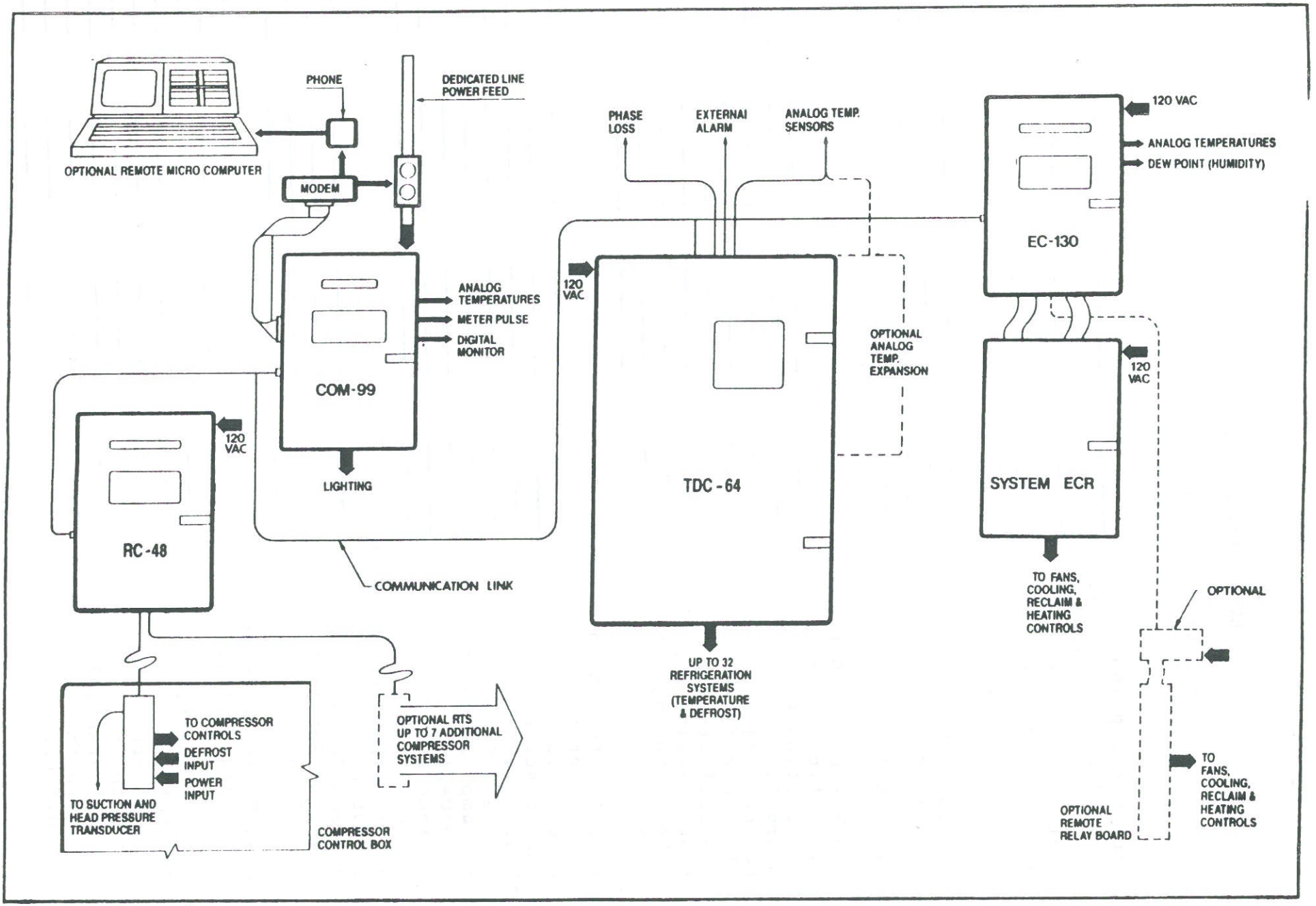
RC-48 Program Sheet

Position	A	B	C	D
Rack Description				
Control Mode (Pres or Temp)				
Control Sequence				
Sequence Description				
Suction (or temp) Set Points				
Suction C.I.				
Suction C.O.				
C.I. Time Delay				
Min. OFF T.D.				
Min. ON T.D.				
Alarm Pressure Setpoints				
HI Suction Alarm				
LOW Suction Alarm				
Alarm T.D.				
LOW Head Alarm				
HIGH Head Alarm				
Head Differential				
Head Override ON/OFF				
Auto/Manual Head reset				
Reset T.D.				
Temperature Compensation				
1st Sensor #				
Description				
2nd Sensor #				
Description				
LOW Temp Setpoint				
HI Temp Setpoint				
Time Delay				
Maximum C.I.				
Alarm Temperature Setpoint				
Sensor #				
HI Temp Setpoint				
LOW Temp Setpoint				
Time Delay				
Head Pressure Setpoint				
Time Delay - 15,30,45,60				
# 1 Setpoint				
# 1 Differential				
# 2 Setpoint				
# 2 Differential				
# 3 Setpoint				
# 3 Differential				
# 4 Setpoint				
# 4 Differential				

RC-48 Program Sheet

Position	E	F	G	H
Rack Description				
Control Mode (Pres or Temp)				
Control Sequence				
Sequence Description				
Suction (or temp) Set Points				
Suction C.I.				
Suction C.O.				
C.I. Time Delay				
Min. OFF T.D.				
Min. ON T.D.				
Alarm Pressure Setpoints				
HI Suction Alarm				
LOW Suction Alarm				
Alarm T.D.				
LOW Head Alarm				
HIGH Head Alarm				
Head Differential				
Head Override ON/OFF				
Auto/Manual Head reset				
Reset T.D.				
Temperature Compensation				
1st Sensor #				
Description				
2nd Sensor #				
Description				
LOW Temp Setpoint				
HI Temp Setpoint				
Time Delay				
Maximum C.I.				
Alarm Temperature Setpoint				
Sensor #				
HI Temp Setpoint				
LOW Temp Setpoint				
Time Delay				
Head Pressure Setpoint				
Time Delay - 15,30,45,60				
# 1 Setpoint				
# 1 Differential				
# 2 Setpoint				
# 2 Differential				
# 3 Setpoint				
# 3 Differential				
# 4 Setpoint				
# 4 Differential				

SUPERMARKET SYSTEMS



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COMPONENT REFERENCE

REFERENCE	ABBREVIATION	SYMBOL	PICTURE
CURRENT TRANSFORMER	CT		
SMART MODEM	SM	SM	
LIGHTING CONTROL BOX	LC#	LC#	
SENSOR (DUCT)	TD#		
SENSOR (INSIDE)	T#		
DEWPOINT SENSOR (INSIDE)	H#		
SENSOR (OUTSIDE)	TO		
COM 99	CM	CM	
RC 48	RC	RC	
EC 130	EC	EC	
TDC 84	TDC	TDC	
UTILITY METER	UM	(M)	
WATTHOUR TRANSDUCER	WT	WH	
WIRING RUN	WR	FROM — TO	VARIOUS

REFERENCE	ABBREVIATION	SYMBOL	PICTURE
THERMOSTAT	T-STAT	MAKE ON FALL MAKE ON RISE	
REFRIGERATION TEMPERATURE SENSORS			
SUPPLY AIR	SA		S# E# R#
RETURN AIR	RA		
EVAPORATOR	EV		
COMPRESSOR CONTROL REMOTE TERMINAL UNIT	RT#	RT#	
WIRE SHIELD		OR	
WIRES IN TWISTED PAIRS			

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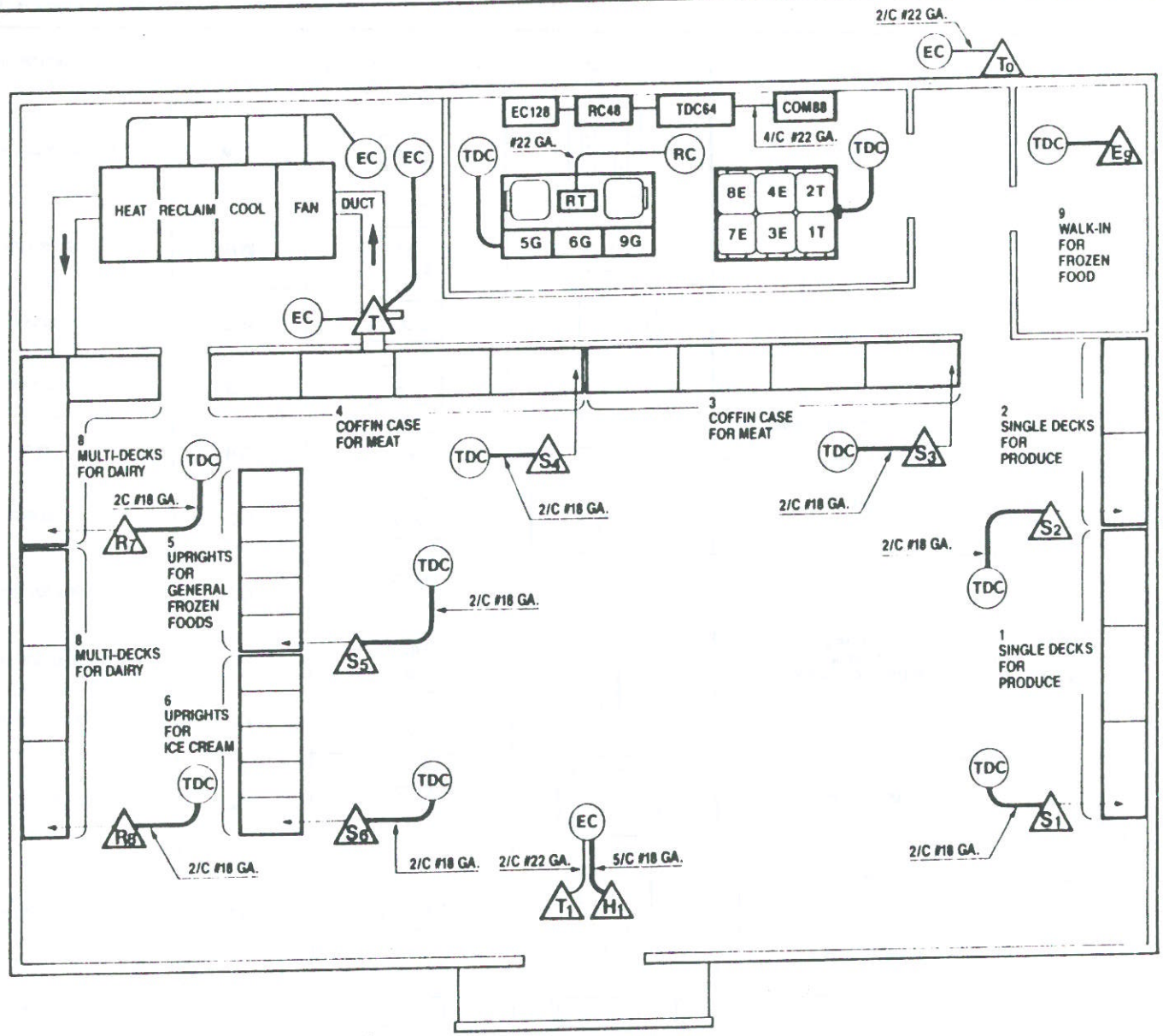
SAMPLE BUILDING LAYOUT



REFRIGERATION NUMBERS
E ELECTRIC DEFROST
G GAS DEFROST
T TIME OFF DEFROST

SEE "COMPONENT REFERENCE" FOR ADDITIONAL SYMBOLS

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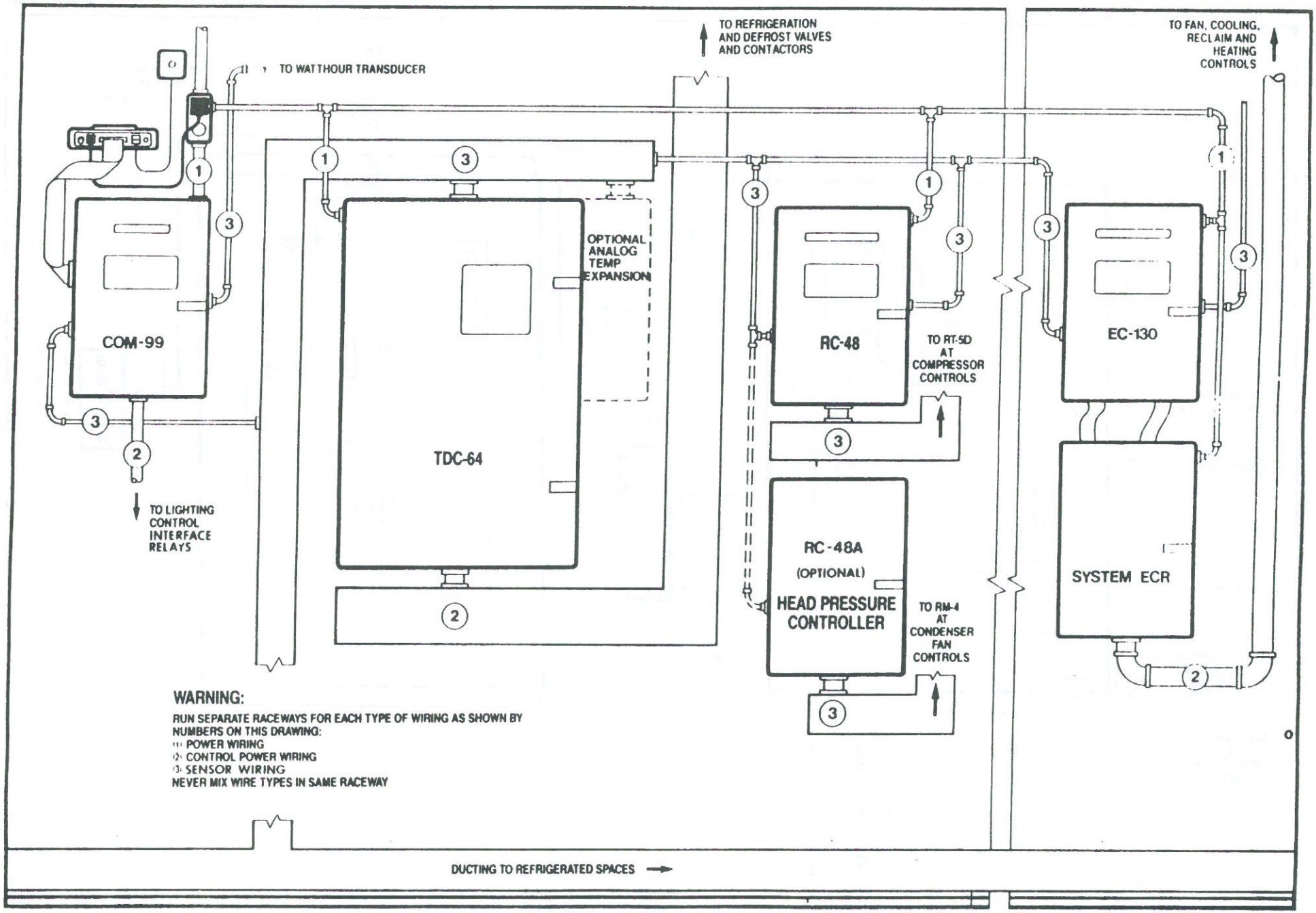
TYPICAL WALL PLACEMENT



WARNING:

RUN SEPARATE RACEWAYS FOR EACH TYPE OF WIRING AS SHOWN BY NUMBERS ON THIS DRAWING:
(1) POWER WIRING
(2) CONTROL POWER WIRING
(3) SENSOR WIRING
NEVER MIX WIRE TYPES IN SAME RACEWAY

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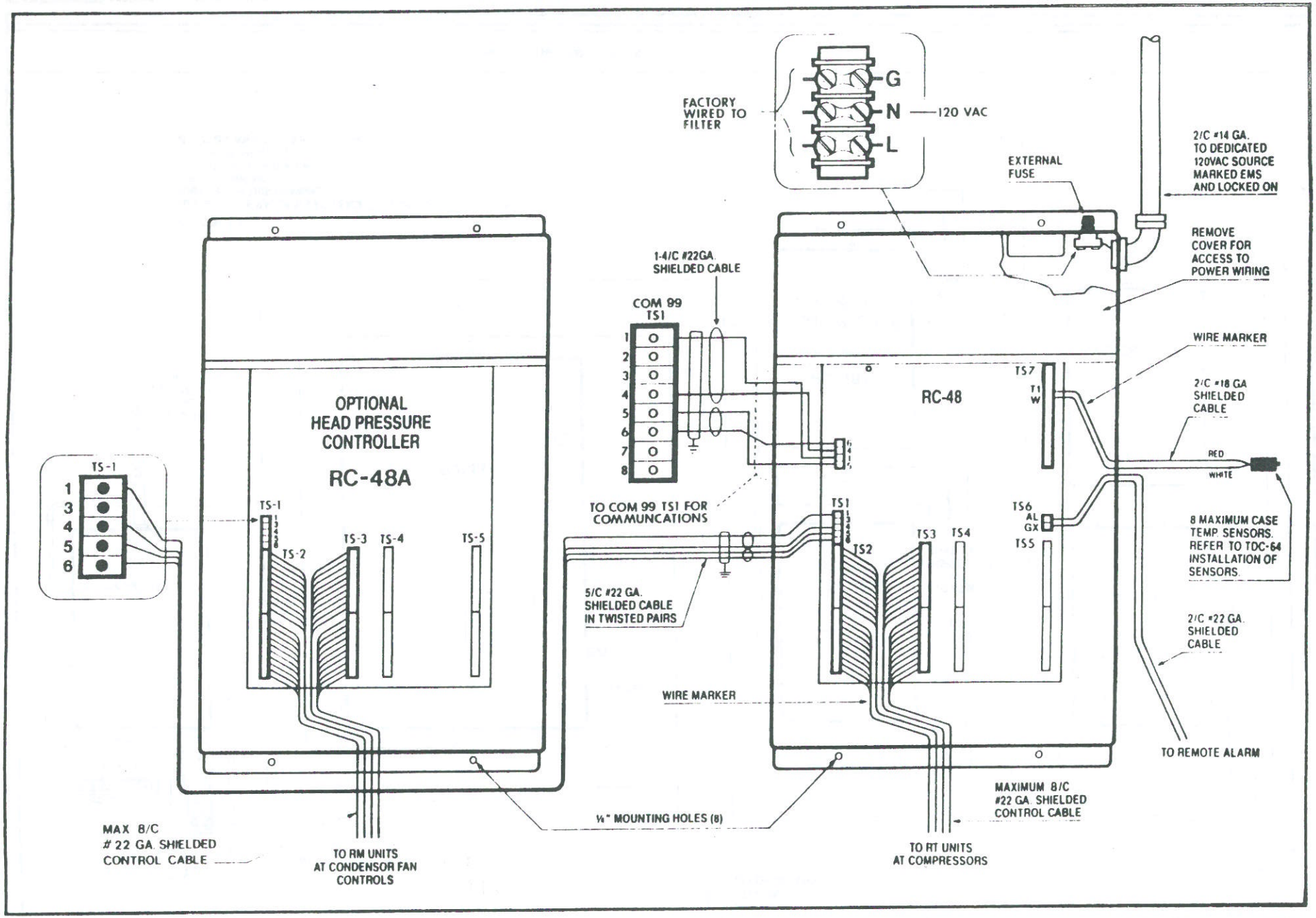
RC-48 MOUNTING & HOOKUP



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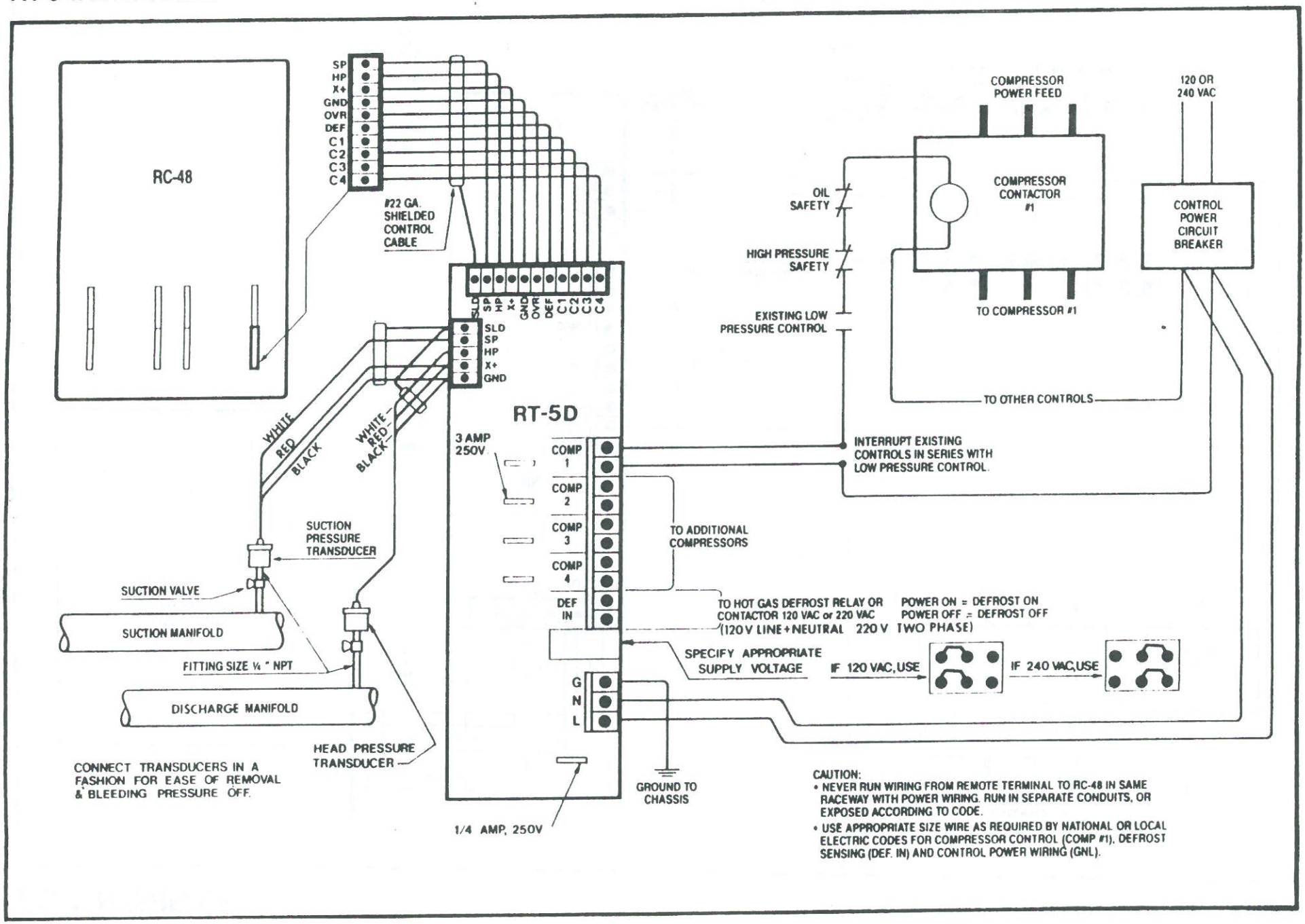
RT-5 INTERFACE



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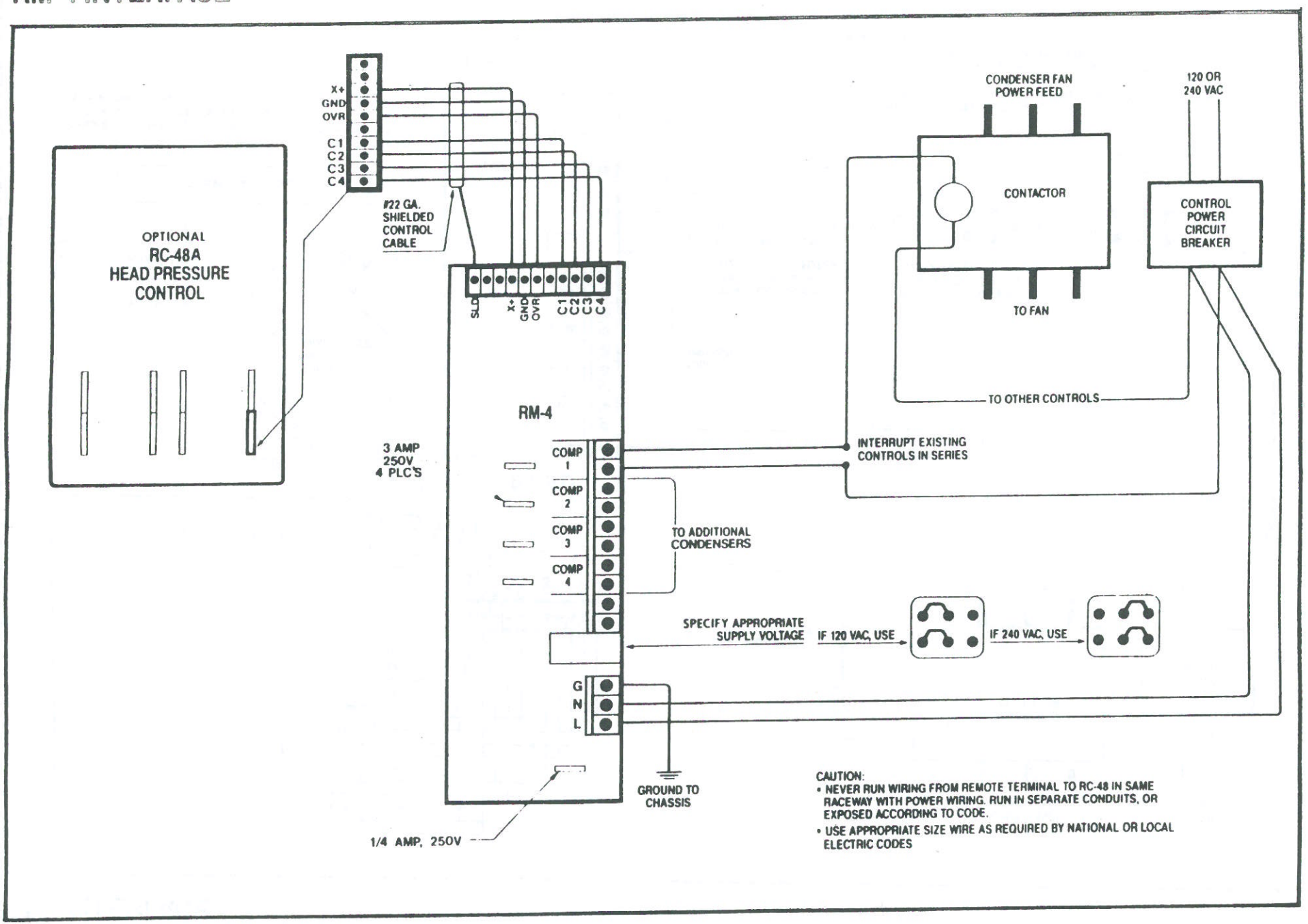
RM-4 INTERFACE



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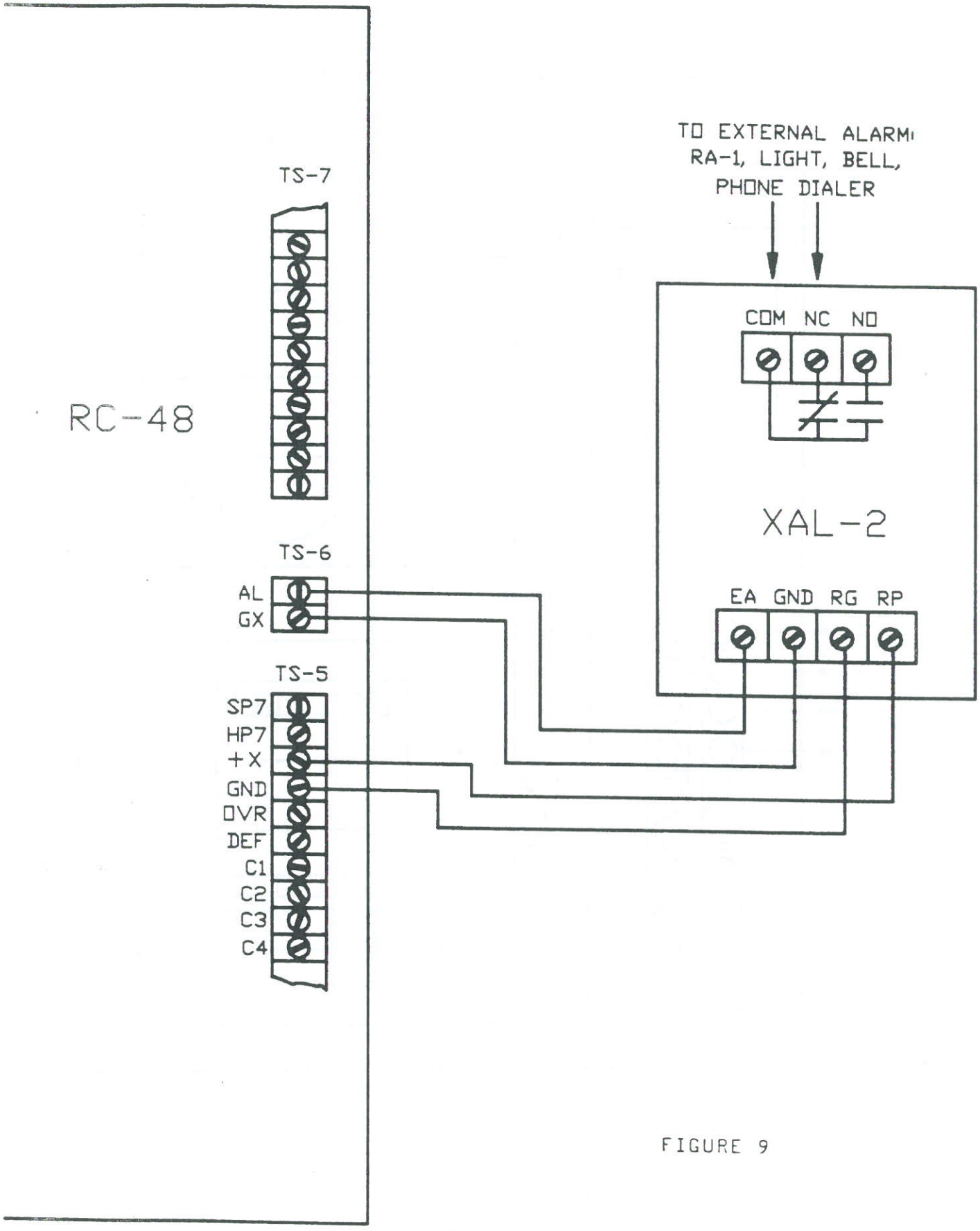


FIGURE 9

EXTERNAL ALARM INSTALLATION WIRING DIAGRAM.

RA-1 REMOTE ALARM INSTALLATION DIAGRAM

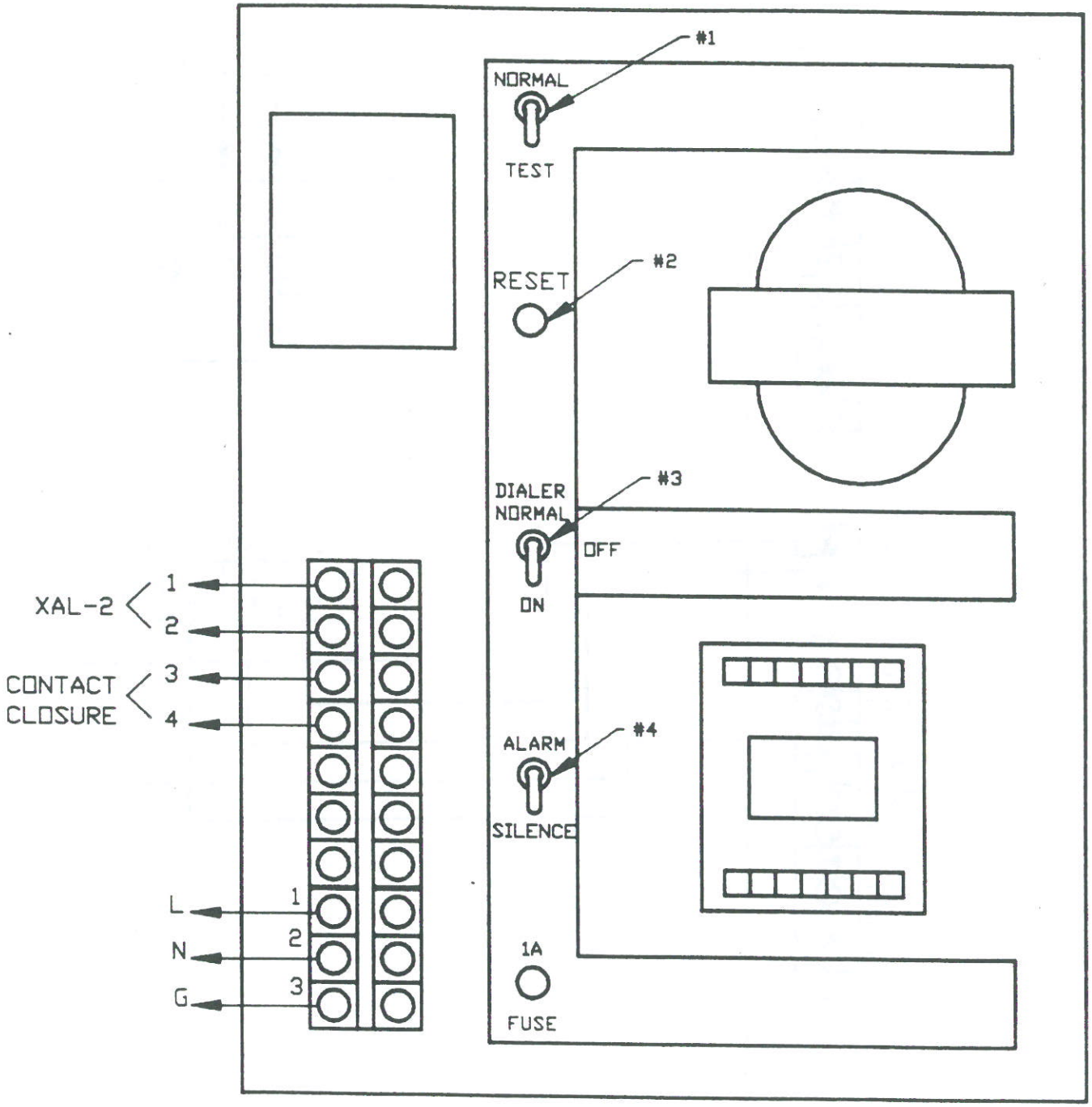
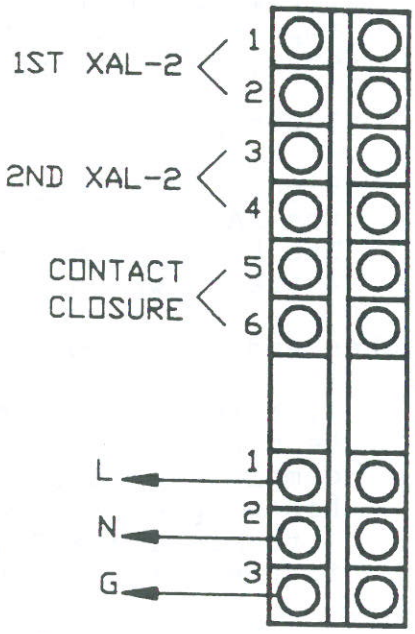


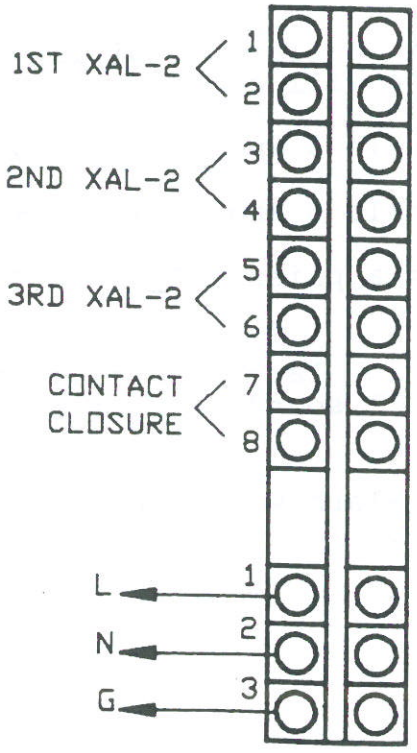
FIGURE 10

FIGURE 11

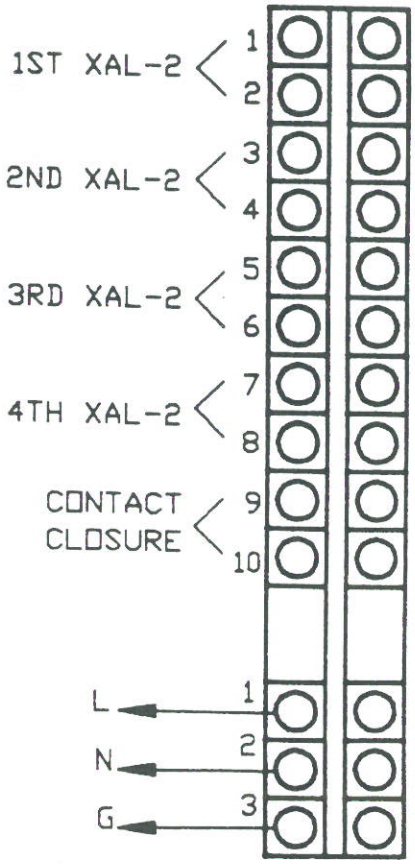
RA-2



RA-3



RA-4



REMOTE ALARM INSTALLATION

A. Terminals 1 and 2 are from the XAL-2 terminals marked " COM " and " NC ". These terminals supply 24 VAC.

B. Terminals 3 and 4 are dry contacts rated at 3 amps at 120 VAC. These contacts may be used to energize a telephone dialer , alarm light, etc.

C. Input power is 120 VAC.

D. Figure 10 illustrates the hookup connections of the RA-1 (single channel Remote Alarm panel). The terminal connections for the RA-2, RA-3, RA-4 are shown on the following diagram.

E. Switches and their operation:

1. Normal Mode : The RA-1 will alarm out (on terminal 3 and 4) if terminal 1 and 2 have completed a circuit and the 2 minute Time Delay has elapsed. Test mode : RA-1 will alarm out (terminal 3 and 4) immediately without any further requirements.

2. Reset : When the alarm has been activated, it will remain latched (ON) until the reset button is pushed. This will stop the alarm condition, but if terminals 1 and 2 still sense an alarm (completed circuit), the RA-1 will go back into Alarm following the 2 minute Time Delay.

3. Normal : When an alarm condition is present, terminals 3 and 4 will close.

a. OFF : Terminals 3 and 4 will never close.

b. ON : Terminals 3 and 4 will remain closed.

4. The following applies <u>only</u> when Sonalert is installed :

a. ALARM - when an alarm condition is present, the beeper will sound until reset button is pressed.

b. SILENCE : no alarm will sound under any circumstances.

RC-48 TROUBLESHOOTING GUIDELINES

A. RC-48 Voltage checks

1. In order to read voltages at P3 connector at upper left hand corner of I/O Board : See Figure A .

   a. Remove line voltage fuse.
   b. Remove black cover on red connector.
   c. Reapply line voltage fuse.
   d. You should have the following voltage readings:

		Readings as found
Green	Ground	
Orange	+7VDC +/-.5VDC	_____
Non Connection		
Black	+5VDC +/-.5VDC	_____
Yellow	-5VDC +/-.5VDC	_____
Blue	+35VDC +/-3VDC	_____
Red	+12VDC +/-.5VDC	_____
White	+5VDC +/-.5VDC	_____

   e. If you do not have readings corresponding to the above, contact EIL factory, Systems & Products Division.

2. Check voltage readings on terminal strip located on lower part of I/O Board as follows:

   a. Terminal reading should be approximately + 12 VDC from Ground Terminal to TX or +X. (See Figure A.)

      1. If you do not get a + 12 VDC reading, measure between Ground and the lower side of Fuse F1 in the upper left hand side of the I/O Board.
      2. If you still do not get a + 12 VDC reading, measure between Ground and the upper side of the same fuse. If you then measure + 12 VDC, the fuse is blown.
      3. Depower the the RC-48 unit in order to replace the fuse (AGC 250V 1A).
      4. If voltage does not then measure approximately + 12 VDC after fuse replacement and fuse has not blown again, remove the black cover from connector P4 for further measurement.
      5. Measure from Ground to " out " terminal - voltage should be 12 VDC.
      6. If 12 VDC is not present at " out " terminal, measure at the " in " terminal for 16 to 18 VDC.
      7. If NO voltage is present , call EIL factory , Systems & Products Division.

3. Check voltage reading from Ground to C1, C2, C3 or C4.

   a. When LED is not lit, the voltage reading between Ground and corresponding C terminal should be approximately + 0.7 VDC.

   b. When LED is lit, the voltage reading between Ground and corresponding C terminal should be approximately + 7 VDC.

   c. If you are unable to measure the above voltages, contact the factory for further information.

4. Battery Voltage Check (See Figure B)

   a. The battery is located on the upper left side of the CPU Board.

   b. With RC-48 unit powered up, measure from Ground to Test Point 1 of Resistor R46 : reading should be approximately + 5 VDC.

   c. DEPOWER the RC-48 unit for about 5 minutes and remeasure voltage at the same point - voltage reading should not be lower than + 3.6 VDC; if it is lower, contact the factory for further information.

B. <u>Suction Transducer (EIL model # SA-100)</u>

1. When the transducer is open to the atmosphere, the voltage reading should measure approximately 1 VDC between Ground and corresponding SP terminal. This voltage should be the same at the RT-5D module. At this time, the transducer would be zero-adjusted. The suction side of the transducer is then connected to the suction manifold.

2. Voltage to Pressure Conversion Formula

   For example : if 2 VDC is the measured voltage between Ground and SP terminal after the suction side of the transducer is connected, use the following formula to compute the pressure reading :

   (2 VDC - 1) X 20 = 20 PSI

C. Head Pressure Transducer (EIL model # SA-500)

1. When the transducer is open to the atmosphere, the voltage reading should measure approximately 1 VDC between Ground and the corresponding HP terminal. This voltage should be the same at the RT-5D module. At this time, the transducer would be zero-adjusted. The head pressure side of the transducer is then connected to the head pressure manifold.

2. Voltage to Pressure Conversion Formula

For example : if 2 VDC is the measured voltage between ground and HP terminal after the head pressure side of the transducer is connected, use the following formula to compute the pressure reading :

(2 VDC - 1) X 100 = 100 PSI

D. RT-5D Control Module (See Figure C)

1. Line voltage is wired at the factory for 240 VAC input.

2. Line voltage fuse F1 is rated AGX 250V 1/4A.

3. Relay power can be measured from ground strap to Point A : voltage reading should be between + 16 to + 18 VDC.

4. Fuses F2, F3, F4, and F5 on the load side of the relay are rated at AGX 3A 250V.

5. Voltage checks on the TS1 terminal strip (assuming all wiring is correct from main panel)

   a. Ground to X+ should measure approximately + 12 VDC.

   b. When LED is NOT lit, voltage reading from Ground to C1, C2, C3, or C4 should measure approximately + 0.7 VDC.

   c. When LED is lit, voltage reading from Ground to C1, C2, C3, or C4 should measure approximately + 7 VDC.

6. Point B (Green LED) : when lit, indicates power from the main panel (+ 12 VDC)

7. Switches SW2, 3, 4 and 5 are Override Switches.

   a. In Auto position, the RC-48 controls compressors.

   b. In OVR position, compressors will energize , but RC-48 will have NO control.

c. Override LED will light when any switch is in the Override position.

8. Troubleshooting - Do not have relay power, but do have power from the main panel -

a. All relay contacts will be closed, whether LED's, C1, C2, C3, or C4 are lit or not lit.

b. Check for relay voltage at appropriate point.

c. If you do not get a relay voltage reading, check line voltage fuse to see if the fuse is blown.

d. Override and Defrost LED's will not light without line voltage being applied.

e. If relay contacts are closed or open at ALL times, remove relay and check for bent or broken pins.

E. Communication

1. To check communication between the CPU board and I/O board :

a. Press 9 key, display indicates :

L O A D 0 0 (with 00 flashing)

b. Press EXIT Key, display will indicate :

1. O O O O Communication Good

2. F F F F NO Communication

3. F F O O (any combination) NO Communication

2. To check communication between the CPU board and the slave board (RC-48A) :

a. Follow above procedure in # 1 - display will indicate:

1. O O O O O O O O Communication Good

2. F F F F O O O O NO Communication to slave / Main I/O board is OK.

3. O O O O F F F F NO Communication to main I/O board ;slave board (RC-48A) is OK.

4. Any combination - Determine if main I/O board or slave board with faulty communication / or both.

SEQUENCE # ___ X=OFF O=ON

COMP./STAGES	H.P./BTU ___	H.P./BTU ___	H.P./BTU ___	H.P./BTU ___
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

SEQUENCE # ___

COMP./STAGES	H.P./BTU ___	H.P./BTU ___	H.P./BTU ___	H.P./BTU ___
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

BY USING THE SAMPLE CHART A SEQUENCE CAN BE DEVELOPED FOR ANY COMPRESSOR RACK BEING USED.

SEQUENCE #9 X=OFF O=ON

COMP./STAGES	H.P./BTU _3_	H.P./BTU _5_	H.P./BTU _10_	H.P./BTU ___
1	X	X	X	
2	O	X	X	
3	X	O	X	
4	O	O	X	
5	X	X	O	
6	O	X	O	
7	X	O	O	
8	O	O	O	
9				
10				
11				
12				

SEQUENCE ___

COMP./STAGES	H.P./BTU ___	H.P./BTU ___	H.P./BTU ___	H.P./BTU ___
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

BY USING THE SAMPLE CHART A SEQUENCE CAN BE DEVELOPED FOR ANY COMPRESSOR RACK BEING USED.

3. Troubleshooting

a. Check wiring between TS1 of I/O board and slave board for hook-up of terminals 1,4,5 and 6 corresondingly on each board.

b. DEPOWER RC-48 unit for 3 minutes and then repower.

c. MASTER CLEAR RC-48 unit.

d. On units manufactured prior to 1-1-88, the RC-48 and slave (RC-48A) will not communicate with each other until the following is done :

1. Put the unit in Program Mode.
2. Press Head Pressure setpoint key.
3. Go through loop of setpoint parameters (it is not necessary , however, to enter any setpoints.)
4. Exit the Program Mode.

4. Remote Communication through the COM-99

a. Refer to Figure A and check voltage levels at TS8 as shown.

b. The RC-48 must be connected to the COM-99 in order to get the following voltage readings:

1. Voltage between terminals 1 and 6 (Ground)should be approximately 4.2 VDC and fluctuating .
2. Voltage between terminals 4 and 6 (Ground) should be approximately 4.2 VDC and fluctuating .
3. Voltage between terminals 5 and 6 (Ground) should be approximately .4 VDC and fluctuating, going negative at times.

c. If voltage readings are not correct :

1. Isolate other units (TDC-64, EC-130) from communication link and retest voltages.
2. DEPOWER RC-48 unit for 2 minutes and then repower.
3. Check for correct hook-up to COM-99.

FIGURE A (I/O BOARD)

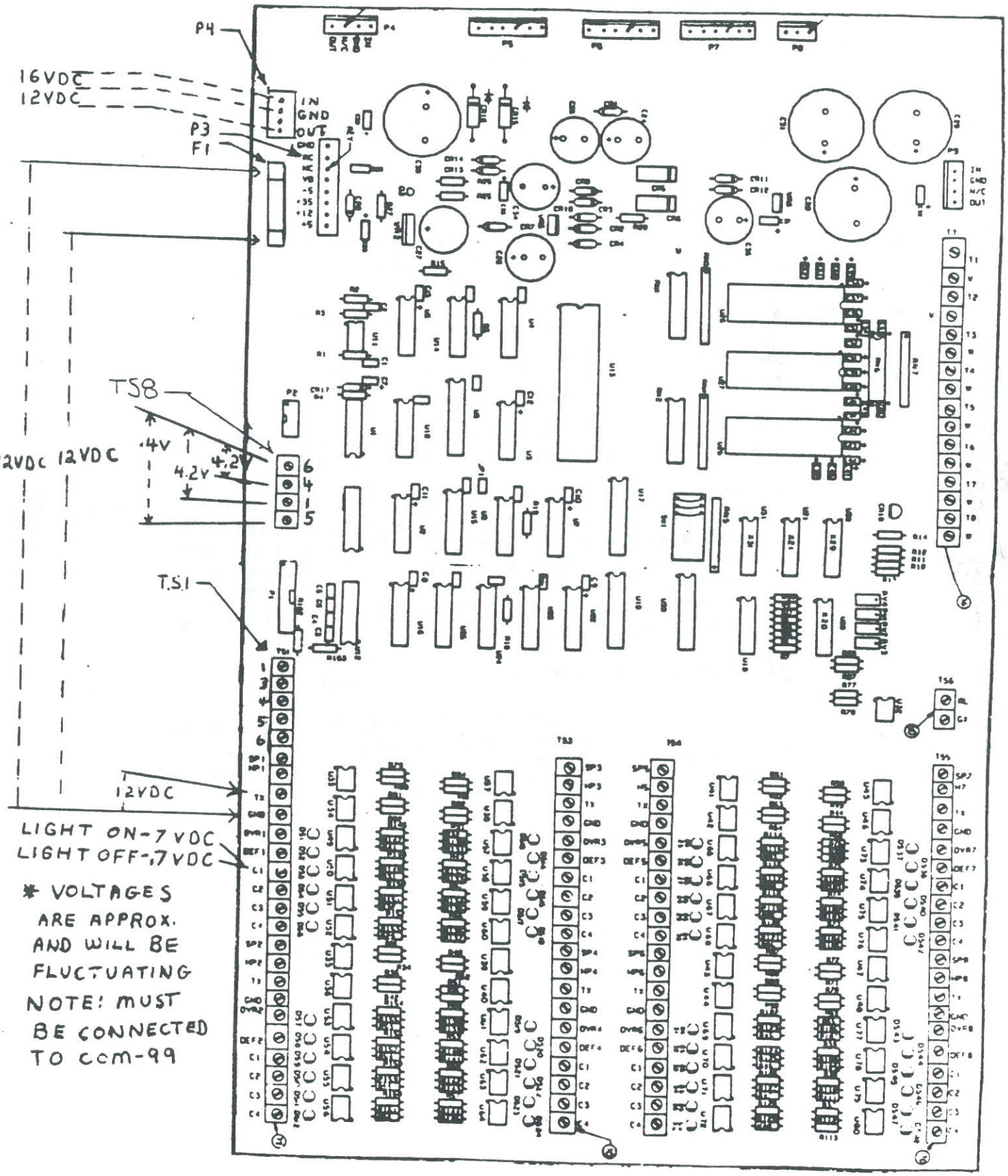


FIGURE B (CPU BOARD)

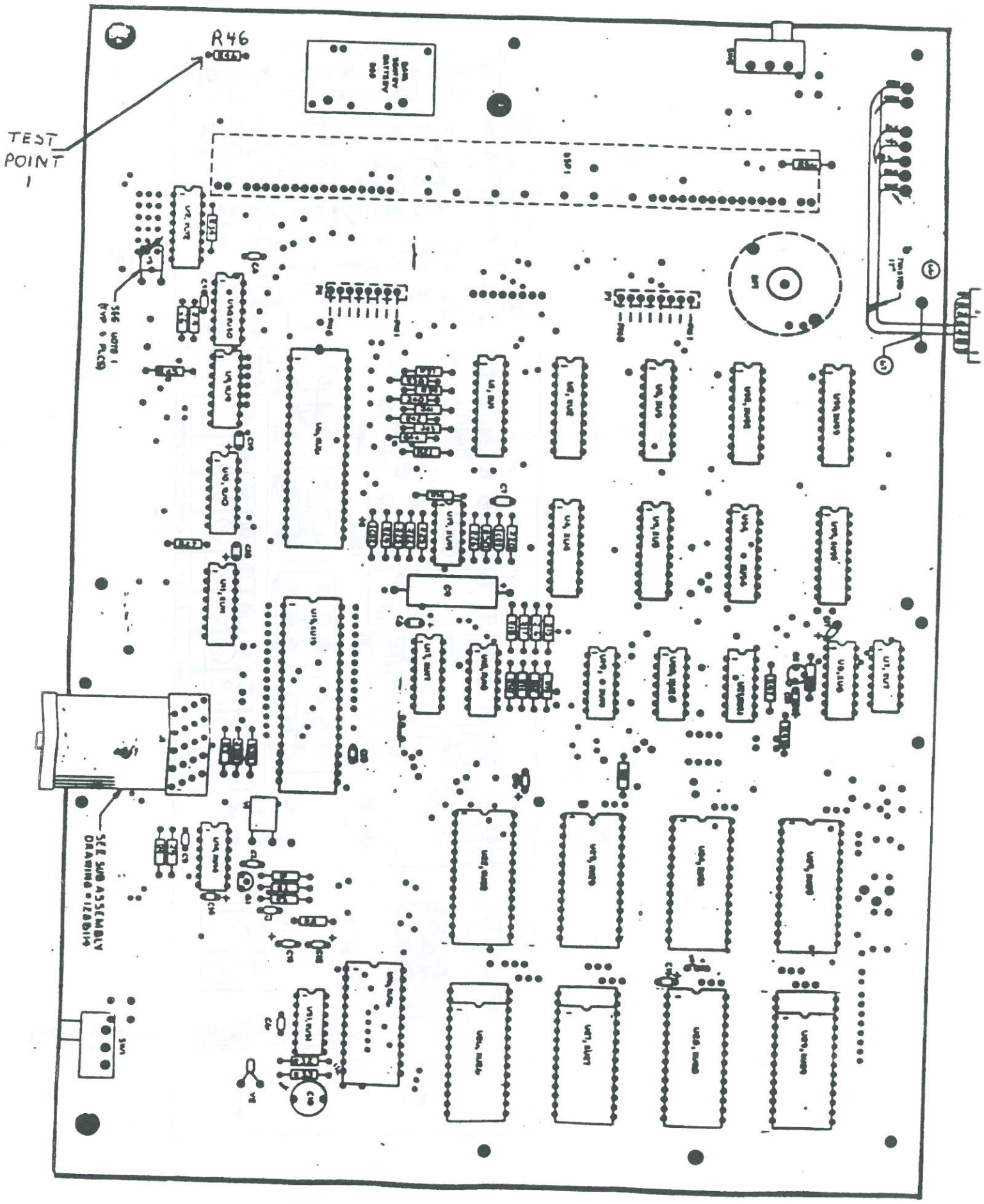


FIGURE C (RT-5D BOARD)