SOLID STATE PRESSURE CONTROLS SSPC-2,3,4

CONTROLS ENERGY COST AND
CONQUERS "PROFIT COMPRESSION"

INSTALLATION AND SERVICE MANUAL

FOR THE

SSPC-2,3,4

MULTI-COMPRESSOR

SOLID STATE PRESSURE CONTROLLER

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THIS PRODUCT IS COVERED BY ONE OR MORE OF THE FOLLOWING PATENTS:
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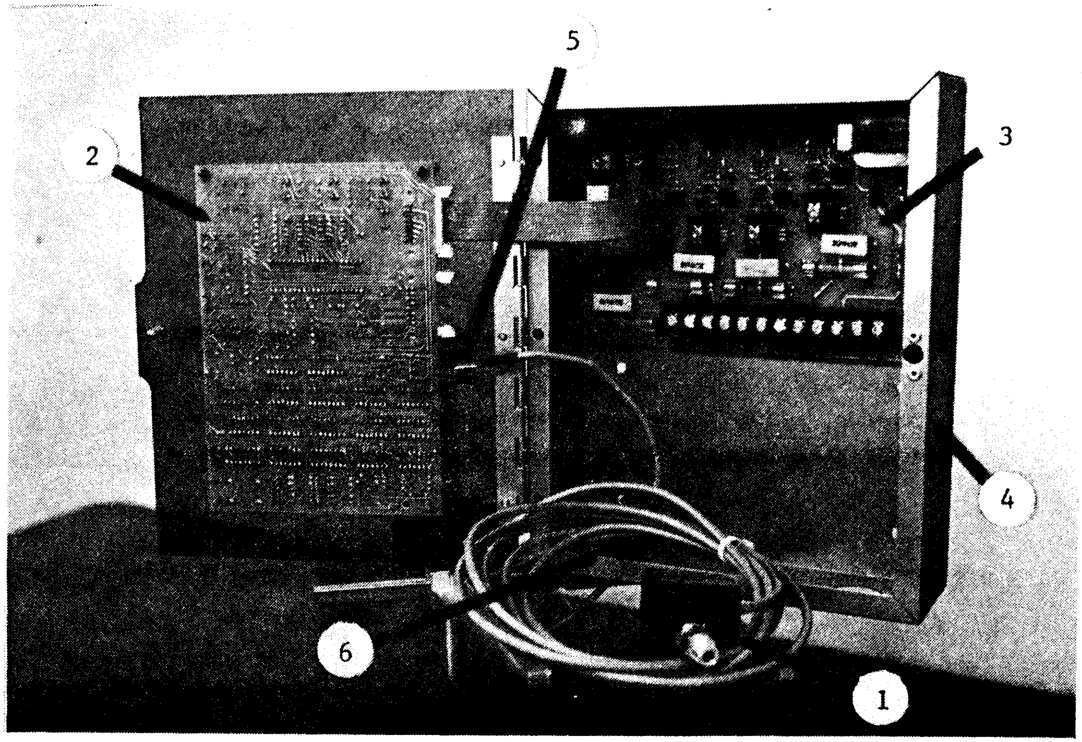
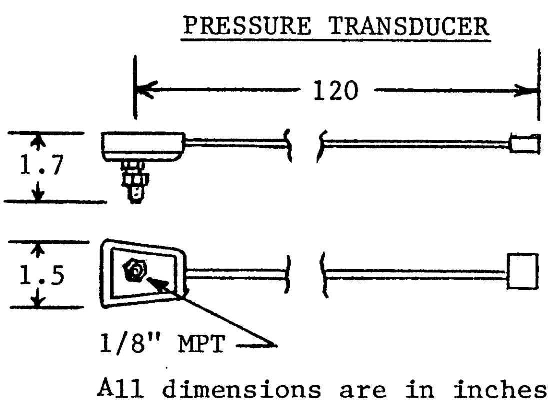


FIGURE 1

The SSPC controls up to four (4) parallel piped refrigeration compressors with one set of cut-in and cut-out suction pressure settings and time delays.

A typical SSPC is shown in Figure 1. It consists of: 1 - Remote Pressure Transducer, 2 - CPU Board, 3 - I/O Board, and 4 - Enclosure with a pop-open hinged door.



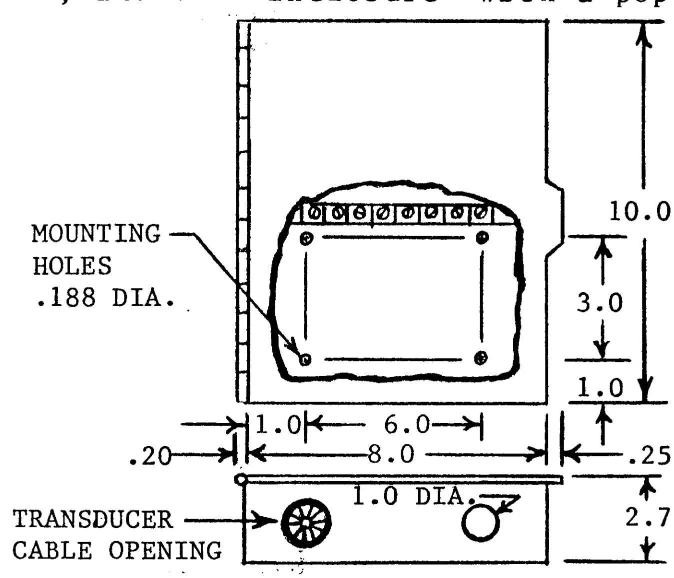


FIGURE 2

The SSPC for multiple compressor units comes in three basic units:
- SSPC-2...For controlling 2 compresser parallel units
- SSPC-3...For controlling 3 compressor parallel units
- SSPC-4...For controlling 4 compressor parallel units

Each basic unit has the option of 24,115 or 208/240 VAC as a supply voltage In addition, the SSPC's can be ordered with the standard compressor rotation logic or with the a "Shift Logic" which selects compressor capacities from combinations of unequal compressors. Each SSPC can also have some option boards added to it to give the SSPC some new functions. The standard option boards are:

Optimizer: Automatically adjusts the Cut In setting for optimum efficiency
Phase Protect: Will shut down all compressors in event of a loss of a phase
Computer Interface: Allows a Computer to monitor a SSPC control
AMPS Interface: Allows a means of connecting a SSPC to a Demand Controller

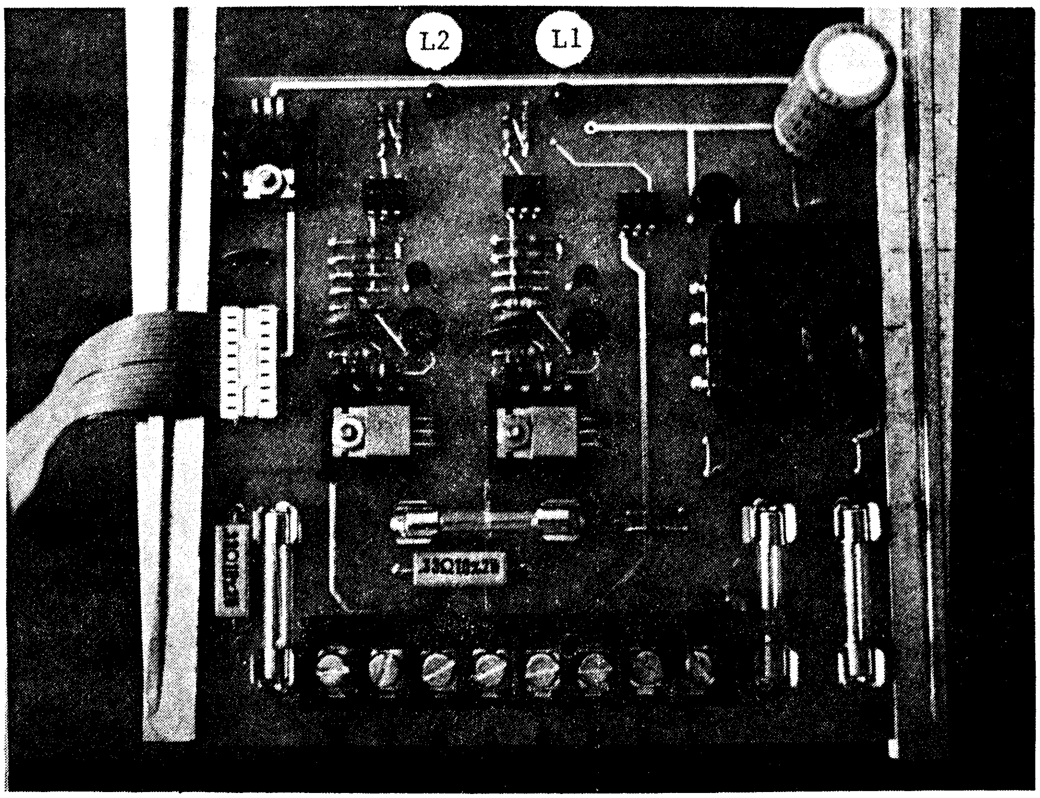


Figure 3

SSPC 2
Consists of the same components shown in Figure 1 except the I/O board (Item 3) is not as large. The I/O 2 board is shown in Figure 5. The face side of the CPU board (Figure 4) will have a plug in location DP3 with "2 comp" printed right side up. Note that the same CPU board is used for all three basic units, consequently, the light emitting diodes L1,L2,L3 and L4 representing compressors 1,2,3 and 4 respectivly will be physically in place on a SSPC-2 even though L3 and L4 should never light. The legend on the cover of an SSPC 2 may even have L3 and L4 identified as compressors 3 and 4. Again check the plug in location DP-3 to determine which type of program is in the control board.

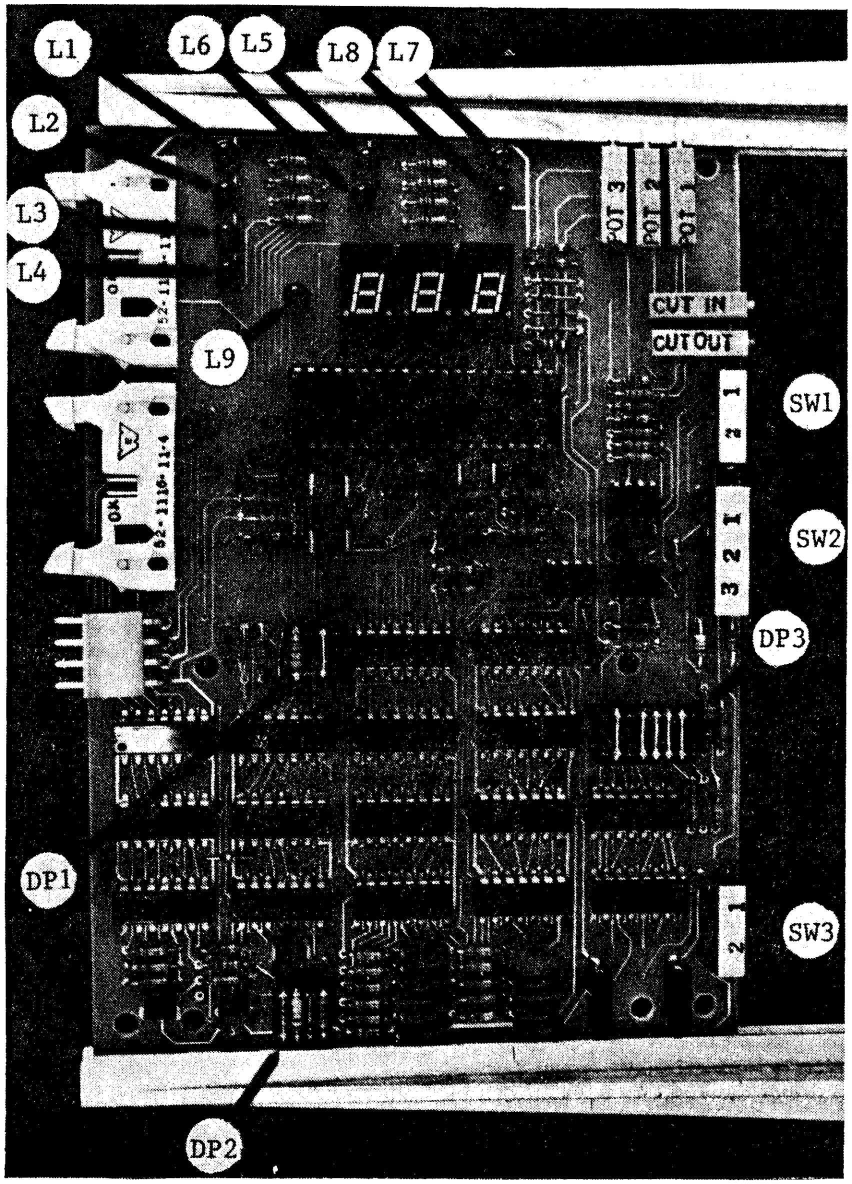


FIGURE 4

SSPC 3

Consists of basically the same components as shown in Figure 1 except the I/O 4 Board shown (also see Figure 5) may be an I/O 3 Board. The I/O 3 Board will be physically the same size as the I/O 4 Board but will have fewer components and will not have terminals 11 and 12. The component side of the CPU Board (see Figure 4) will have a plug in location DP-3 with "3 Comp" printed right side up. The same conditions apply to L4 on the CPU Board (Figure 4) on a SSPC-3 as applied to LED 3 and 4 on a SSPC-2.

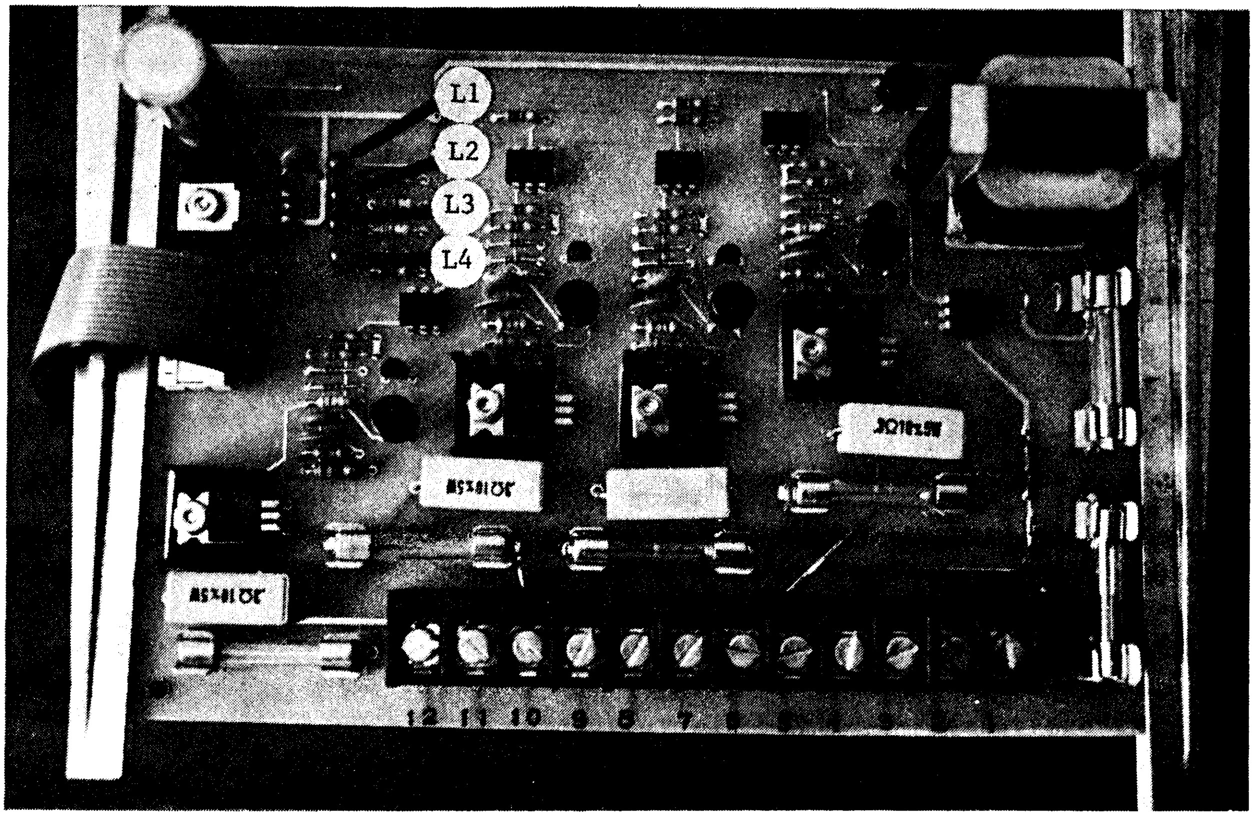


FIGURE 5

SSPC 4

Consists of the components shown in Figure 1. The component side of the CPU Board (See Figure 4 will have a plug in location DP-3 with "4 Comp" printed right side up.

SPECIFICATIONS

POWER CONSUMPTION:

6 VA Maximum
115 VAC 50/60 HZ
208/240 VAC 50/60 HZ

SWITCH RATINGS (EACH COMPRESSOR SWITCH):

1 Amp @ 24 VAC
1 Amp @ 115/208/230 VAC

AMBIENT:

45° F. to 105° F.
o% to 90% RH

WEIGHT:

2.5 pounds

DIMENSIONS:

See Figure 2

PRESSURE TRANSDUCER

Maximum Pressure Reading: 65 PSI
Maximum Pressure Rating: 150 PSI
Refrigerants: R12, 22, 502
Fitting: Brass 1/8" MPT
Cable Length: 10 Feet

Note: Continual engineering research results in steady improvements; therefore, design and specifications are subject to change without notice.

GENERAL OPERATION

ROTATION LOGIC

° **One Cut In Setting/One Cut Out Setting With Time Delays**

In general the SSPC will stage compressors on when the actual pressure exceeds an adjustable cut in setting. It will also stage compressors off when the pressure falls below an adjustable cut out setting. When the pressure falls between the two settings no compressors will be added or deleted.

To prevent excessive compressor cycling, the SSPC has two programmed time delays; one prevents the adding of compressors and the other prevents compressors from being deleted. The standard turn "on" time delay is 3 minutes and the standard turn "off" time delay is 1 minute and both start when either a compressor is added or deleted. Other time delay configurations are available.

° **Wear Is Distributed Among All Compressors**

The unit rotates the compressor usage so that the compressors will receive equal wear. The compressor that has run the longest will be the first shut down and conversely the compressor that has been off the longest will be the first one turned on.

° **Special Speed Up Logic**

The programmed time delays are reduced to 1/8 normal whenever the following conditions occur:

(1.) The suction pressure exceeds the cut in setting by 10 PSI. This helps speed up initial pull down
(2.) The suction pressure goes into a vacuum.
(3.) Whenever the fast timing switch SW3 on the CPU board (See Figure 4) is in position "2".

° **Power Up and Power Interruption Logic**

Under a power up condition or after a power interruption of one second or more the SSPC will shut off all compressors and sequence them on per the standard SSPC logic.

The previous feature allows the high head pressure control to be wired as to remove power to not only the compressors but the SSPC control as well. Consequently when the head pressure control resets, the SSPC will initially have all the compressors off and then will stage them on per the SSPC logic.

DISPLAY AND VISUAL STATUS INDICATORS

The standard SSPC has a 3 digit LED display which can display the following with the different positions of SW2 on the CPU board (Figure 4).

Position 1 Suction Pressure
Position 2 Cut In Pressure Setting
Position 3 Cut Out Pressure Setting

CPU board is also equipped with 9 LED status lights (see Figure 4). As described previously, Lights L1-L4 indicate which compressors the SSPC has turned on. The other indicator lights indicate the following:

L5 Suction pressure above the Cut In setting.
L6 Suction pressure below the Cut Out setting.
L7 SSPC control overridden
L8 Defrost in process.
L9 Displayed pressure is a vacuum.

DEFROST INHIBIT

This logic maintains one compressor running during hot gas defrost even when the pressure falls below the cut out setting. The last compressor is allowed to go off only when the suction pressure falls into a vacuum. Such a condition indicates that the parallel unit is short of gas and may have a severe leak.

The SSPC is put into this mode of operation by sensing the presence of voltage (same as the supply voltage) between terminals 3 and 4 of I/O boards. When Defrost Inhibit is not required, do not hook any wires to terminals 3 and 4, the SSPC will operate as though no defrost inhibit was provided.

OVERRIDE SWITCH (SW1)

SW1 on the CPU board (see Figure 4) allows a serviceman to override the SSPC's control of the compressors and turn all compressors on. Position "1" is for normal operation. Position 2 is for SSPC override.

The SSPC logic is not altered by this switch. Consequently the indicator lights on both the CPU board and the I/O boards will reflect what the SSPC thinks should be done under existing suction pressure.

SELECTABLE TIME DELAYS

The standard SSPC comes with the time delays set as follows:

DP2-1	Turn On Time Delay: 3 Minutes Turn Off Time Delay: 1 Minute	Orange Background

Alternate time modules (DP2) for the CPU board can be ordered to meet a particular need. They can either be shipped with the SSPC from the factory or added in the field to an existing unit. If added in the field, be sure to position the notched corner to the lower left hand corner.

DP2-2	Turn On Time Delay: 3 Minutes Turn Off Time Delay: 5 Seconds	Yellow Background
DP2-3	Turn On Time Delay: 6 Minutes Turn Off Time Delay: 5 Seconds	White Background

SSPC LOGIC CHART

ROTATION LOGIC

Maximum Pressure 65 psi

WHEN THE PRESSURE IS IN THIS REGION:

- The cut in light will be on.
- The unit which has been off the longest will turn on (provided it has been longer than 1/8 of the programmed time delay since the last compresser was turned on or off).

10 psi

WHEN PRESSURE IS IN THIS REGION:

- The cut in light will be on.
- The unit which has been off the longest will turn on (provided it has been longer than the programmed time delay since the last compressor was turned on or off). Note: The standard time delay is 3 minutes.

Cut In Setting
(Minimum Setting O PSI)

Differential
Maximum 10 PSI
Minimum 0 PSI

WHEN THE PRESSURE IS IN THIS REGION:

- No decisions are made by the SSPC.
- Cut out and cut in lights are off.

Cut Out Setting

WHEN THE PRESSURE IS IN THIS REGION:

- The cut out light will be on.
- The compressor which has run the longest will turn off (provided it has been longer than the programmed time delay since the last compressor was turned off or on). Note: The standard time delay is 1 minute.
- The last compressor will not turn off if the defrost in progress light is on.

O psi

WHEN THE PRESSURE IS IN THIS REGION:

- The programmed cut out time delay will run 8 times faster than normal.
- The defrost inhibit signal holding the last compressor on will be overridden although the defrost light will stay on.

SSPC SHIFT LOGIC FOR CONTROL OF UNEQUAL PARALLEL COMPRESSOR UNITS

SHIFT LOGIC GENERAL INFO:

SSPC controls equipped with the optional CPU-SL board in place of the standard CPU board, will control 2, 3, or 4 compressors in a different manner than the rotation method described in the SSPC Installation and Service Manual. The CPU-SL board is designed to maintain a more uniform suction pressure by selecting unequal compressor combinations in increasing or decreasing capacity increments depending on whether the suction pressure is above the Cut In setting or below the Cut-Out setting. The capacity combinations are selected to prevent excessive compressor cycling.

In order for the Shift Logic to work properly, the compressor sizes must increase from Compressor #1 to Compressor #2 to Compressor #3 to Compressor #4. An example using typical compressors would be:

Compressor #1	Compressor #2	Compressor #3	Compressor #4
10 Hp.	15 Hp.	20 Hp.	25 Hp.

The exact compressor combinations selected at a particular capacity step are shown on the second page of this literature. If some of the compressors are of equal size, then the CPU-SL board can be supplied with a special set of programming plugs in order to eliminate any duplications of compressor capacity.

SEQUENCE LOGIC:

The CPU-SL board can also be programmed to sequence the compressors in a first on last off logic for situations such as compressors with several stages of unloaders where an unloaded compressor should be the first stage turned on and the last stage to be turned off. The details of this logic are listed on the second page of this literature.

INTERCHANGEABILITY:

The CPU-SL is designed to be completely interchangable with the standard CPU board. All option boards designed to work with the standard CPU board will also work with the CPU-SL board. The only differences between the two boards is the the compressor selection logic and the programming Dip Plugs (DP3, DP4, and DP5)

APPLICATION:

The standard timing module (DP2-1) provided with the CPU-SL board is the same as the standard timing module supplied with the standard CPU board (3 min. ON/ 1 min. OFF). If the refrigeration load has a tendency to change rapidly, it may be necessary to operate the SSPC in the "Fast Timing" mode. This would reduce the the time delays to 1/8 of the regular times (22 sec. On/8 sec. Off). Alternate standard timing modules are listed in the SSPC Manual.

The CPU-SL board also has the option of reducing the high pressure speed up logic switchpoint from 10 psi to 5 psi above the Cut-In setting by replacing a diode located at D1 (mounted in lead sockets) with a zero ohm resistor or a 22ga wire. Be sure to use a needle-nose pliers to insert or remove the components. The high pressure speed up logic can be deleted by clipping D26 located by U8.

ORDERING:

(1) Indicate the total number of compressors to be controlled.

(2) Indicate which type of logic desired. Note: If a logic is not specified it will be assumed that the standard rotation logic was desired.

(3) If Shift Logic is specified, be sure to note with the order if any of the compressors are of equal size. In that case be sure to either indicate all the compressor sizes so that the proper selection of programing plugs can be determined or if you determined the proper plugs from the second page of this literature then specify them (DP3, DP4, and DP5) by number. Unless specified otherwise, shift logic boards will assume that all the compressors are different sizes.

2 COMPRESSOR SHIFT LOGIC:

CAPACITY STEPS

	0	1	2	3
COMPRESSOR #1	OFF	(RUN)	OFF	(RUN)
COMPRESSOR #2	OFF	OFF	(RUN)	(RUN)

Programming Plugs:
DP3 Location: DP3-20
DP4 Location: DP4-5
DP5 Location: NO DP5 REQ'D

---

2 COMPRESSOR SEQUENCE LOGIC:

STEPS

	0	1	2
COMPRESSOR #1	OFF	(RUN)	(RUN)
COMPRESSOR #2	OFF	OFF	(RUN)

Programming Plugs:
DP3 Location: DP3-20
DP4 Location: DP4-0
DP5 Location: DP5-1

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3 COMPRESSOR SHIFT LOGIC:

CAPACITY STEPS

	0	1	2	3	4	5	6
COMPRESSOR #1	OFF	(RUN)	OFF	OFF	(RUN)	OFF	(RUN)
COMPRESSOR #2	OFF	OFF	(RUN)	OFF	OFF	(RUN)	(RUN)
COMPRESSOR #3	OFF	OFF	OFF	(RUN)	(RUN)	(RUN)	(RUN)

Programming Plugs:
DP3 Location: DP3-30
DP4 Location: DP4-6
DP5 Location: If all the compressors are different sizes..........: NO DP5 REQ'D
If Compressor #1 and Compressor #2 are the same size: DP5-1
If Compressor #2 and Compressor #3 are the same size: DP5-2

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3 COMPRESSOR SEQUENCE LOGIC:

STEPS

	0	1	2	3
COMPRESSOR #1	OFF	(RUN)	(RUN)	(RUN)
COMPRESSOR #2	OFF	OFF	(RUN)	(RUN)
COMPRESSOR #3	OFF	OFF	OFF	(RUN)

Programming Plugs:
DP3 Location: DP3-31
DP4 Location: DP4-0
DP5 Location: DP5-0

****

4 COMPRESSOR SHIFT LOGIC:

CAPACITY STEPS

	0	1	2	3	4	5	6	7	8	9	10
COMPRESSOR #1	OFF	(RUN)	OFF	OFF	OFF	(RUN)	OFF	OFF	(RUN)	OFF	(RUN)
COMPRESSOR #2	OFF	OFF	(RUN)	OFF	OFF	OFF	(RUN)	OFF	OFF	(RUN)	(RUN)
COMPRESSOR #3	OFF	OFF	OFF	(RUN)	OFF	OFF	OFF	(RUN)	(RUN)	(RUN)	(RUN)
COMPRESSOR #4	OFF	OFF	OFF	OFF	(RUN)	(RUN)	(RUN)	(RUN)	(RUN)	(RUN)	(RUN)

Programming Plugs:
DP3 Location: DP3-40
DP4 Location: If all the compressors are different sizes..........: NO DP4 REQ'D
If Compressor #1 and Compressor #2 are the same size: DP4-1
If Compressor #2 and Compressor #3 are the same size: DP4-2
If Compressor #3 and Compressor #4 are the same size: DP4-3
If Compressors #1 = #2 and #3 = #4 : DP4-4
DP5 Location: NO DP5 REQ'D

---

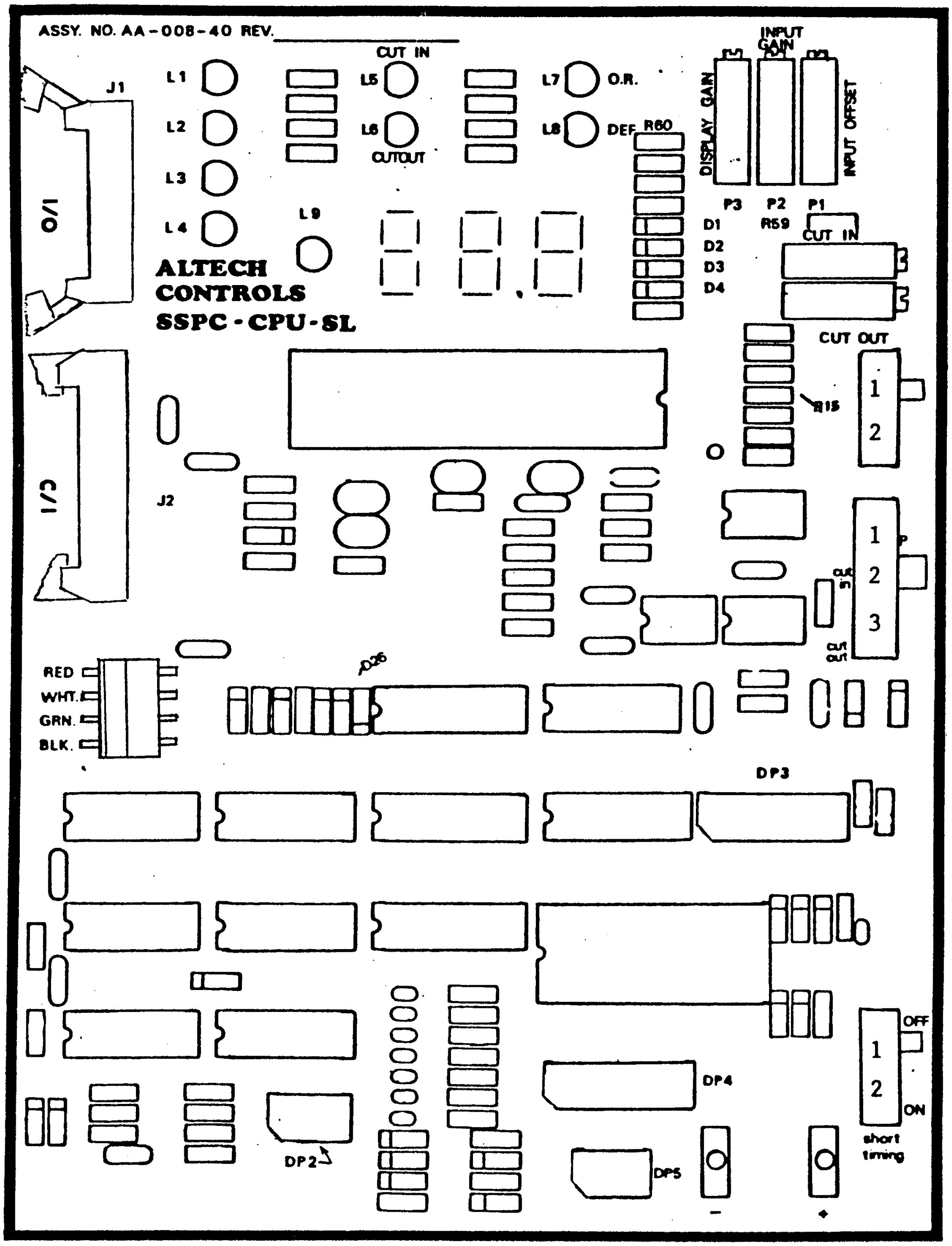
4 COMPRESSOR SEQUENCE LOGIC:

STEPS

	0	1	2	3	4
COMPRESSOR #1	OFF	(RUN)	(RUN)	(RUN)	(RUN)
COMPRESSOR #2	OFF	OFF	(RUN)	(RUN)	(RUN)
COMPRESSOR #3	OFF	OFF	OFF	(RUN)	(RUN)
COMPRESSOR #4	OFF	OFF	OFF	OFF	(RUN)

Programming Plugs:
DP3 Location: DP3-41
DP4 Location: DP4-0
DP5 Location: DP5-0

FIGURE SL-1



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APPLICATION NOTE: Controlling Parallel Compressors Equipped With Unloaders

The following description shows how a two compressor parallel compressor unit equipped with two stages of unloading on each compressor can be controlled with a Shift Logic SSPC4 control to supply 6 different capacity steps.

Compressor Capacity Sequence

Capacity Steps	Compressor #1	Compressor #2
0	OFF	OFF
1	33% LOADED	OFF
2	67% LOADED	OFF
3	100% LOADED	OFF
4	100% LOADED	33% LOADED
5	100% LOADED	67% LOADED
6	100% LOADED	100% LOADED

SSPC Switch Positions At Each Capacity Step

SSPC Switch	Controls	0	1	2	3	4	5	6
Switch #1	Compressor #1	OFF	ON	ON	ON	ON	ON	ON
Switch #2	Unldrs C1A & C2A	OFF	OFF	ON	ON	OFF	ON	ON
Switch #3	Unldrs C1B & C2B	OFF	OFF	OFF	ON	OFF	OFF	ON
Switch #4	Compressor #2	OFF	OFF	OFF	OFF	ON	ON	ON

Shift Logic Programming

DP3 Location : DP3-42
DP4 Location : DP4-8
DP5 Location : DP5-0

Proposed Wiring Diagram

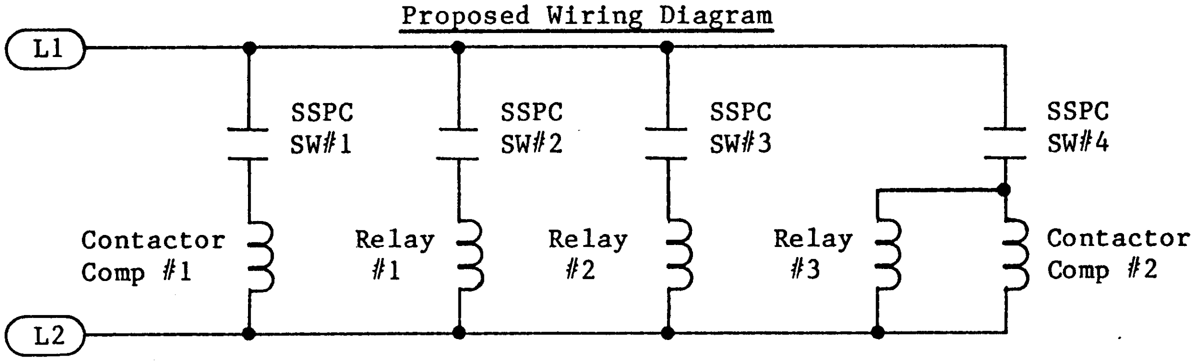
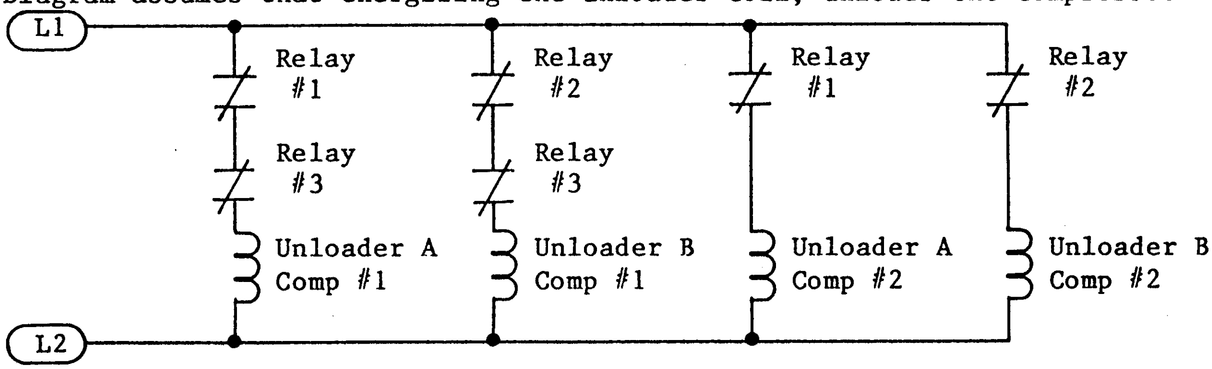


Diagram assumes that energizing the unloader coil, unloads the compressor



INSTALLATION

CAUTION

1. Installer must be a trained and experienced serviceman.
2. Disconnect power supply before beginning installation.
3. Always conduct a complete check-out when installation is completed.

MOUNTING

The SSPC is designed to be mounted directly to the outside of the refrigeration control panel using the 4 provided mounting holes. Any other mounting method must provide adequate support for the SSPC enclosure against vibration. Also the mounting location must not be in an area where water could get on the SSPC.

The high voltage field installed connections shall be made to terminal labeled 1 thru 12 on the I/O boards shown in Figures 3 and 5. Note that the terminals are labeled right to left. It is recommended that only stranded wire be connected to the SSPC due to the vibration associated with the application. The terminal identifications for both the I/O 2 board (Figure 3) and the I/O 4 board (Figure 5) are the same.

They are:

Terminals 1 and 2:	Power Supply either 115V, 208/240 V
Terminals 3 and 4:	Defrost Inhibit
Terminals 5 and 6:	Compressor #1 Switch (NC)
Terminals 7 and 8:	Compressor #2 Switch (NC)
Terminals 9 and 10:	Compressor #3 Switch (NC) I/0 3 and I/0 4 only
Terminals 11 and 12:	Compressor #4 Switch (NC) I/0 4 only

The high voltage field installed wires should be directed through the 3/4 conduit hole provided in the bottom right hand side of the SSPC enclosure. After the wires are connected, the wires should be neatly dressed.

The SSPC is supplied with a remote pressure transducer (or sensor) that is to be mounted to the suction manifold. To mount the transducer, first unplug the transducer cable from the CPU board by simply pulling on the plug, shown as Item 5 in Figure 1. Second push the plug thru the plastic bushing (Item 6 in Figure 1) located in the bottom left hand side of the enclosure.

The transducer is now separate from the enclosure and can be threaded into any 1/8" female pipe thread fitting along with adequate pipe thread compound. Use only the lower half of the transducer fittings (see Figure 6) to tighten the transducer. Tightening on the top half of the transducer fitting can cause permanent damage to the transducer.

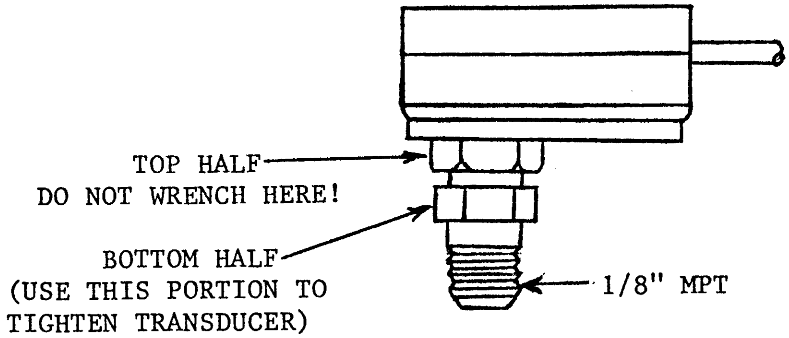
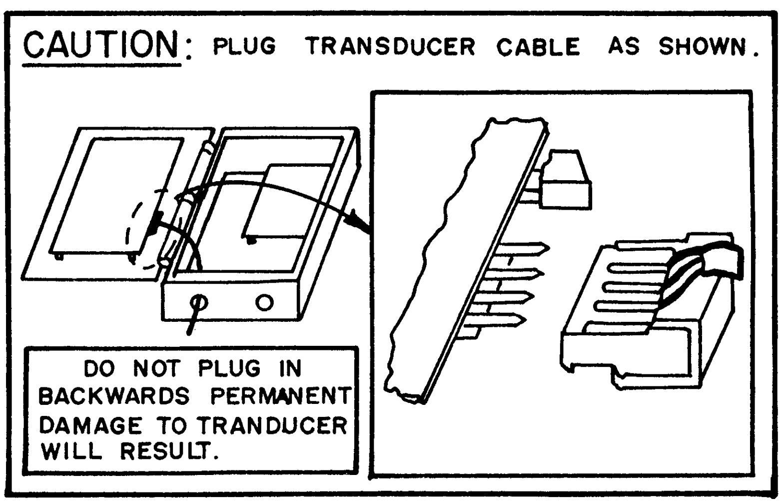


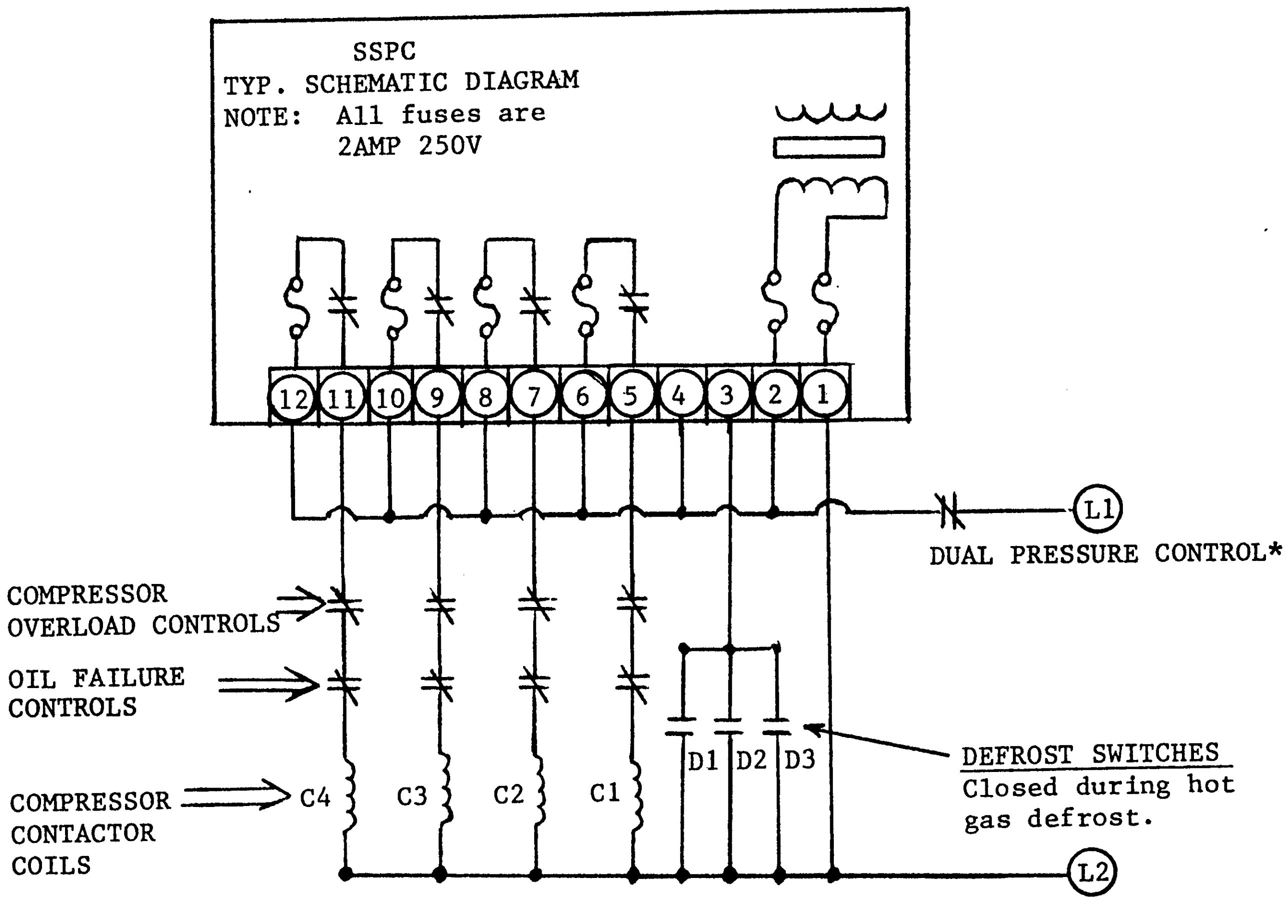
FIGURE 6

The transducer cable can now be reconnected to the SSPC's control board. Be sure not to interchange transducers between SSPC control boards. Each transducer is calibrated to a particular control board before it leaves the factory. If transducers are interchanged then the transducer will have to be recalibrated to the control board using the "Pressure Transducer Checkout and Calibration Procedure" described in a later section.

Re-route the transducer cable thru the plastic bushing (Item 6 of Figure 1) and plug into the CPU board as shown in Figure 1. Note that the transducer wire will come out away from the front cover when installed correctly. The plug's receptacle has a catch to hold the plug from vibrating loose once plugged in. Do not plug the transducer cable in backwards, it can cause permanent damage to the transducer. It should also be noted that the CPU board's wiring is entirely current limited low voltage and does not pose an electrical shock hazard.



TYPICAL WIRING DIAGRAM



* Individual pressure controls can be left in the system if set sufficiently below the SSPC's operating pressures.

FIGURE 7

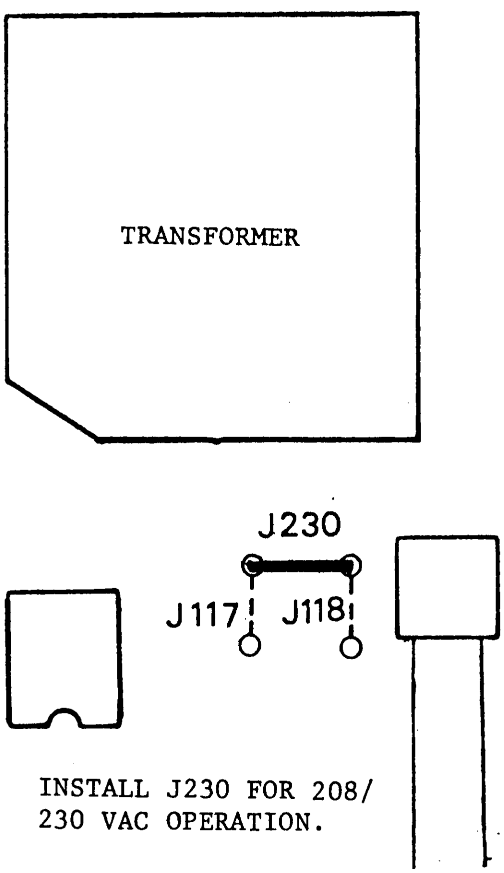
VOLTAGE SELECTION FOR I/O-3 AND I/O-4

The I/O-3 and I/O-4 circuit boards can be set up to operate on either 115 VAC or 208/230 VAC by inserting wire jumpers into plug in sockets on the circuit boards as shown in Figures VS-1 and VS-2. Use 22 AWG solid wire, (same wire used as leads on 1/4 watt resistors available at Radio Shack) to form the jumpers. Use a needle nose pliers to insert or remove the jumper.

CAUTION 1: BE SURE ALL POWER IS REMOVED FROM THE CIRCUIT BOARD BEFORE INSERTING OR REMOVING JUMPER WIRES!

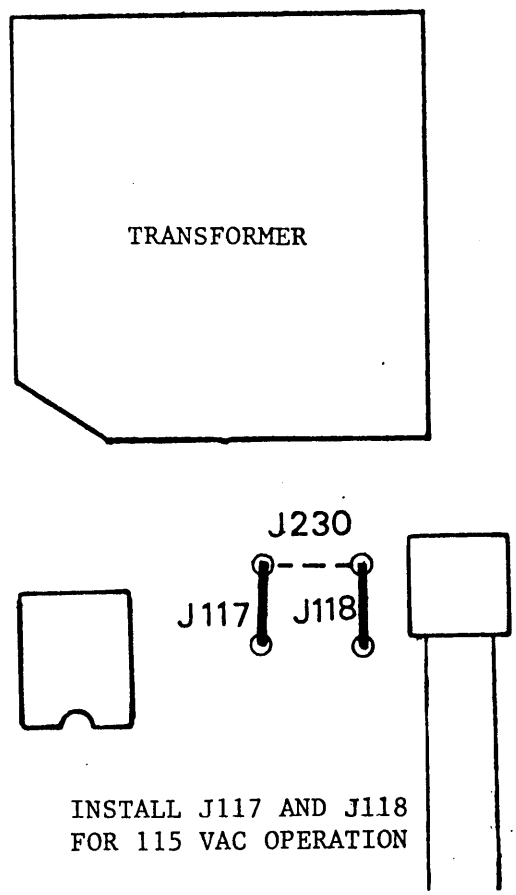
CAUTION 2: BE SURE TO CHANGE THE VOLTAGE MARKINGS PROVIDED AT TERMIANAL 1 AND 2 TO CORRESPOND WITH VOLTAGE SELECTED BY THE JUMPER WIRES.

FIGURES VS-1



INSTALL J230 FOR 208/
230 VAC OPERATION.

FIGURES VS-2



INSTALL J117 AND J118
FOR 115 VAC OPERATION

SETTINGS AND ADJUSTMENTS

START UP

Before applying power to the SSPC check the following:

(1) Is the pressure transducer plugged in properly (wire directed away from the front cover)?

(2) The override switch on the CPU Board (labeled SW1 on Figure 4) should be in the "1" position (up) for normal operation.

(3) The display select switch on the CPU Board (labeled SW2 on Figure 4) should be in the "2" position (middle).

(4) The fast timing switch on the CPU Board (labeled SW3 on Figure 4) should be in the "1" position. The "1" position is the standard timing mode.

CAUTION

Be sure to double check wiring before applying power

(5) Now apply power only to the circuit. The cut in pressure should be displayed.

(6) To set the SSPC's cut-in pressure, determine the necessary coil temperatures on the unit by consulting the manufacturer's specifications.

Then select the lowest coil temperature and find the corresponding pressure (by consulting a vapor pressure chart) needed to provide this temperature.

If the fixture with the coldest coil temperature is equipped with an evaporator pressure regulator (EPR), set the cut-in pressure 2 psi lower than the coil pressure required by the manufacturer.

Now locate the cut-in pressure potentiometer (it is an 18-turn device labeled cut-in on Figure 4). Using a small flat screw driver adjust the potentiometer until the display pressure corresponds to the desired cut-in pressure settings.

Note 1: The cut-in pressure cannot be set below 0 PSIG
Note 2: Be sure to not try adjusting the potentiometers labeled Pot 1, Pot 2, Pot 3. Theses are factory calibrated and should not be moved.

(7) The cut-out pressure setting is selected via a 0 to 10 PSI differential lower than the cut-in pressure setting. As a general rule, the more compressors on the system, the closer the differential may be operated. It is our recommendation that a 2 PSI be tried initially.

The cut-out point can be set by first observing the displayed cut-in pressure setting (SW2 in "2" position) then switching SW2 to "3" position. The cut-out setting is now displayed. Subtract the cut-out from the cut-in to determine the differential. The differential can be changed by adjusting the 18-turn potentiometer on the CPU board labeled Cut-Out (See Figure 4) until properly set.

(8.) Now switch SW2 to the "1" position to display the suction pressure once the pressure drops below 65 PSI.

(9.) Now energize the compressor circuit breakers and let the unit pull down to the operating pressure and then check the settings of any mechanical low pressure control in the system. The override switch may be useful in this step. The mechanical pressure control's cut-in should be set at least 2 PSI lower than the cut-out of the SSPC.

(10.) After 1 to 2 hours operation without a defrost, the temperature of the fixture with the coldest coil temperature should be monitored. Should the temperature of the fixture be too high, lowering of the cut-in by 1 PSI for each 1°F should be tried.

Note: It should not be necessary to operate a system at more than 5 PSI lower than the manufacturers recommended coil pressure.

Note: EPR valves (whether electronic or mechanical) function by introducing a pressure drop in the suction line which is an inefficiency in the thermocynamic cycle - which in turn raises the average coil temperature. By eliminating the EPR valve on the lowest temperature coil and controlling this temperature with the SSPC at least a portion of this inefficiency will be eliminated.

TROUBLE SHOOTING A REFRIGERATION SYSTEM UNDER SSPC CONTROL

A. Before working on a SSPC control, familiarize yourself with the "GENERAL OPERATION" section of this manual. Also be sure the model you are working on is the same one shown in Figure 1.

B. Check that the digital display will light up in both Positions 2 and 3 of the display select switch SW2.
   1. If so, go on to next step.
   2. If not, go to "Display Checkout and Calibration Procedure" in this manual.

C. Confirm that the actual suction pressure corresponds to the SSPC's indicated pressure by comparing it to the re^ding of a calibrated set of gauges.
   1. If they agree, go on to the next step.
   2. If not, recalibrate the transducer per the "Pressure Transducer Checkout and Calibration Procedure".

D. Locate the Override Switch SW1 on the CPU board (See Fi ure 4). Place in the overriden position (Position 2).
   1. If all compressors operate regardless of status lights, return override to position 1 and go on to the next step.
   2. If not, check for blown fuses on the I/O board. (Note: NEMA contacts can blow a 1 amp fuse if they hang up.) Also confirm that other pressure controls, relays, or other safety controls are not holding the compressors off.
   3. If not, proceed to Step "F".

E. Confirm that the actual compressor operation corresponds to the logic detailed in "General Operation" of this manual. Use the fast timing switch SW3 to speed up the test. The time delays will run 8 times faster when in Position 2. Also the override switch SW1 can be used in this checkout; it does not alter the logic of the CPU board.
   1. If the operation of the SSPC is as described in the manual, go on to Step "G".
   2. If not, proceed to Step "F".

F. The problem cannot be repaired in the field. Contact your Altech Distributor or Altech for Warranty Repair information.

G. SSPC is operating correctly. Verify that all switches on the SSPC are in the normal position. Verify that all circuit breakers are made and that all safety and limit controls are made.

BOARD LEVEL SERVICING OF SSPC CONTROLS

The best means of diagnosing problems to the board level is to use "Board Swapping" techniques similar to the tube swapping technique often used to locate defective tubes in television sets. This technique is especially applicable to the SSPC since most installations have more than one control. The board or transducer for a SSPC that appears to be defective can be temporarily replaced with a board from a control that is operating correctly to determine if that does solve the problem.

NOTE: It is not recommended that any calibration pots be changed on the CPU boards during any temporary exchanges.

Once a defective board has been isolated, please take a moment to briefly describe the nature of the problem on a piece of paper and attach it to the board. Please be more specific than "defective" or "bad"!

RETURN MATERIAL PROCEDURE

In order to serve you in an expeditious manner, we must ask you to follow the following procedure when returning material(s) to Altech for any reason:

> Prior to shipping, call Altech and have the Field Service Coordinator give you an Returned Materials Order (RMO) number which must be included with the returned material. We must also request that you include the name and phone number of the individual within your organization to whom we should interface in regards to the returned material.

If the above is not adhered to, Altech cannot accept responsibility for material disposition!

Altech has set up a fixed price repair policy for non-warranty repairs. The cost to repair (replace) a circuit board is the same regardless of the problem. This perits us to quote repair costs prior to receiving the defective board. The price schedule offers significant cost incentives for servicemen to diagnose the problem to a particular board rather than sending the entire control back for repair. Details can be obtained from the Field Service Coordinator or an Altech Representative.

DISPLAY CHECKOUT AND CALIBRATION PROCEDURE

1. If there is no display, check if any other indicator LEDs are properly lighted (See L1 - L7 in Figure 4).
   a. If so, go on to Step 2.

   b. If not: *Check to see if you have the correct voltage between Terminals 1 and 2 on the I/O terminal strip.
      *Check power supply fuses F1 and F2 for discontinuity. Replace only once before contacting your Altech Distributor or Altech.
      *Unplug the pressure transducer cable and measure the voltage between the two outside terminals. It should be between 10 - 13 VDC. If it is, go on to Step 2. If it is not, then the I/O Board is suspect. Contact Your Altech Distributor.

2. Display Calibration
   a. Locate a digital voltmeter with an input impedence of at least 10 meg. ohms.

   b. Set scale on 10 VDC.

   c. Insert probe into test points TP1 (+) and TP2 (-) located on the lower righthand corner of the CPU Board (See Figure 4). Note: The probes can be plugged in without removing the CPU Board from the door. Simply open the door and insert the probes from the bottom.

   d. The volt meter is now seeing the same signal as the display 1 PSI = .1 VDC or 29.1 PSI = 2.91 VDC. Move the Display Select Switch SW2 to Position 2 to read the Cut In pressure setting. Compare the display reading to the volt meter's reading (using the conversion). If they match, then the display is calibrated. If they do not match or the display is blank then go on to step "e".

   e. Adjust Pot 3 until the display agrees with the volt meter. Pot 3 is an 18 turn potentiometer with internal slip clutches. Consequently, it may be necessary to first turn 18 turns one direction then 18 turns the other direction to get the display in the proper range. Once they do match, the display is calibrated.

PRESSURE TRANSDUCER CHECKOUT AND CALIBRATION PROCEDURE

1. Be sure the display is reading actual pressure -- not Cut In or Cut Out. SW2 should be in Position 1 (See Figure 4).

2. With the pressure transducer not connected to any pressure, adjust Pot #1 (See Figure 4) until the pressure reads "00.0". Note that Pot #1 is an 18 turn potentiometer with a slip clutch arrangement at either end of its travel. Turning Pot 1 (As viewed from the top) clockwise will increase the pressure reading. If the display cannot be zeroed (Be sure to try the full range of Pot 1!) then replace the transducer.

3. Reconnect the transducer to the suction line.

4. By some means, raise the pressure in the suction line to a range of 25 to 40 PSI as indicated by a set of accurate pressure gauges.

5. Adjust Pot #2 until the indicated pressure corresponds to the actual pressure. Be sure no valves are closed preventing pressure from being sensed by the transducer.

6. Allow the pressure to change. Confirm that the indicated pressure changes accordingly.

7. If the indicated pressure goes off calibration shortly after being calibrated, then replace the pressure transducer.

8. Note: Each pressure transducer has its own unique electrical characteristics. Consequently, each transducer must be calibrated to the SSPC control on which it is to be used.

Raising the Operating Pressure Range of the SSPC Controls:

Under some operating conditions it may be necessary for the SSPC to control at pressures above the maximum pressure setting provided with the standard SSPC control. The following procedure details how the SSPC can be recalibrated to provide a maximum Cut In setting of 95psi. This recalibration procedure will will raise the maximum pressure displayed by the SSPC from 80 psi to 99 psi.

* The standard voltage to pressure conversion of 1 Vdc = 10 psi will no longer hold true for display calibration or for the analog pressure output of the Computer Interface. The new voltage to pressure conversion ratio will be 1 Vdc = 20 psi.
* The high pressure speed-up logic on the SSPC 2,3,& 4 will change from 10 psi to 20 psi above the Cut In setting.

Procedure: (Refer to the SSPC Service Manuals):

(1) Position the "Display Select" switch (SW2) into position "1"to read the suction pressure.

(2) Find a stable pressure preferably with the compressors off and note it. Divide that pressure reading by 2 and adjust Pot 2 until the display matches the calculated pressure setting (Original Setting / 2).

(3) Put the "Display Select" switch (SW2) into position "2" to read the cut-in setting.

(4) Adjust the "Cut-In" potentiometer to read "25.0" by adjusting the Cut-In potentiometer.

(5) Slowly adjust "Pot 3" until the display reads "50.0".

(6) The SSPC is now back in calibration. However, as a double check, the display pressure should be compared to the actual pressure as measured by a reliable manifold gauge. If they do not match, refer to the Pressure Transducer Check Out and Calibration Procedure in the Installation and Service Manuals.

Metric Pressure Display on the SSPC Controls:

The SSPC line of pressure controls come standard with a digital display calibrated in "PSI". However, on special order , the controls can be supplied with the display calibrated in "BARS". The controls calibrated this way will be marked with the word "BARS" beside the CPU label on the component side of the CPU or CPU-1 board.

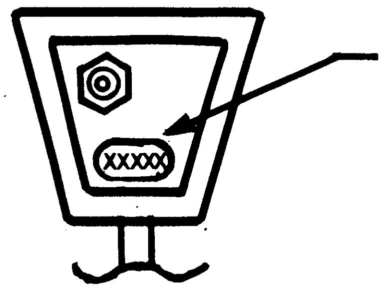
CPU boards set up for a metric display will have the following characteristics:

* The CPU test jacks and Computer Interface analog output will have the following conversion rate: 1 Vdc = 1 Bar
* The high pressure speed-up logic will occur at 1 Bar above the Cut-In Setting
* The Bars CPU boards require a factory modification, consequently standard CPU boards can not be recalibrated in the field to the Bars readout.

Notes: (1) Both the psi and the Bar displays are in terms of gauge pressure.
(2) The convesion ratio between psi and Bars is: 1 psi = .0696 Bars.

April 30, 1981

SERVICE MEMORANDUM: FIELD REPLACEMENT OF PRESSURE TRANSDUCERS



PRESSURE TRANSDUCER
SERIAL NUMBER

EXAMPLE: 4321M

One part of the pressure transducers supplied with the SSPC pressure contollers is manufactured by two different suppliers. These parts are not directly interchangeable. The letter suffix on the end of the pressure transducers serial number provides the key to determining which type you have. It is recommended that pressure transducers be replaced with a pressure transducer made by the same manufacturer. If the two are mixed, the transducer may not zero correctly and could have a tendency to drift.

Manufacturer Codes:

"N" Manufacturer Letter Suffix "None", "L", or "N"
"M" Manufacturer Letter Suffix "M"

For SSPC-2,3 and4:

If a situation occurs where it is not known in advance which brand of transducer will be needed for replacement, it is possible to replace a "M" type transducer with an "N" type as long as a 1/4 watt calibration resistor in location R-15 on the CPU Board (SSPC 2, 3, 4) is changed from 10,000,000 ohms to 1,000,000 ohms. R15 is located to the left of the override switch and whenever "M" transducers were used, the resistor was plugged into lead sockets rather than soldered directly in the board. The best way to make this change-out is to use a needle-nose pliers. A 10,000,000 ohm resistor has the following color code: "brown, black, blue, gold" whereas the 1,000,000 ohm resistor has the following color code: "brown, black, green, gold".

For SSPC-1:

The change-out is slightly different on a SSPC-1. If a "M" type transducer is to be replaced with a "N" type transducer then the timing module DP-1 must also be changed. The timing module contains the calibration resistor in it's leftmost position. The following standard timing plugs can be ordered from Altech:

Transducer	Timing Plug #	Timing (Minutes)
"M"	DP-1-5M (Blue/Yellow)	Turn On Time Delay: 30 Seconds Maximum Cycle Rate: 10 Per Hour
N"	DP-1-5N (Blue/Orange)	Turn On Time Delay: 30 Seconds Maximum Cycle Rate: 10 Per Hour

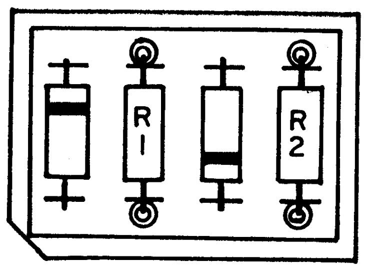
RAn141

Time Delay Selection Plug Kit

For many new applications of the SSPC or CFC controls, the selection of the proper time delays can be made without soldering soldering. This kit contains two special plugs that are inserted into the DP-2 location. Then individual resistors are plugged into the provided lead sockets at locations R1 and R2.

R1 : Time delay to turn off

R2 : Time delay to turn on



Also included with each kit are four resistors of each value listed below. Note which timing value each represents as well as the color code.

Resistance	Timing	Color Code
15K OHMS	5 Seconds	Brown-Green-Orange-Gold
100K OHMS	18 Seconds	Brown-Black-Yellow-Gold
360K OHMS	65 Seconds	Orange-Blue-Yellow-Gold
470K OHMS	1.5 Minutes	Yellow-Violet-Yellow-Gold
680K OHMS	2.0 Minutes	Blue-Gray-Yellow-Gold
1MEG OHMS	3.0 Minutes	Brown-Black-Green-Gold
1.5MEG OHMS	4.5 Minutes	Brown-Green-Green-Gold
20 MEG OHMS	6.0 Minutes	Red-Black-Green-Gold
3.6MEG OHMS	10 Minutes	Orange-Blue-Green-Gold
10 MEG OHMS	30 Minutes	Brown-Black-Blue-Gold

To avoid bending the resistor leads, it is recommended that a needle-nose pliers be used for both insertion and removal of the resistors from the lead sockets.

Once the proper timing values are selected and tested, then a timing plug can be ordered from Altech with the proper resistors soldered in place.

ELIMINATION OF THE HIGH SUCTION PRESSURE FAST TIMING ON SSPC'S

Under some conditions it may be desirable to eliminate the turn on timing that occurs whenever the suction pressure rises 10 PSI above the cut-in setting. This feature can be easily eliminated in the field or ordered that way from the factory. Elimination of this feature does not effect the fast timing switch. Note that the field modification is different between units built before Serial #6250.

The field modification to SSPC's with serial numbers larger than 6250 requires the removal (by clipping the leads) of the diode mounted in the leftmost position of the 8 pin dip plug DP1. DP1 is positioned on the CPU board next to the transducer receptacle. On the SSPC's with the correct serial numbers, the DP1 has a green background behind the diode. On the earlier units DP1 had a black background and a resistor in the far left hand position. Do not remove the resistor, it has nothing to do with the high suction pressure fast timing. A new dip plug can be ordered with this dip plug removed.

The modification for SSPC's with serial numbers 6000 thru 6250, equipped with a DP1 plug with a black background, involves removing the the by clipping its leads) from the CPU board. D7 is labeled clearly on the CPU component silkscreen and is located immediately to the right of the DP1 dip plug. Once D7 is clipped the fast timing feature cannot be returned to the board except by returning the board to Altech for repair.

General Information:

The Optimizer option for the SSPC provides a means for automatically adjusting the SSPC by raising the SSPC's pressure settings whenever the refrigeration is providing lower air temperature than required. Consequently the Optimizer will provide the most energy efficient pressure settings for maintaining proper temperature under all loading conditions.

The Optimizer option consists of a circuit board mounted to the top of the CPU board (see Figure OP-2) and a set of temperature probes sensing the refrigerated air temperature. The Optimizer can be ordered with new SSPC's or can be added to most SSPC's already installed in the field. All other SSPC option boards are compatable with the Optimizer board.

Component Identification

Figure OP-1 shown below is the top view of the Optimizer circuit board.

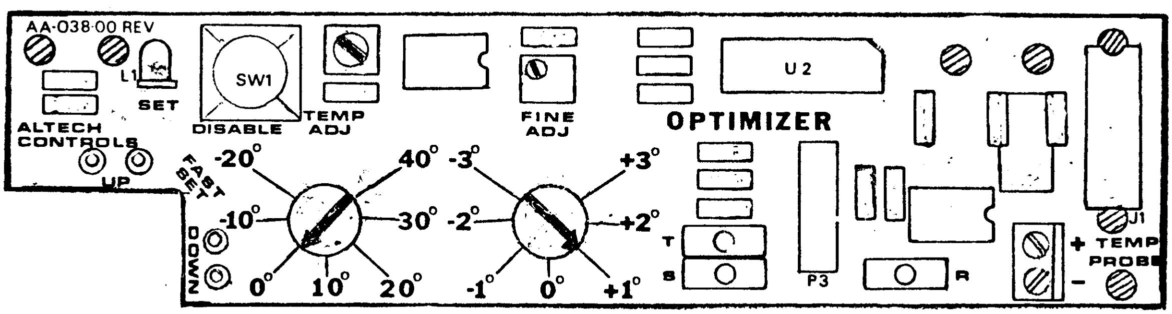


Figure OP-1

Component Identification (Cont.)

"Temp Adj." Potentiometer:	Provides a coarse air temperature setting to be maintained. It is adjustable from -20° to +40°F.
"Fine Adj." Potentiometer:	Provides a fine adjustment for the TEMP ADJ potentiometer. The temperature can be either increased or decreased a maximum of 3°F.
"Set" Indicator LED (L1):	This LED will be "ON" whenever the sensed temperature is above the set point.
Optimizer Module(U2):	The Optimizer module inserts into the socket in position U2. The speed of response and the defrost lock-out feature are programmed into these field interchangable modules.
Fast Set " Up ": Fast Set "Down":	These circuit board pads on the left side of the board allows a serviceman to raise or lower the pressure settings by bridging the gaps between the pads with one's finger.
Disable Switch (SW1):	Disables the Optimizer's effect on the pressure settings while pushed. The settings of the SSPC can be checked or set at this time.
Temp Probe Terminal Block:	The temperature probe is wired to this terminal block.
Test Jacks T, S, and R:	The temperature sensed by the temperature probes and a more exact indication of the temperature setting can be read from these test jacks.
Calibration Pots:	P3, the pot next to SW1 and the multi-turn pot located above the "Fine Adj" pot and the pot located to the right of push button switch SW1 are for calibrating the Optimizer board. These have been set at the factory and should never need to be field calibrated. Do not remove the sealant applied to these pots.
Temperature Probes:	(Not Shown) One calibrated set of two probes provided with each Optimizer. Probes are provided with 6 ft. Stranded parallel leads. Probe Size: .375" OD X 3.00".

*General Operation:

The Optimizer senses the refrigerated air temperature and compares it to the temperature set on the "Temp. Adj. and Fine Adj." potentiometers.

(A) If The Probe Temperature Is Warmer Than The Set Point:

- The indicator LED L2 will be "ON"

- The SSPC's pressure settings will decrease.

NOTE: The Optimizer cannot lower the pressure setting below the set point on the SSPC.

(B) If The Probe Temperature Is Colder Than The Set Point:

- The indicator LED L2 will be "OFF"

- The SSPC's pressure settings will increase.

NOTE: If the probe temperature has spent a great deal of time above the set point temperature and the pressure settings correspond to those set on the SSPC, then a time delay will occur before the pressure settings start to rise.

*Maintains Differential Setting:

The Optimizer will maintain the differential set in the SSPC regardless how far the Cut In setting is raised. If a SSPC's pressure settings were 30 PSI Cut In and 25 PSI Cut Out, and if the Optimizer raised the Cut In setting to 40 PSI, then the Cut Out would be raised to 35 PSI. The pressure settings actually being used for control will be displayed if the CPU's display select switch were put into positions 2 and 3. In order to display the pressure settings of the SSPC, push the "Disable" switch SW1 on the Optimizer board. Optimizer board.

*Field Replaceable Module:

The Optimizer has field replaceable modules that can change the the rate which the pressure setting increases or decreases. The Optimizer modules will be labeled with a number. The higher the number the slower the response.

*Defrost Lock-Out:

This feature causes the pressure setting to remain relatively unaffected whenever the "Defrost Inhibit" function is enabled. Consequently whenever the refrigeration system with the temperature probes is in defrost it is desirable to enable the defrost inhibit to hold that setting until after defrost to prevent abnormal re-adjustment time. This feature can be deleted by ordering an Optimizer module without it. The modules with this feature will be denoted by a "D" suffix. Those modules without the lock out feature will not have a "D" in the label suffix.

*Start-Up and Power Failure Operation:

The Optimizer will, upon intial power up, have a pressure setting of approximately 20 PSI. In event of a power failure, the Optimizer will hold its setting for a least 5 minutes.

*Open or Shorted Probe Circuit:

The Optimizer circuit board automatically returns the pressure settings to the SSPC's settings if it senses either an open or shorted probe circuit.

*Probe Temperature and Set Point Temperature Readout:

The temperature sensed by the temperature probes can be readout at the Optimizer board by measuring the DC voltage between the "Temp" test jack (Labeled "T") (+) and the "Ref" test jack (labeled "R") (-). The conversion is .01Vdc = 1°F. Consequently, .230 Vdc indicates 23°F.

The temperature setting can also be read out more exactly using a similiar method only measuring between the "Setting" test jack (labeled "S") (+) and the "REF" test jack. The conversion again is .01 Vdc equals 1°F.

*Fast Set Up or Down:

The Optimizer has a service feature that allows the serviceman to check the operation of the Optimizer by quickly raising or lowering the Optimizer's pressure set points. This is done by bridging the gaps between the circuit board pads located near the "UP" or "DOWN" labels.

NOTE: If the Optimizer's setting is far below the SSPC's settings, then it make take up to 10 seconds for the displayed (cut in setting to reflect on "UP" command.

APPLICATION INFORMATION

*Optimizer To Control System With Lowest Suction Pressure:

The Optimizer is designed to replace other temperature control means on the system with the lowest suction pressure requirements This has several benefits:

(A) Possible elimination of EPR or CTR valves which are expensive to buy but also usually result in lower than optimum average suction pressures. A rule of thumb says that each degree lost in the suction temperature results in 1 1/4% loss in compressor efficiency.

NOTE: Some hot gas defrost systems use the EPR's or CTR's to provide a a suction stop. Other systems with higher suction pressure requirements will still require either an EPR, CTR, or thermostat and solenoid to properly control their temperature. Pressure drops in these systems will not affect overall system efficiency.

(B) The average suction pressure will run several pounds higher than with EPR's. This will occur because suction pressure settings have to take into account the most severe load requirements Whereas the Optimizer takes the load requirements into consideration and is able to raise the settings when the load is light.

(C) Reduced compressor cycling can also be achieved while insuring that the average refrigeration temperatures are maintained. With the Optimizer, the differential between Cut In and Cut Out settings can be increased since the settings will be raised if the temperature becomes too cold. Also longer time delays are possible for the same reason.

(D) Oversized twin parallel systems will operate smoother when the load requires less than one compressor. As a general rule, twins equipped with an Optimizer should have a minimum run time of 1 minute and a minimum off time of 3 minutes. In the more severe cases of oversizing, thermostat and solenoid control of the warmer systems may be required.

*Parallels With Two or More Lowest Suction Systems:

Whenever a parallel compressor system has more than one refrigeration circuit operating at approximately the same lowest suction pressure, a decision will need to be made. One circuit will need to become the master and the other slave circuits. If the circuit picked as the master turns out not to be the system requiring the lowest suction pressure, then the temperature probes may need to be moved to another circuit and it become the master.

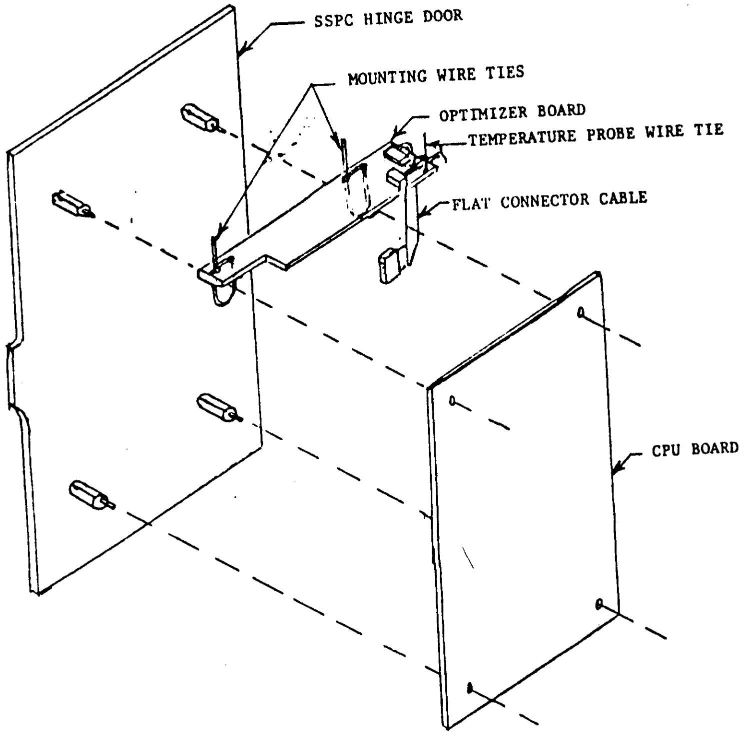


Figure OP-2

*Installation of the Optimizer Board On a CPU Board:

(1) Optimizers can not be used on some CPU boards without a modification. CPU boards marked "WT-008-00 Rev. C" in the middle right section do not require modifications. All other boards require the addition of a factory installed jumper wire before mounting the Optimizer. The change to Rev. C occurred around October, 1980 and was incorporated in SSPC's by serial number 7500.

(2) Install the Optimizer as shown. The CPU board must be loosened from the circuit board supports far enough to allow the tie-wraps to loop over the supports. The CPU board is then repositioned on the supports and only then are the mounting tie-wraps tightened. Clip the tie-wrap's loose ends.

(3) Fold the flat cable as shown in Figure OP-2 and plug into C/I receptacle on the CPU board. If the CPU board has a phase protect board or computer interface board, then a special flat connector cable needs to be specified on the order for the Optimizer. The special cable will have an extension that will plug into the optional board. The existing cable to the optional board will not be used.

(4) Mount the provided temperature probe set to sense air temperature in the system requiring the lowest suction pressure. Each probe reflects half the sensed temperature. The best control is achieved by mounting one probe in the discharge air and the other in the return air of the same refrigerated fixture. These probes are calibrated as a set that can be connected to any Optimizer; however, do not mix probes among sets.

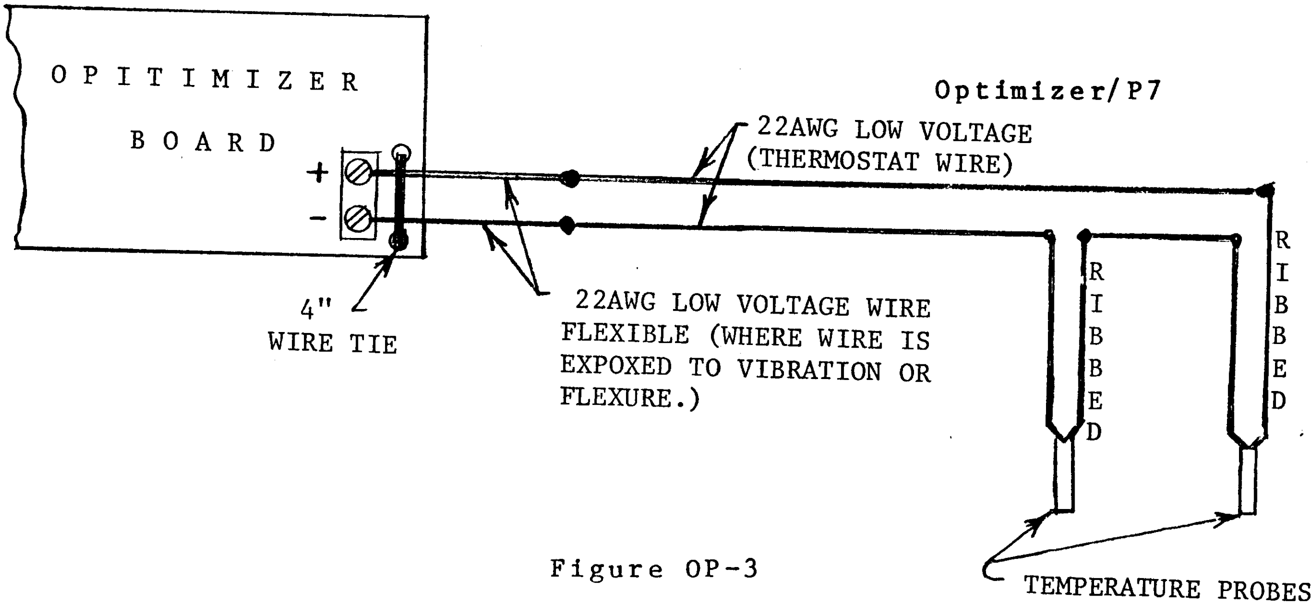


Figure OP-3

(5) Wire the Optimizer to the temperature probes as shown in Figure OP-3. Be sure to observe all polarities shown. All wiring is low voltage and low current. Although solid thermostat wire can be used most of the way, it is recommended that stranded wire be used where vibration or straining is encountered. Wire nuts can be used for making the interconnections. Be sure to tie-wrap the ends attached to the Optimizer board.

SETTINGS AND ADJUSTMENTS

* The only adjustments required to be made to the Optimizer board is the temperature settings:

(1) Position the "Fine Adj." potentiometer to 0°F

(2) Position the "Temp. Adj." potentiometer to approximately the average temperature to be maintained between the two temperature probes. (Either by the dial or with the digital voltmeter method described in "General Optimizer".

* The settings on the CPU board also need to be set to the lowest settings desired, if for some reason the temperature of the refrigerated space does not fall below the Optimizer set point:

(3) Push the "Disable" switch on the Optimizer board. This locks out the effect on the settings by the Optimizer. The CPU's settings can be read out on the display by switching the display switch to postions 2 and 3. The settings can set by adjusting the "Cut In" and "Cut Out" pots on the CPU board.

* The system should be allowed to operate for at least two hours. Then check the temperature of the sensed refrigerated case. If it is not exactly the temperature desired:

(4) Adjust the "Fine Adj." potentiometer on the Optimizer to make minor adjustments in temperature. The temperature can be either increased or decreased by 3°F.

SERVICE HINTS:

* The voltage across the (+) and (-) temperature probe will be 12 Vdc if either the probe circuit is open or a probe is wired backwards.

NOTE: The Optimizer will return the control to the CPU board's settings if the probe circuit is either open or shorted.

* Use the "Fast Set" pads to rapidly raise or lower the settings to a point where operation of the Optimizer can be observed more closely.

* The "Disable" switch can be used to check how much the Optimizer has raised the settings.

* If the Optimizer Module is to be changed out:

  (1) Disconnect power to the SSPC.

  (2) Since the pins for the module can be bent, it is recommended that a small screw driver used to pry the module from it's socket.

  (3) Make sure all legs of the module are lined up in their matching receptacle before pushing the replacement module into place. Be sure to install the module as shown in Figure OB-1. Note that the beveled edge is in the upper right hand corner.

* If the Optimizer board has to be removed in the field, use some diagonal cutters to cut the mounting wire-ties. New 4" wire ties will be shipped with repaired Optimizer.

ALTECH CONTROLS
1545 Industrial Road
Missouri City, Texas 77459
713/499-5697

August 19, 1982

Service Memorandum: Changing the Temperature Control Range of the Optimizer

Under some applications, it may become necessary to change the range of the Optimizer beyond the standard -20°F to 40°F limits. The following procedure details how the range can be raised or lowered. The temperature difference will stay at 60°F however the upper and lower limits will be shifted in the same direction. The recalibration procedure described here will not alter the 65psi maximum pressure the Optimizer can raise the SSPC's Cut In set point. Refer to the SSPC recalibration procedure for raising the maximum Cut In setting.

Recalibration Procedure: (Refer to Fig. OP-1A)

(1) Set a digital voltmeter to read 0-2.00 Vdc.

(2) Plug the positive probe into the "Setting" test jack (Marked "S") and the negative probe into the "Reference" test jack (Marked "R"). The digital display will indicate the actual temperature setting for the Optimizer using the following conversion: 1.00 Vdc = 100°F.

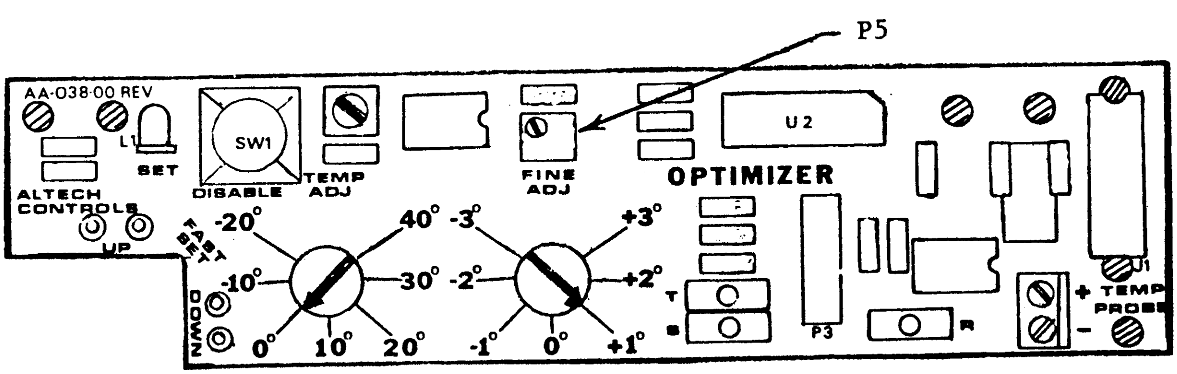
(3) Turn the "Fine Adj." potentiometer to the middle (0°F).

(4) Turn the "Temp Adj." potentiometer to the end of the range to be extended. (Example: If the new limit is to be 50°F then turn the potentiometer to read 40°F.)

(5) Remove the sealing compound from the potentiometer P5 (See Fig. OP-1A) immediately above the wording "FINE ADJ". Slowly adjust the this pot while observing the voltmeter's voltage reading until the reading corresponds to the new limit desired. Confirm the new range by turning the "Temp Adj" pot to both extremes.

(6) Using numbered wire markers or an equivalent substitute label, remark the scale around the "Temp Adj" potentiometer. The Optimizer is now recalibrated

FIGURE OP-1A



ALTECH CONTROLS

1545 Industrial Road
Missouri City, Texas 77459
713/499-5697

February 11,1983

Service Memo: Checkout and Recalibration of the Optimizer's Temperature Probe

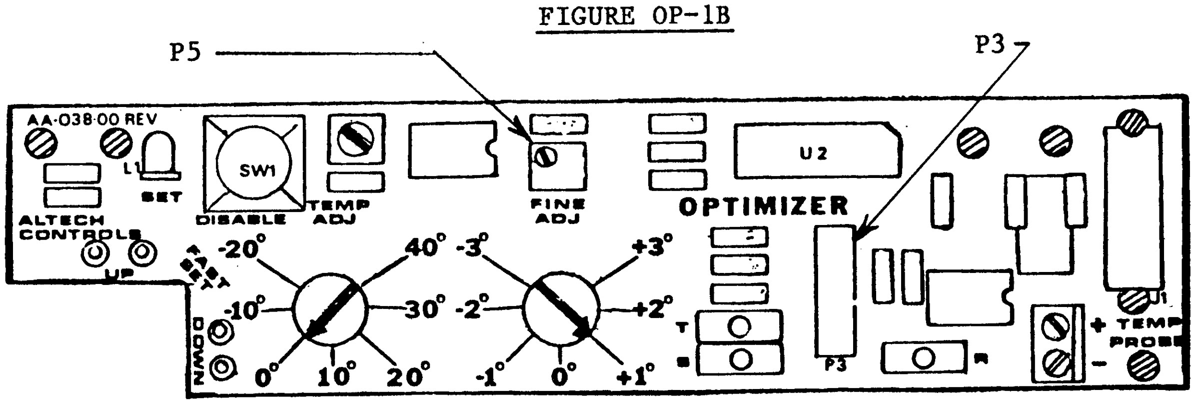
If it appears that the temperature sensed by the Optimizer is in error it is recommended that the following items be checked prior to recalibrating the Optimizer:

(1) Reconfirm that all probes have been located. There are many systems installed with 2 or 3 probes that each equally contribute to the temperature sensed by the Optimizer. If there are two probes in a system then the temperature at each probe should be added up and then divided by 2 in order to arrive at the temperature that would be indicated by the Optimizer.
(2) Determine if any of the probes are in contact with metal or are located in such a way as give a faulty reading. Be sure to allow for the response time for a probe located in air of changing temperature.
(3) Check all connections for faulty or corroded joints.
(4) Reconfirm the polarity of the probes. A properly connected temperature probe will have a voltage between 5 and 7 Vdc appearing across the Optimizer's temperature probe terminal block. A probe wired in backwards or an open will cause a 11 to 13 Vdc voltage to appear at that same location.
(5) Visually check the Optimizer for any physical damage such as corrosion.

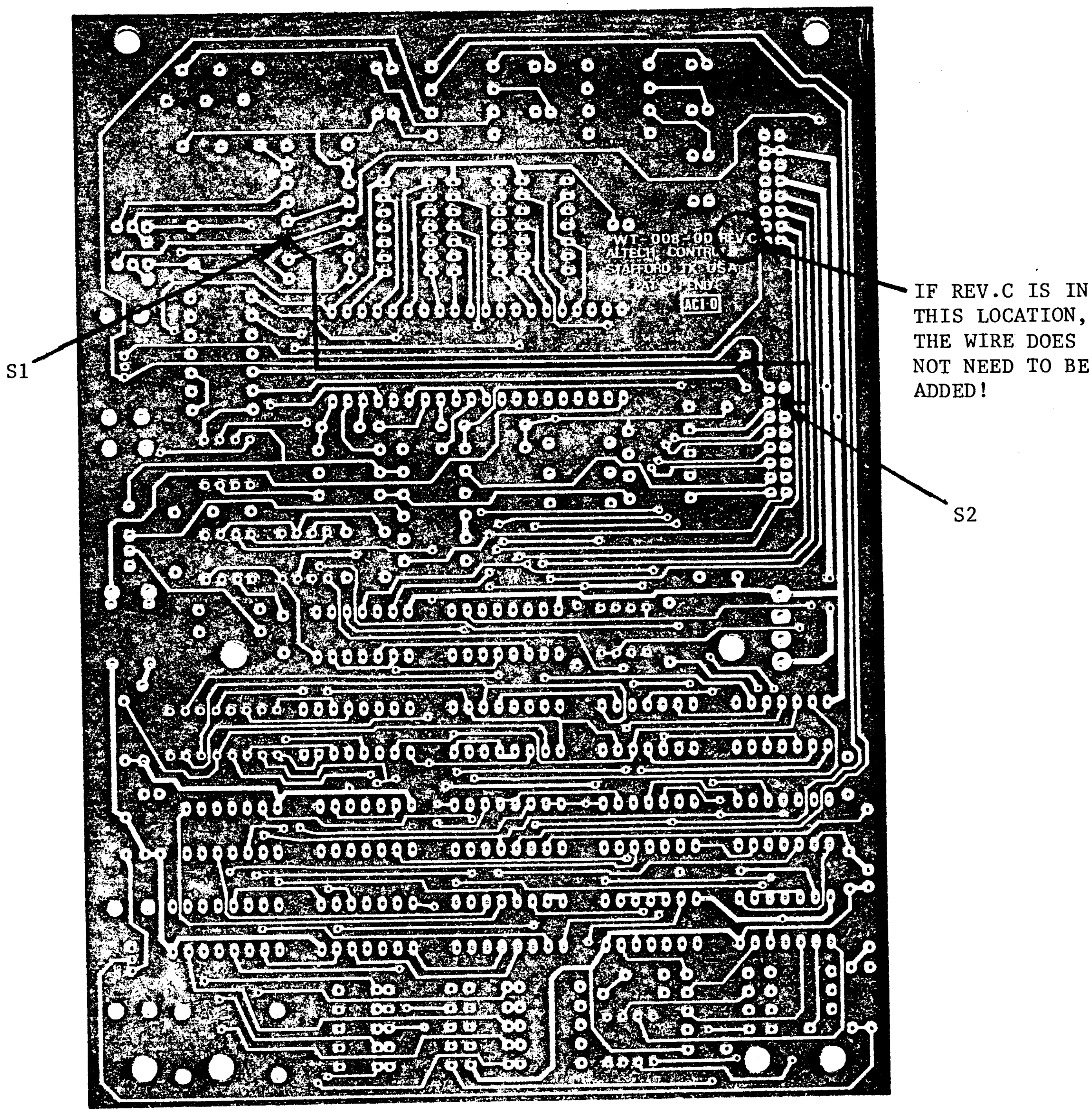
If all of the previously mentioned checks found nothing unusual, then the Optimizer can be recalibrated with the following method:

(A) Immerse all the probes in an ice bath with ice at least 3/4 of the way down. Locate the probes in the bath such that they are not resting on the bottom or near the edge of the container. Let the probes stabilize for at least 5 minutes.
(B) Connect the DVM to the Optimizer so as to read temperature then adjust potentiometer P3 on the Optimizer (See Figure OP-1B) until the DVM reads .320 Vdc (Corresponds to 32°F).
(C) Adjusting P3 will alter the range that the Temperature settings pots. To bring them back into calibration, first center the "Fine Adj." and position the "Temp Adj" pot at 10°.
(D) Connect the DVM to the Optimizer so as to read the temperature setting then adjust the multiturn potentiometer P5 until the DVM reads .100 Vdc (Corresponds to 10°). Now check that the temperature setting can be set from -20° to 40°F. If so, then seal pots P3 and P5 with nail polish.

FIGURE OP-1B



MODIFICATION TO THE CPU BOARDS REV.-,REV.A, AND REV.B THAT WILL ALLOW THE OPTIMIZER TO BE USED.



INSTRUCTIONS:

SOLDER THE PRE-FORMED GREEN WIRE TO THE REAR OF THE CPU BOARD AT LOCATIONS S1 and S2. DRESS WIRE AS SHOWN AND BOND TO THE CIRCUIT BOARD WITH A SMALL AMOUNT OF SILICON SEALER (CLEAR). THE SILICON SEALER SHOULD BE SET UP ENOUGH IN 2 TO 4 HOURS.

NOTE: IT IS BEST TO USE A 40 WATT OR LESS SOLDERING IRON AND IF ADDITIONAL SOLDER IS REQUIRED, USE RESIN CORE ONLY.

PHASE PROTECTION OPTION

OPERATION

The loss of one or more of the phases will cause the SSPC to immediately turn all compressors off. Re-application of 3 phase power will cause the SSPC to stage the compressors on beginning with all compressors off.

INSTALLATION

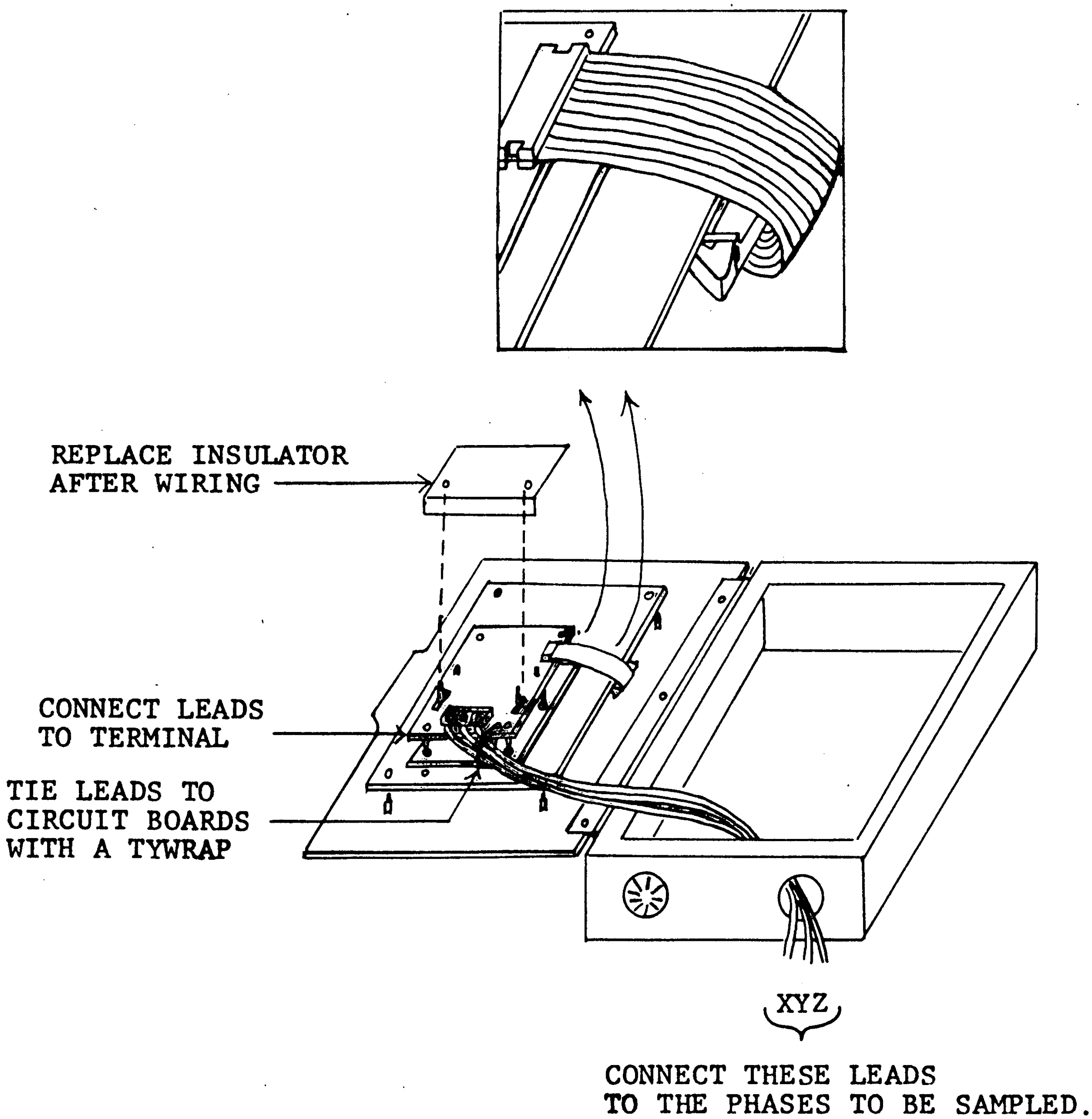
1. Route wires as shown in Figure 11. Be sure to attach wires to accessory board using a wire tie.

2. For 400-480 VAC monitoring, cut jumpers J1, J2 and J3 located on the printed circuit board directly above the terminal block.

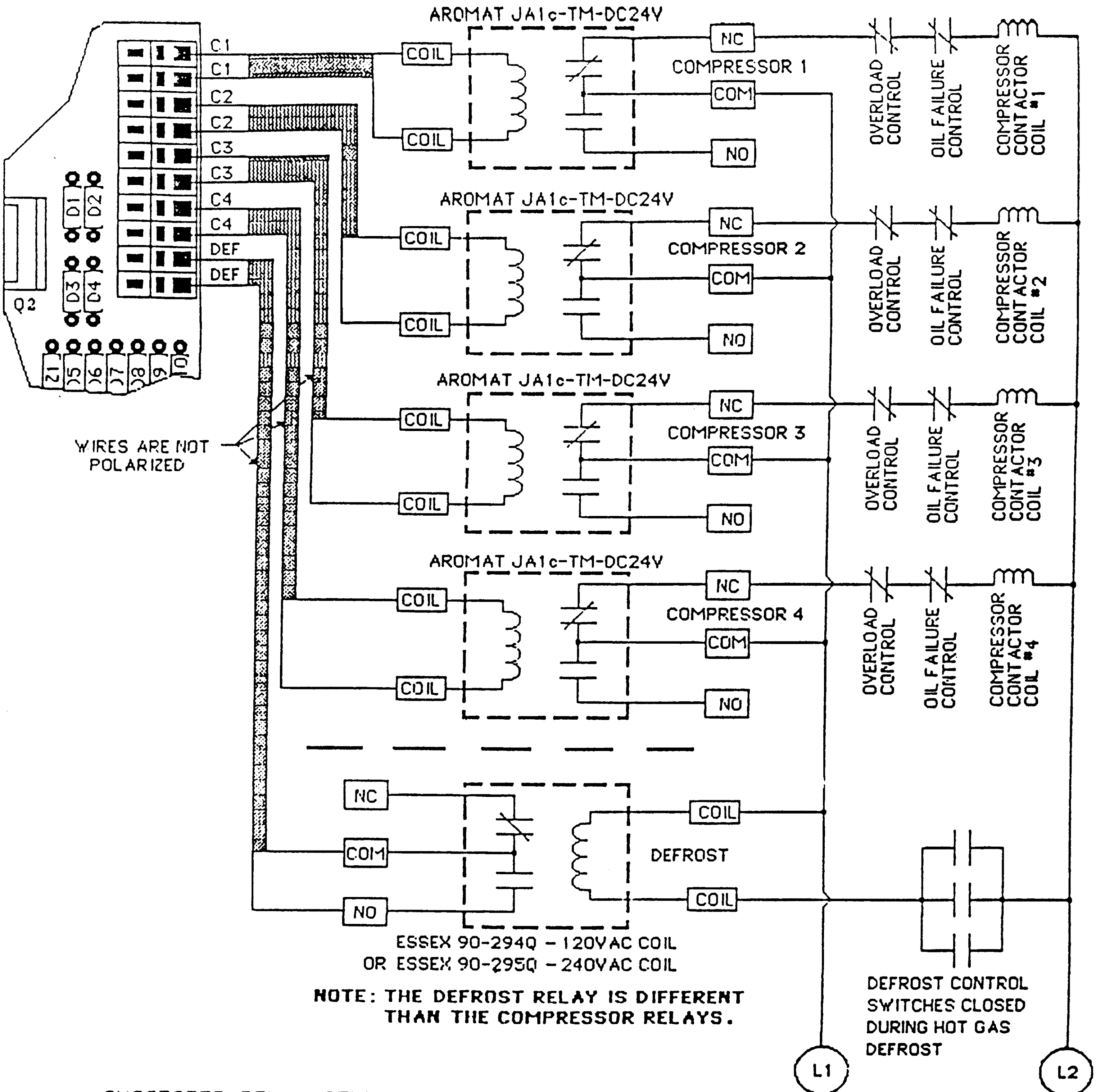
3. Replace cover over terminals when installation and service work is completed.

SERVICING

If the phase protection board seems to be malfunctioning, simply disconnect the phase protection cable from the CPU board and check the SSPC's operation.


REPLACE INSULATOR
AFTER WIRING
CONNECT LEADS
TO TERMINAL
TIE LEADS TO
CIRCUIT BOARDS
WITH A TYWRAP
XYZ
CONNECT THESE LEADS
TO THE PHASES TO BE SAMPLED.

TYPICAL WIRING SCHEMATIC



NOTE: THE DEFROST RELAY IS DIFFERENT THAN THE COMPRESSOR RELAYS.

SUGGESTED RELAY SOURCES:

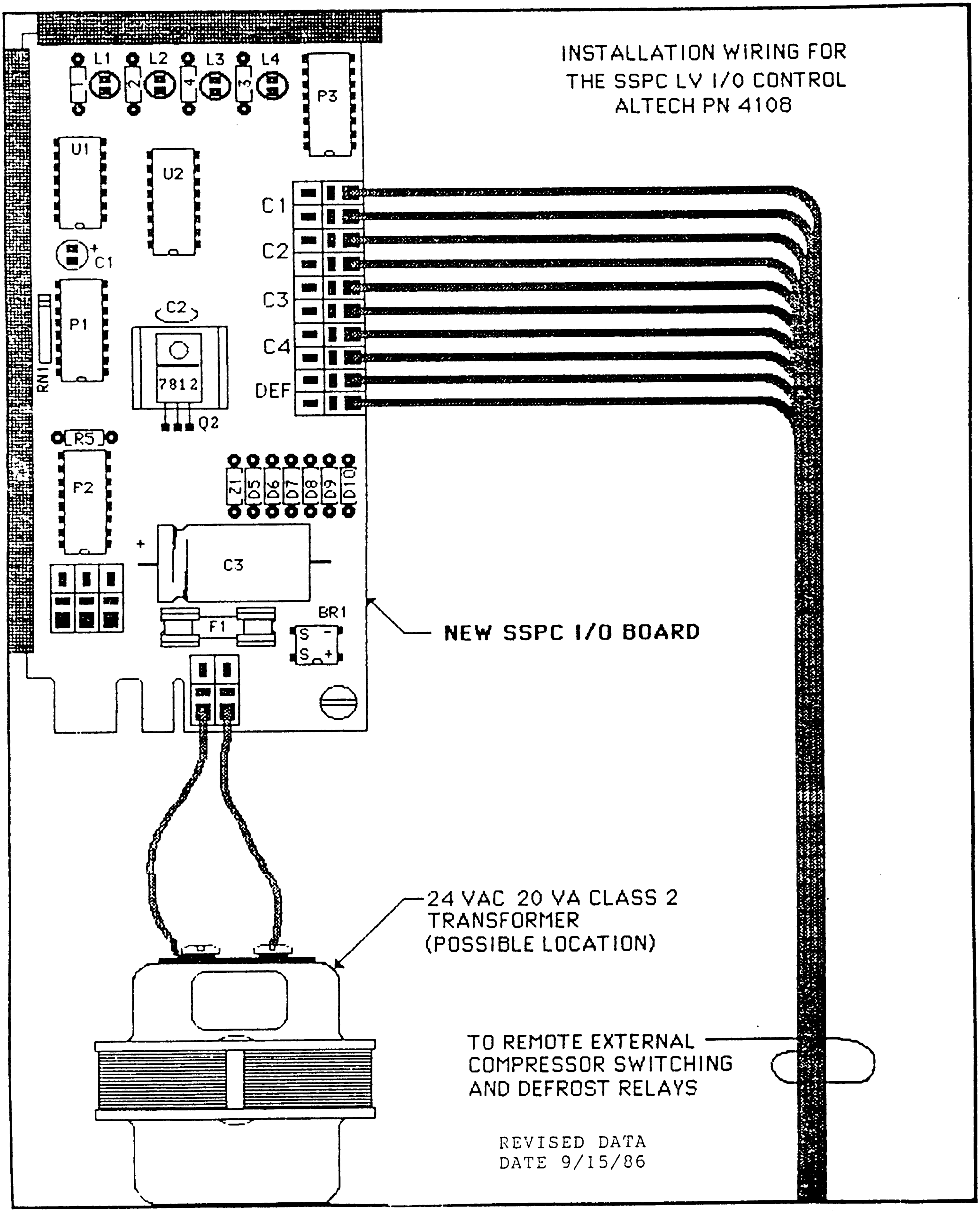
COMPRESSOR RELAYS: AROMAT JA1c-TM-DC24 ; MAGNECRAFT W389C24-3 OR -8 OR -13 OR EQUAL

DEFROST RELAYS:

120 VAC - ESSEX 90-294Q 120 VAC
MAGNECRAFT W389AC120-4 OR -9 OR -14
OR EQUIVALENT

208/240 VAC - ESSEX 90-295Q 240VAC
MAGNECRAFT W389AC240-5 OR -10 OR -15
OR EQUIVALENT

REV. 9/15/86



REVISED DATA
DATE 9/15/86

LIMITED WARRANTY

ALTECH CONTROLS CORPORATION warrants to the original purchaser or distributor our products to be free from defects in material and workmanship under normal use and service for a period of twelve months from date of shipment from the factory. Our obligation shall be limited to repairing or replacing at our discretion, F.O.B. factory, any part or portion of any product of our manufacture which upon examination we judge to be defective. The warranty stated does not include the cost of labor incurred in the handling, removing or installing of any equipment or component thereof, or loss of refrigerant. Furthermore, the warranty does not apply to any material that has been subjected to improper installation, application, misuse, neglect, alteration or accident. Removal of original serial number or date code shall release ALTECH from all obligations. ALTECH assumes no liability for product failure beyond repairing or replacing our product. If the product was damaged in transit, the perchaser must file a claim with the carrier.

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Product design and specifications are subject to change without notification.