FORM NUMBER: 81-192-8
DATE: 8/24/81
REVISED:

WARREN//SHERER

INSTALLATION & OPERATION MANUAL

MODEL:

SSPC SOLID STATE PRESSURE CONTROL

THIS REFRIGERATOR CONFORMS TO THE COMMERCIAL REFRIGERATOR MANUFACTURERS ASSOCIATION HEALTH AND SANITATION STANDARD.
CRS-SI-78

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GENERAL INFORMATION

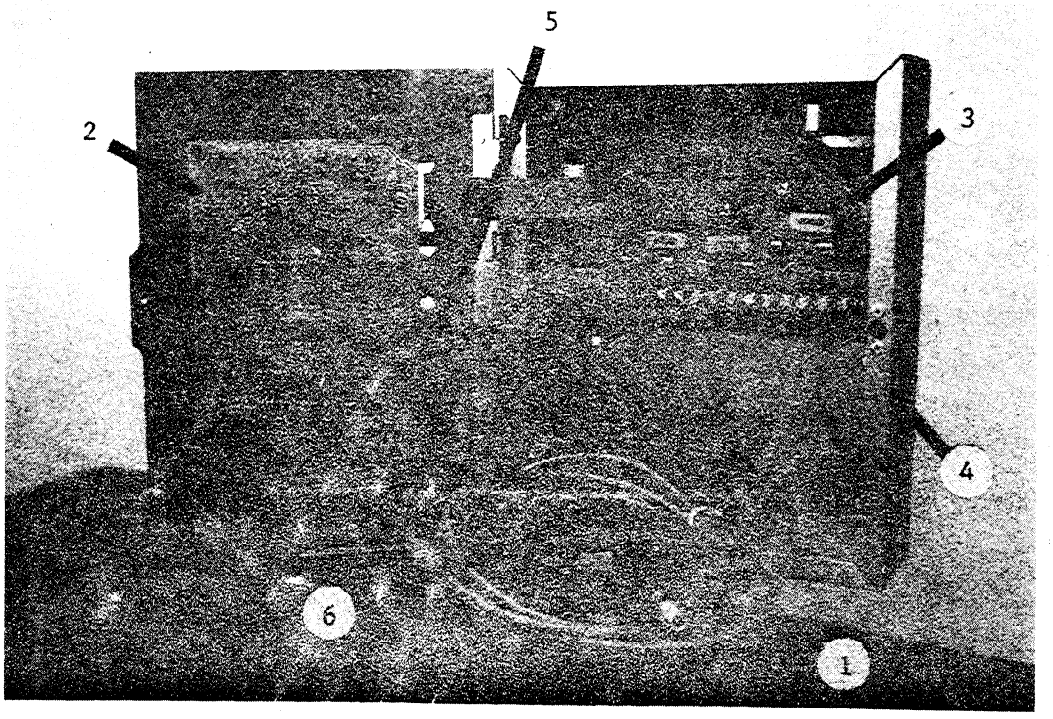
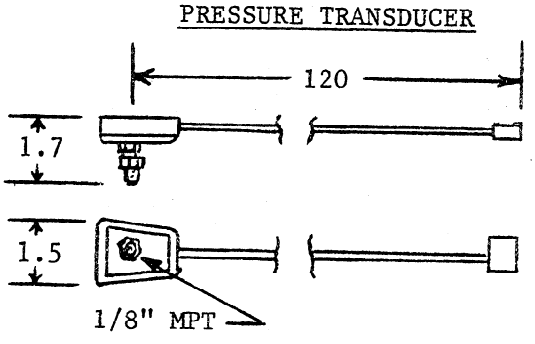


FIGURE 1

The SSPC controls up to 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-A remote pressure transducer, 2-A CPU board, 3-An I/O board, and 4-An enclosure with a pop open hinged door.



All dimensions are in inches

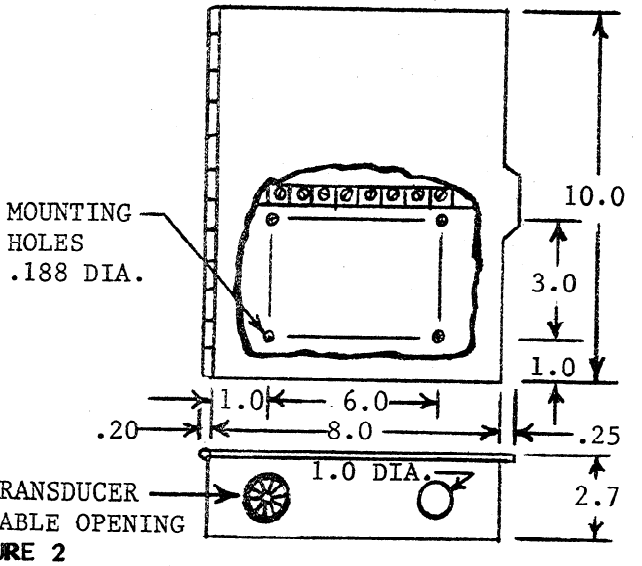


FIGURE 2

The SSPC for multiple compressor units comes in three basic units:

SSPC-2...For controlling 2 compressor 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 115V or 208/240 VAC as a supply voltage and an optional hot gas defrost control logic.

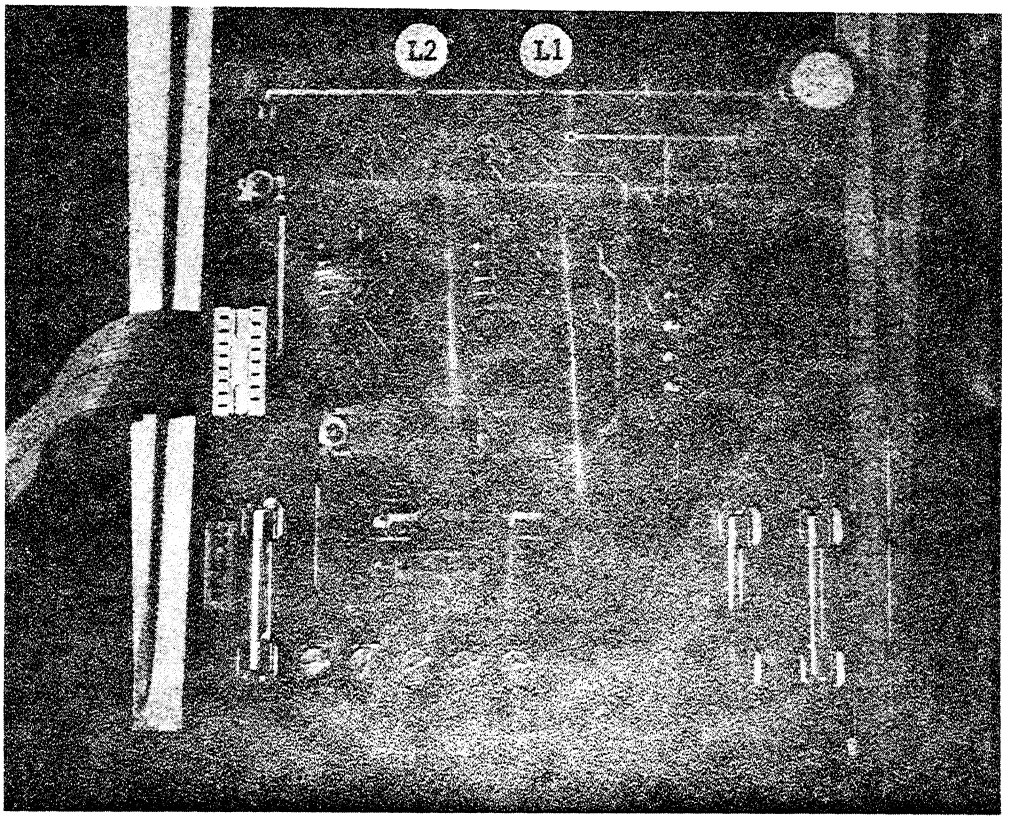


FIGURE 3

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 3. 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 3 basic units, consequently, the light emitting diodes L1, L2, L3 and L4 representing compressors 1,2,3, and 4 respectively 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.

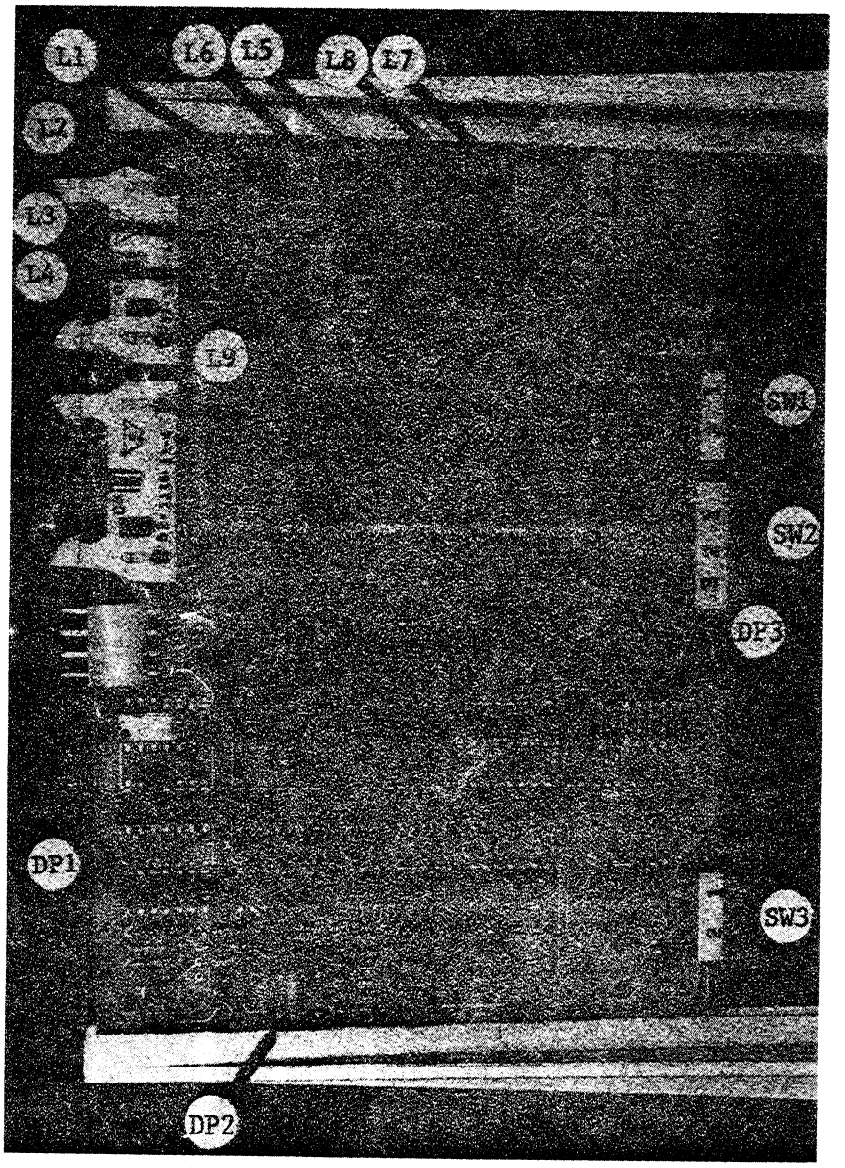


FIGURE 4

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.

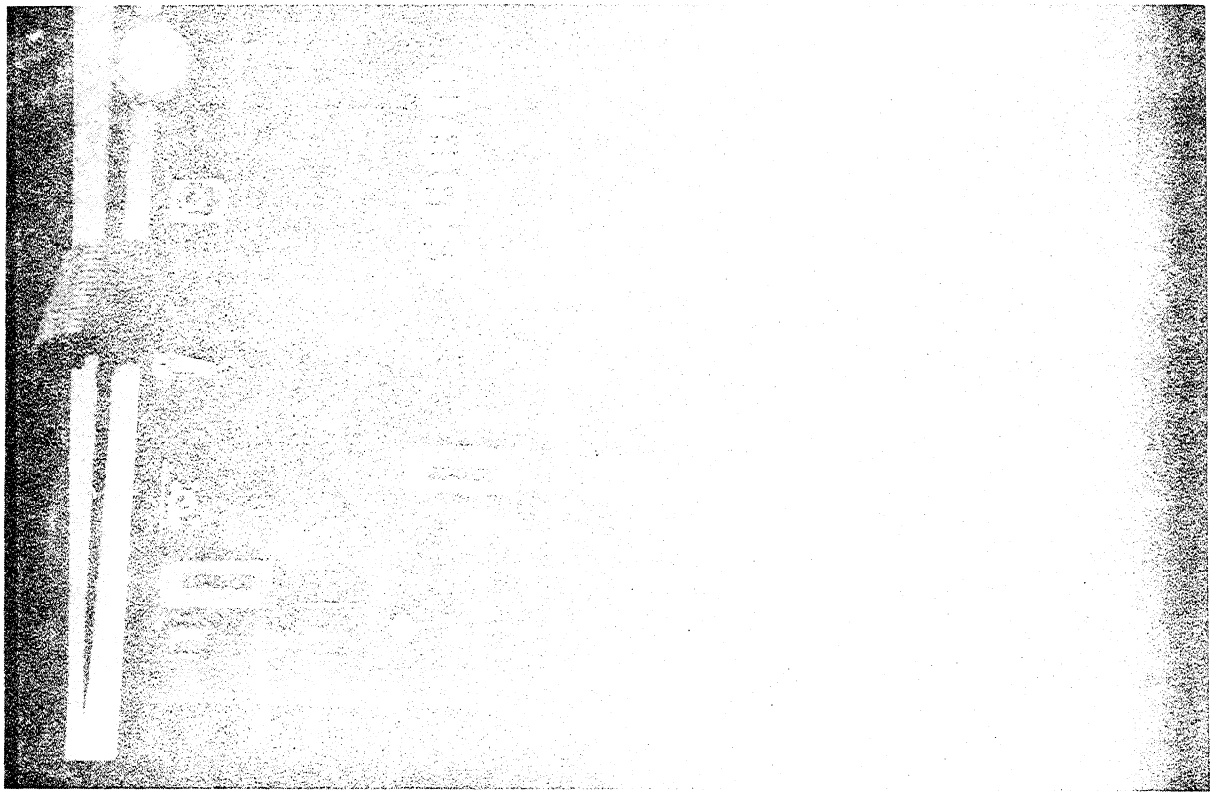


FIGURE 3

SSPC 4

Consists of the components shown in Figure [illegible] the CPU board (see Figure 4) will have a plug [illegible] printed right side up.

GENERAL OPERATION

° 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. Both time delays on the standard unit are 3 minutes and both start when either a compressor is added or deleted.

° 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.

The I/O Boards also have indicator lights, one for each compressor (See Figs. 3 and 5. These lights should correspond to the compressor indicator lights on the CPU board (Figure 4 L1-4).

° Defrost Inhibit (Optional)

This option maintains one compressor running during hot gas defrost even when the pressure falls below the cut out setting. If no compresser is running when defrost is initiated, one compressor is started. 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 (approximately the same as the supply voltage) between terminals 3 and 4 of the I/O boards. (If there are no terminals at contact 3 and 4 then Defrost Inhibit was not provided even though there is a Defrost Inhibit Light on the CPU board.)

Even though Defrost Inhibit was not ordered, an I/O board with defrost inhibit may be supplied (at no charge, of course). In that case, simply do not hook any wires to terminals 3 and 4 and the SSPC will operate as though no defrost inhibit was provided.

° Over Ride Switch (SWI)

SWI 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 the existing suction pressure.

° **Selectable Time Delays**

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

Cut On Time Delay: 3 Minutes
Cut Out Time Delay: 3 Minutes

Alternate time modules (DP2) for the CPU board can be ordered to meet a particular need. They can be either shipped with the SSPC from the factory or added in the field to an existing unit.

SPECIFICATIONS

POWER CONSUMPTION:

- 6 VA Max
- 24 VAC 50/60 HZ
- 115 VAC 50/60 HZ
- 208/240 VAC 50/60 HZ

SWITCH RATINGS (EACH COMPRESSER SWITCH):

- 2 Amp @ 24 VAC
- 2 Amp @ 115/208/230 VAC

AMBIENT:

45°F to 105°F
0% to 90% RH

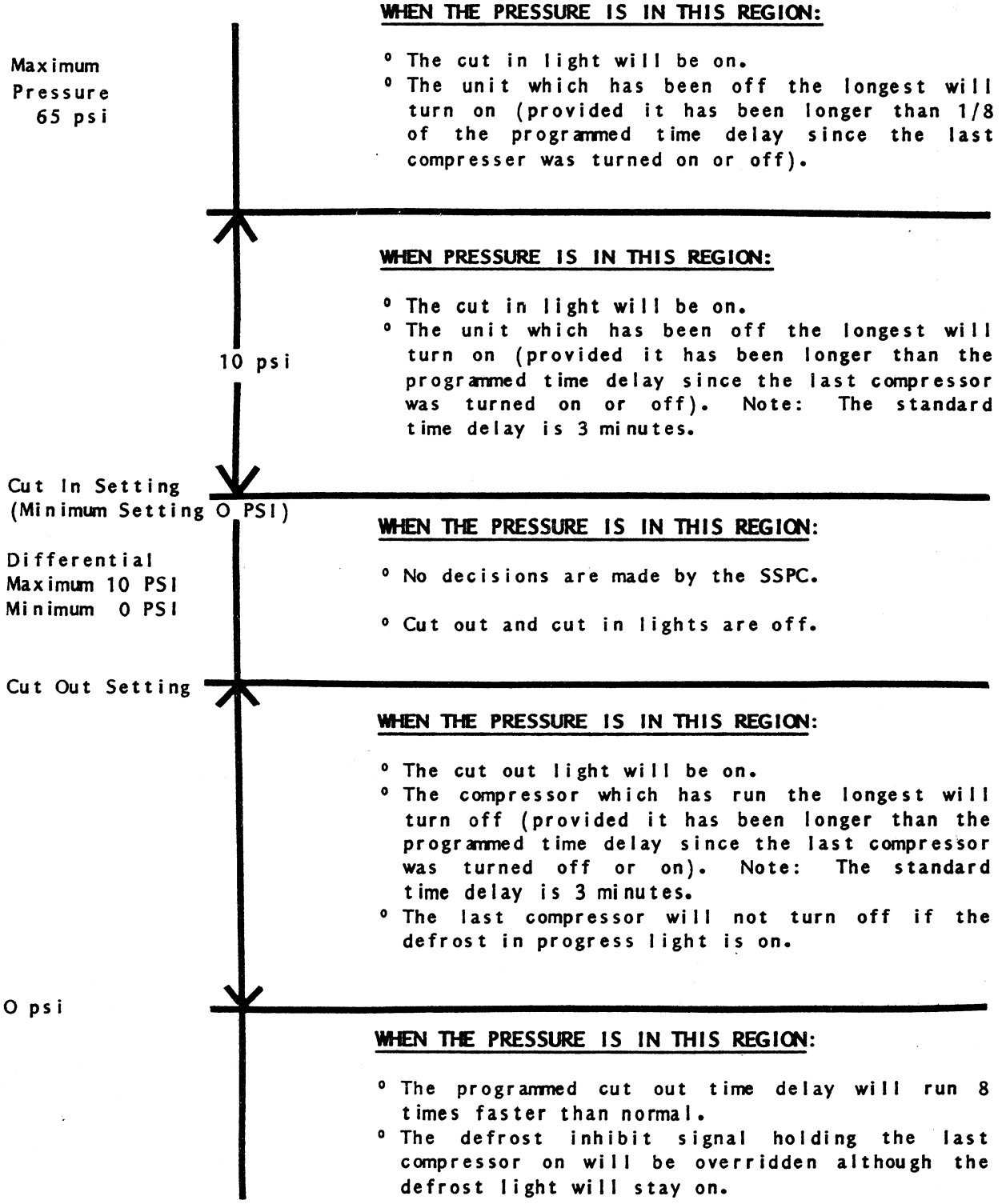
WEIGHT: 2.5 lbs

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

SSPC LOGIC



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).

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.

WHEN THE PRESSURE IS IN THIS REGION:

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

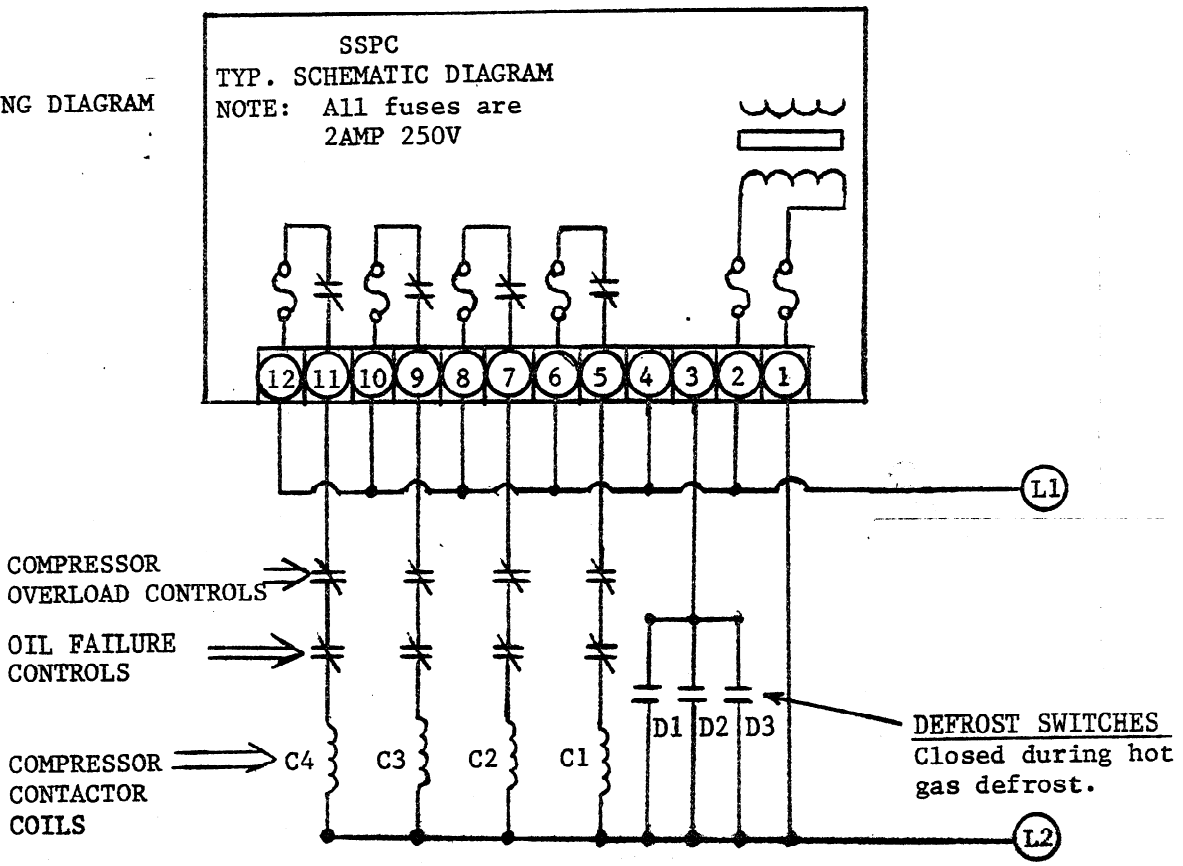
WHEN THE PRESSURE IS IN THIS REGION:

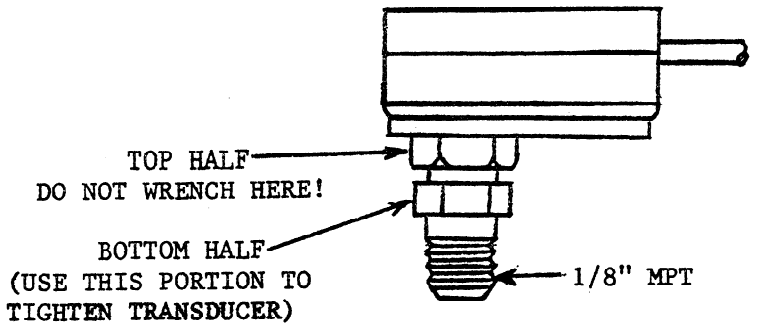
- The cut out light will be on.
- The compressor which has run the longest will turn off (provided it has been longer than the programmed time delay since the last compressor was turned off or on). Note: The standard time delay is 3 minutes.
- The last compressor will not turn off if the defrost in progress light is on.

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.

TYPICAL WIRING DIAGRAM





SETTINGS AND ADJUSTMENTS

START UP

Before applying power to the SSPC check the following:

(1.) Is the pressure transducer plugged in properly (wires 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 (labelled 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 pilot 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) neeeded 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. If the coil is not equipped with an EPR valve set the cut in at 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 setting.

Note 1: The cut in pressure cannot be set below 1 PSIG.
Note 2: Be sure to not try adjusting the potentiometers labeled Pot 1, Pot 2, Pot 3. These 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 6 PSI differential 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 in from the cut out 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 thermo-cynamic 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 reading 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 Calibration and Checkout Procedure".

D. Locate the Override Switch SW1 on the CPU board. (See Figure 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 2 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. Place the override switch in the override position & reset low pressure control as shown on page 15.

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.

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 CALIBRATION AND CHECKOUT 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 "OO.O". 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.

ALTECH OVERRIDE SETTINGS

Approximate settings for compressor dual pressure controls when Altech SSPC is placed in override position.

Dual Metic System	Compressor	Cut-Out	Cut-In
R-502 LT (-25°F)	1	1	11
	2	7	15
R-502 MT (+10°F)	1	20	33
	2	29	40
R-502 MT (+20°F)	1	30	43
	2	40	50
R-12 MT (+10°F)	1	2	11
	2	7	14
R-12 MT (+20°F)	1	7	17
	2	14	21
Tri Metic System			
R-502 LT (-25°F)	1	8	16
	2	4	12
	3	1	10
R-502 MT (+10°F)	1	29	39
	2	25	36
	3	20	33
R-502 MT (+20°F)	1	41	50
	2	35	45
	3	30	41
R-12 MT (+10°F)	1	7	14
	2	5	12
	3	2	10
R-12 MT (+20°F)	1	14	21
	2	10	18
	3	7	15

Note: When compressor control is switched back to the Altech, reset the dual pressure controls to approximately 1 psig.