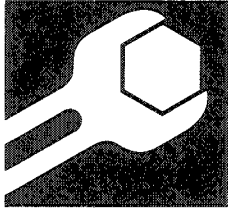
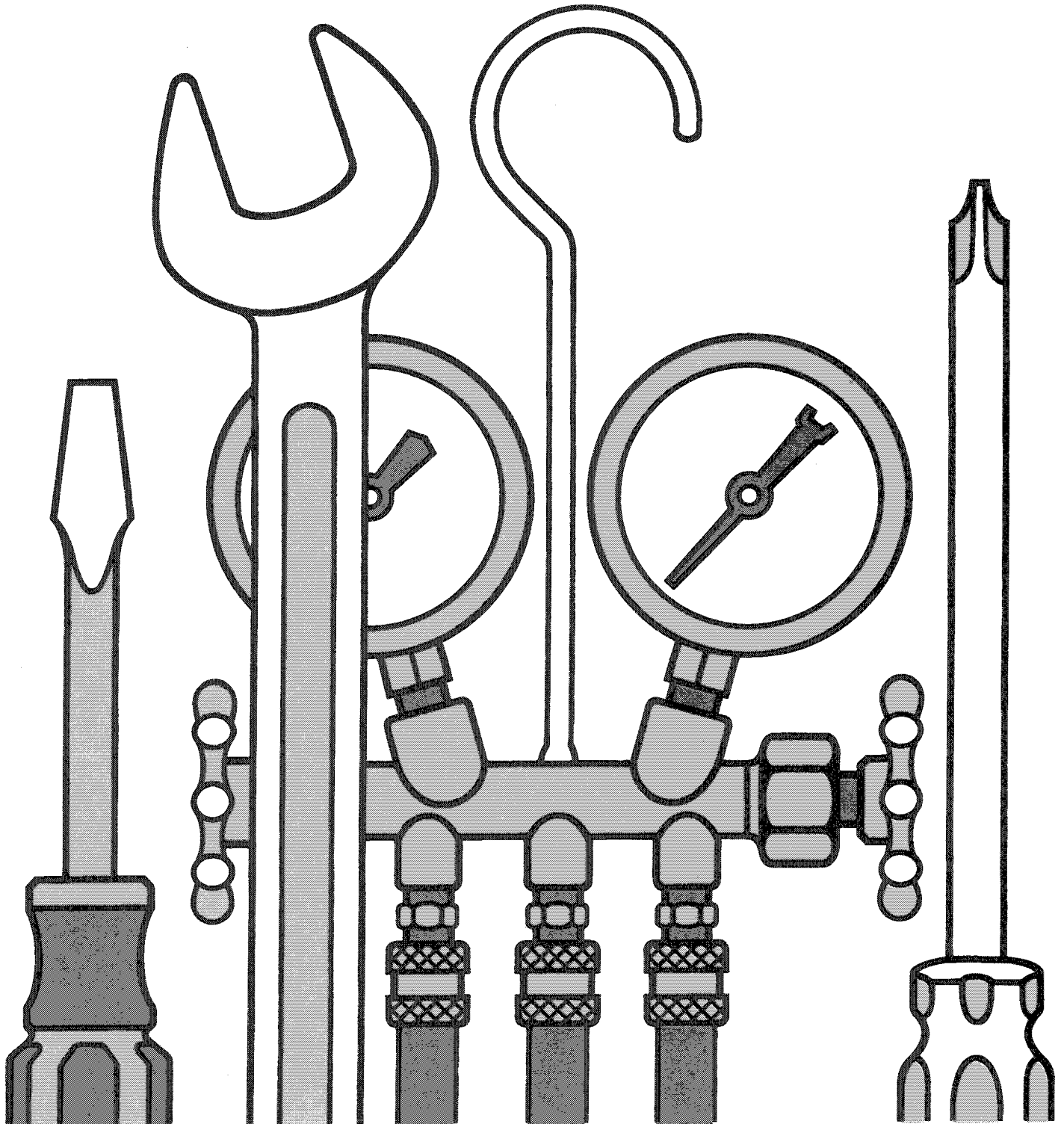


**CARRIER  
TRAINING**  
SERVICE



# 32MP MICROPROCESSOR CONTROL

START UP • TROUBLESHOOTING



## 32MP PROGRAM GUIDE

This is the second part of our two-part lesson on Carrier's 32MP microprocessor control system.

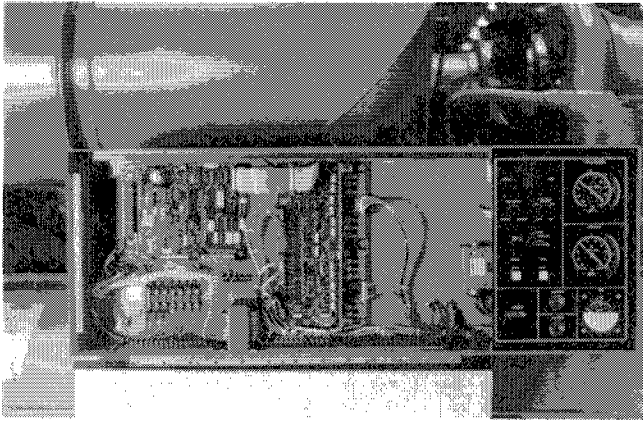
The 32MP replaces the 32SM as the standard control on Carrier's centrifugal chillers. The major difference between the two controls is that the 32MP has a microprocessor to receive, process, and store information sent from other components, which provides for better capacity control and minimum energy usage for any operating condition.

Here's what we will cover:

<u>Subject</u>	<u>Slides</u>	<u>Page</u>
Start-up		
Check Safety and Control Settings and Set Dip Switches	3	1
Controls Test	4 - 11	1
Dry Run	12 - 14	4
Prestart-up Checks	15	4
Start-up Checks	16 - 17	4
Calibrate Motor Current Demand	18 - 25	5
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Troubleshooting		
How to Find and Correct a Control Problem	27 - 34	7
Steps to Follow when Checking Out Pre-Start Failure or Shutdown Code	35 - 44	9
How to Troubleshoot when No Code is Displayed	45 - 57	11
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Located at the back of the book are the following charts:

<u>Chart</u>	<u>Page</u>
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3. Controls Test	20
4. Diagnostic Codes and Troubleshooting Guide	22
5. Sensor Resistance, Temperature and Voltage	27
6. Check-out Procedure for the:	29
Processor Board	
Input/Output Board	
Setpoint/Display Board	



1. This is the second part of our lesson on Carrier's 32MP microprocessor control system.

2. In part one, we covered familiarization and the electrical operating sequences.

In part two, we'll cover start-up and troubleshooting.

In the start-up section, we'll explain the steps to follow when starting the machine.

The troubleshooting section will show you how the control system helps you to diagnose a component malfunction.

3. Now, let's cover the steps that you should follow when starting the machine. Some of the steps may vary depending on your model. We'll use the 19DK for a typical start-up and we'll only cover the major points. For complete details, refer to the Start-up Instructions packaged with the machine.

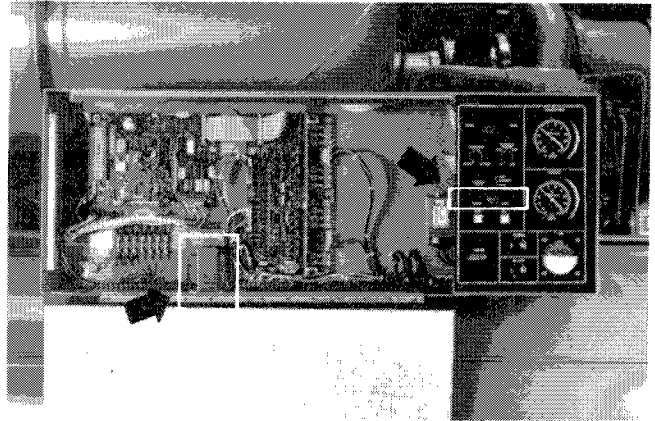
First, check the mechanical safety or control settings of the oil heater thermostat, the oil low-pressure cutout, the condenser high-pressure cutout, and the flow switches.

Then, set the dip switches according to the function and description that matches the requirements or best suits the machine's application. Refer to the configuration switch settings chart in the Start-up Instructions for this information.

[A copy of this chart is also on Page 18.]

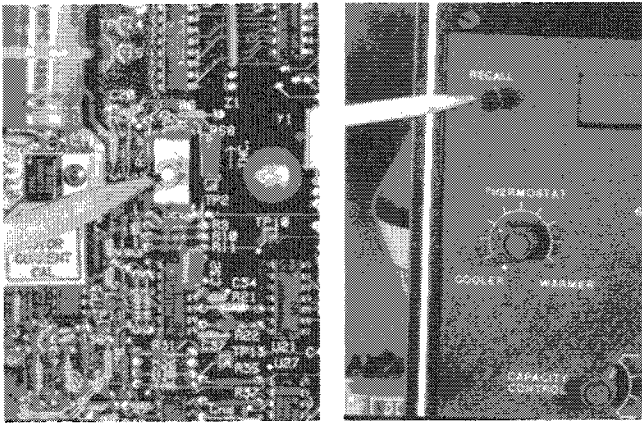
4. Next, perform the controls test to see if all the components in the control system are connected and operating properly. Also, during this test you can make sure the motor current zero potentiometer is calibrated properly and you can adjust the refrigerant temperature potentiometer if the chilled medium dip switch is set for brine.

Here's how to enter the controls test:



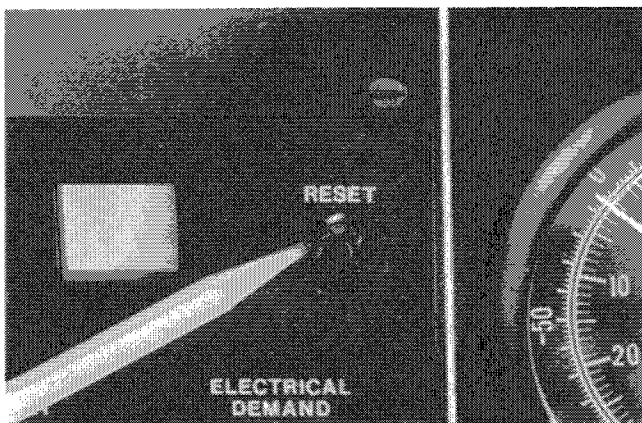
5. First, turn on the 115 volt power supply to energize the control system transformer, if the power is not already on. The transformer supplies the voltage to the processor, input/output board, and setpoint/display board.

Then, make sure the local/remote switch is set to local, otherwise you will not be able to enter the controls test.

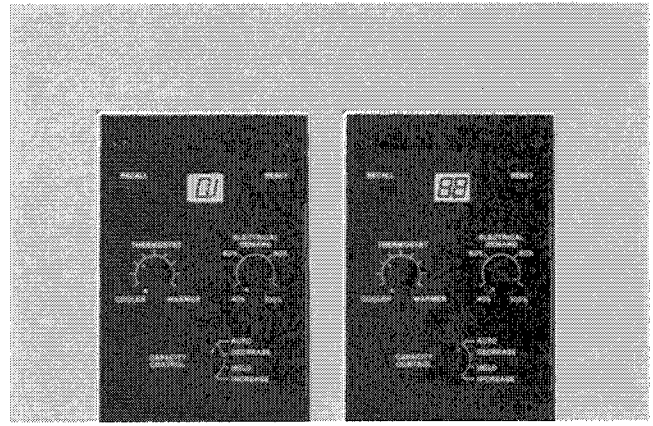


6. Next, press the power-on-reset button on the processor board, if the machine was not started previously. If it was started previously, press the recall button on the setpoint/display board before you press the power-on reset button. This allows up to the last 5 shutdown codes to be displayed, if there are any, so that you can record them for future reference. Once the power-on-reset is pressed, the shutdown codes in memory will be erased.

**CAUTION:** Never press the power-on-reset button while the machine is operating. Remember, if it is pressed while the machine is operating, the compressor motor and oil pump are de-energized at the same time. This means the motor will not be lubricated on coast down and the motor bearings may be damaged.



7. After the power-on-reset is pressed, you must press the reset button on the setpoint/display board within 10 seconds to enter the controls test.



8. When the reset button is pressed, the first step of the controls test will be displayed. There are 34 steps in the controls test for the basic control system and 38 if you have the expanded services panel. For each step, the reset button must be pressed twice. The first press displays the number of the test step with a decimal point between the two digits. Here we are showing step 1, which is displayed as "0.1". The second press displays the results or it exercises the command of the test step and will be shown as a number without a decimal point. The result of step "0.1" (step 1) is an "88", which lets us know that all the elements in the liquid crystal display are operating.

[For a complete listing of all the steps, refer to the Controls Test table on Page 20.]

For 19DR dual compressor units, there are 44 steps in the controls test and 48 if you have the expanded services panel (ESP).

CONTROLS TEST		
STEP NO.	TEST DESCRIPTION	RESULTS DISPLAYED
0.1	VERIFY PROPER OPERATION	88 — OK
		XX — FAULTY
0.2	EVAPORATOR REFRIG. TEMP. SETPOINT	33 — WATER (00 C)
		XX — BRINE TEMP.
0.3	% COMPRESSOR MOTOR CURRENT	00 — OK
		XX — OUT OF ADJUSTMENT

9. Here we see that step "0.2" (step 2) is used to display the evaporator refrigerant temperature setpoint. The present setpoint will be displayed with the second press of the reset button. Water should always be displayed as 33 for fahrenheit or 00 for centigrade. If the chilled medium dip switch is set for brine, the refrigerant temperature setpoint can be adjusted with the refrigerant temperature potentiometer on the processor board. If a blinking number is displayed, this means it is negative. Step "0.3" (step 3) is used to display the percent of compressor motor current; it should always be 0 during the controls test. If not, first check for any stray voltage across terminals 23 and 24. You should read 0 volts AC. If not check the wiring. Is it a twisted, shielded cable? Is the shield terminated on the control cabinet side only? Is the cable run by itself or with control wires only? The answers should be yes. If you are reading 0 volts across the terminals, adjust the motor current zero potentiometer on the processor board.

PRESS RESET	DISPLAY	WHAT HAPPENS
1	14	—
2	14	Oil pump starts

10. Now, let's see how the controls test lets us know if a component is operating properly.

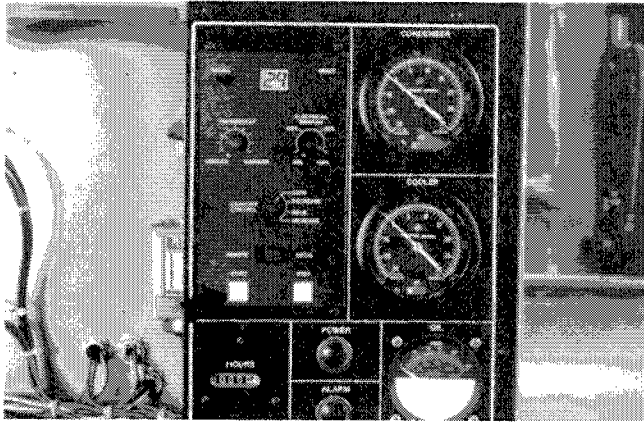
Let's assume we've just completed step 1.3 (step 13) and have pressed the reset button to advance to the next step. A "1.4" will now appear on the display. The Controls Test chart tells us that when we press the button again, the oil pump should start and a "14" should appear in the display. If a "14" doesn't show, this means either the processor board or setpoint/display board is faulty. If a "14" shows and the pump doesn't start, this means the input/output board or a component that is external to the board is faulty. How to determine what the problem is will be covered in the Troubleshooting section.

Keep in mind that if you find a faulty component during the controls test, you should correct the problem and then go back to that step in the test and make sure that the problem has been corrected.

PRESS RESET	DISPLAY	WHAT HAPPENS
	34	
1	01	Returns to step one
PRESS POR	DISPLAY	WHAT HAPPENS
1	03	Exit controls test and countdown before restart

11. After you've reached step 3.4 (step 34), or 3.8 (step 38) if you have the expanded services panel, you can either press the reset button which will return you to step 0.1 (step 1) or you can press the power-on-reset button and exit the controls test.

If you press the power-on-reset, the display will show "03" minutes and then count down in 1-minute increments; after the three minutes has elapsed, when the unit is ready for start, the display will show the point from which start-up can be performed. Code 20 is start-up from the setpoint/display board, Code 21 is from the remote contacts, and 22 is from the expanded services panel. Any of these codes mean that the machine is ready to start. However, do not press the start button yet.



12. The next step in the start-up is to operate the machine in a "dry run" condition and manually trip each mechanical safety to make sure the appropriate code is displayed.

The following safeties should be checked:

1. the flow switches for both the evaporator and condenser water loops
2. the compressor motor overloads
3. oil pump pressure
4. condenser high pressure
5. spare safeties (if any)

A dry run condition is when the main motor leads are removed from the starter, so the machine cannot actually start. For complete details on this procedure and how to check the safeties, refer to the Start-up Instructions. To initiate the "dry run", press the start button. After the machine enters the ramp loading mode (code "29") manually trip each mechanical safety, individually.

13. If a code is displayed and it is not correct, the safety is not connected to the correct terminal on the control panel terminal strip or on the input/output board.

For example, let's assume that you've tripped the condenser water flow switch, which means a "71" should be displayed. However, a "70" is displayed, indicating the chilled water flow switch has opened. In this case, the connections for the condenser and chilled water flow switches are reversed and should be changed.

14. If a code is not displayed, check for voltage from L2 to both sides of the safety; this is the

hopscotch method. If you don't have voltage to both sides, this means the safety has tripped and one of the boards is faulty or the ribbon cable is loose and not making a good connection. To determine which board is faulty, refer to the board troubleshooting guide in the Start-up Instructions; a copy of this guide is on Page 22.

If you do have voltage to both sides of the safety, this means it hasn't tripped because it is faulty or out of adjustment. Try adjusting it first. If this doesn't work, replace the safety.

15. After you've completed the "dry run", reconnect any wires you may have removed. Then, do the following prestart-up checks. Make sure:

**Check 1** The power is on to the main starter; the starters for the oil pump, water pump and tower fan; and the oil heater and machine control center.

**Check 2** The cooling tower water is at the proper level and temperature.

**Check 3** The machine is charged with refrigerant and all refrigerant valves are in the normal operating position.

#### 16. PRE-START CHECKS CONTINUED

**Check 4** The oil level is visible in the reservoir sight glass.

**Check 5** The oil reservoir temperature is 140-150°F (60 to 65.5°C).

**Check 6** The oil cooler plug valve is partially open.

**Check 7** The valves in the evaporator and condenser water circuits are open.

**NOTE:** If the water pumps are not automatic, make sure that you start them. Also, do not permit water or brine warmer than 100°F (37.8°C) to flow through the cooler. Water or brine above this temperature may increase the refrigerant pressure to the point at which the relief valves open and the refrigerant charge is lost.

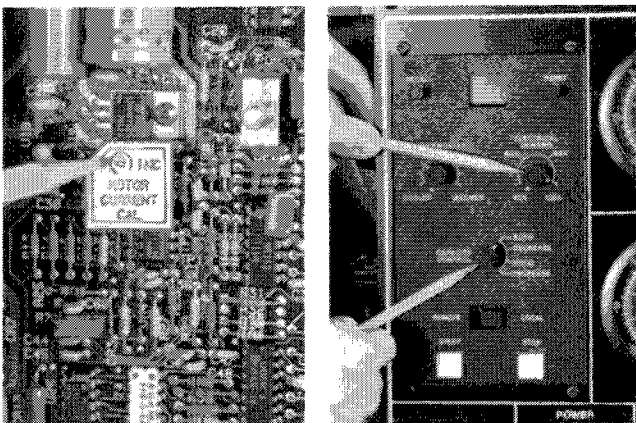
17. Now, after completing the prestart-up checks, set the capacity control knob at hold and press the start button. During initial start-up, you should manually control the machine from the setpoint/display board.

The compressor will start after the prestart-up sequence is completed and the oil pump has operated for about 10 seconds. The pre-start sequence is when the processor board checks the safeties and verifies water flow.

As the compressor motor begins to turn, check for clockwise motor rotation through the motor end bell sight glass. If the rotation is not clockwise, shut the power off and reverse the power leads on any two of the three phases entering the motor starter. Turn the power back on and recheck the rotation.

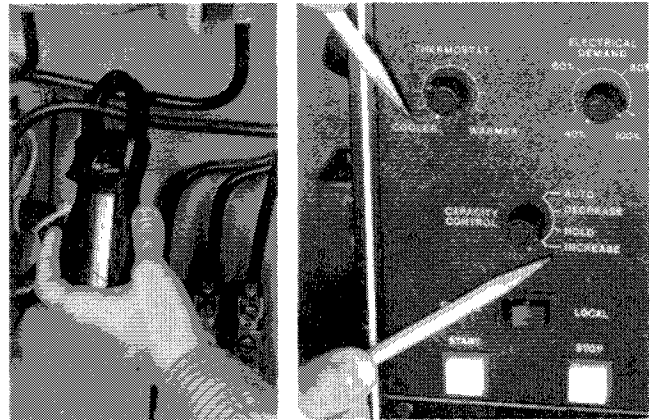
18. Then, let the compressor come up to speed and check the oil differential pressure gauge reading; it should be 20-25 psid. If the pressure is not within this range, refer to the Start-up Instructions packaged with the machine for possible causes.

Next, press the stop button and listen for any unusual sounds from the compressor as it coasts to a stop.



19. After checking the compressor and oil differential pressure, calibrate the motor current demand.

To do this, we will be using the motor current span potentiometer on the processor board and the electrical demand and capacity control knobs on the setpoint/display board.

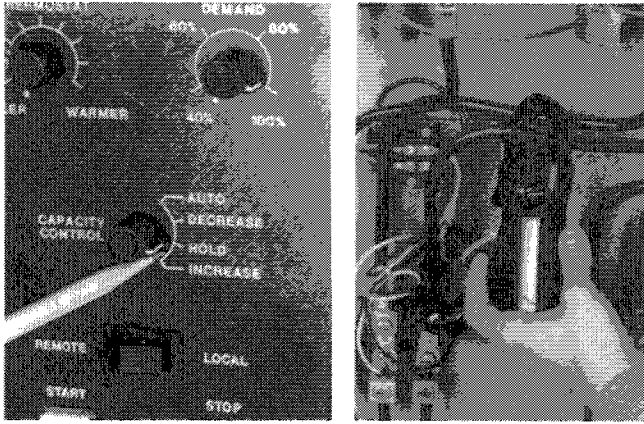


20. First, place an ammeter around the line which runs through the current transformer in the motor starter circuit.

Then, start the compressor and establish a steady motor current value between 50 and 99% of rated load amps. To do this, manually open the guide vanes by setting the capacity control knob to INCREASE while gradually adjusting the thermostat towards cooler.

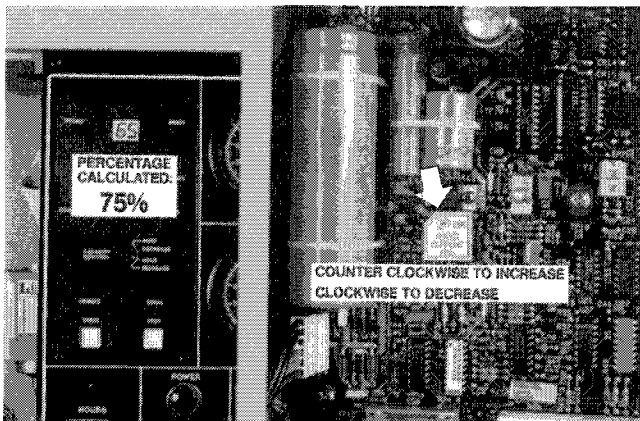
**CAUTION:** Do not exceed 105% of nameplate rated load amps.

**NOTE:** Above 99% of RLA the display blinks because the actual value cannot be shown.



21. Next, set the capacity control knob at HOLD. Measure the motor amps and calculate its percentage of rated load amps.

For example: If the motor current measured by the ammeter is 75 and the rated load amps of the machine is 100, the calculated percentage is  $75 \div 100$ , which equals 75%.



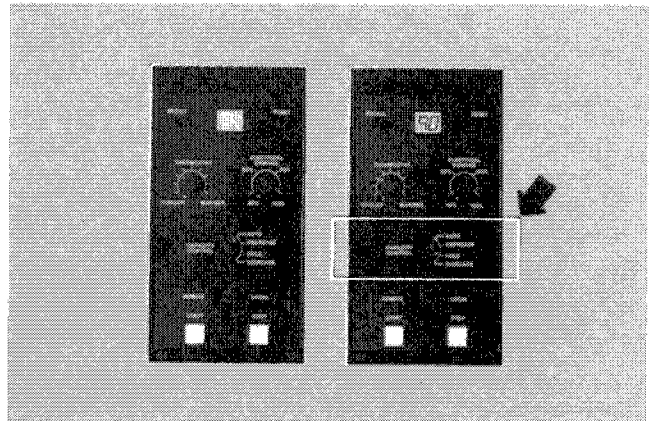
22. Now, compare the percentage calculated, which is 75, with the percentage shown on the display, 65 for this example.

If the percentage displayed does not match the percentage calculated, adjust the motor current span potentiometer counter-clockwise to increase and clockwise to decrease the display reading. Remember, the motor current span potentiometer is on the processor board.

**CAUTION:** Use the calibration tool provided with the machine to prevent the possibility of damaging the potentiometer or board.

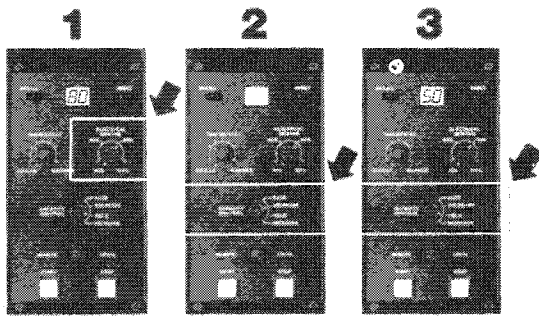
For this example, we will have to turn the current span potentiometer counter clockwise to increase the display reading until it shows 75, the percent calculated.

**NOTE:** When adjusting the motor current span, allow for a time lag of several seconds before the display reading changes.



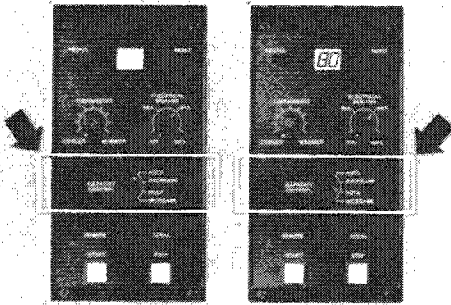
23. To check your calibration, do the following:

**Step 1** Allow the machine to operate and stabilize near full load with the capacity control knob at AUTO. Then, set the control knob to HOLD and note the percent displayed. For our example it is 90%.



24.

**Step 2** Set the electrical demand below the value noted on the display in step 1. We'll set it to 80%. Then, close the guide vanes manually, by setting the control knob to DECREASE, until the percent displayed is less than the electrical demand setting. Here the display shows 50, which is below the electrical demand setting of 80. (To display the percent, you'll have to set the knob to HOLD.)



25.

**Step 3** Turn the control knob back to AUTO. The guide vanes should open and then stop at 80, the electrical demand setting in the previous step. When the guide vanes stop opening, turn the control knob to HOLD. The percent displayed should equal the demand setting, which is 80 for this example.

If the display doesn't equal the electrical demand setting, repeat the calibration procedure.

26. Then, if you find that the electrical demand calibration is still not correct, check the voltage signal between terminals 23 and 24 on the terminal strip inside the control center. The voltage should be  $0.5 \pm .1$  volts AC at 100% rated load amps; if it isn't, check to make sure that the wiring is correct. You could have terminals 23 and 24 reversed. Check the wiring for any loose connections, or breaks in the wire. Check the size of the signal resistor in the starter. If the resistor is the wrong size, change it. If the resistor is OK, and the wiring is OK, the current transformer is bad and must be replaced.

[To determine what size the signal resistor should be, refer to the formula on Page 17.]

27. The next step in the start-up procedure is to operate the machine and adjust the thermostat on the setpoint/display board until the design chilled water or brine temperature is reached. Then, make sure that the temperatures, pressures, water flows, and the oil level are correct.

Also check the refrigerant charge when the machine is operating at design load and trim, if required. For complete details, refer to the Start-up and Operation Manual for your machine.

After completing your start-up, program the expanded services panel, if the machine is equipped with this option.

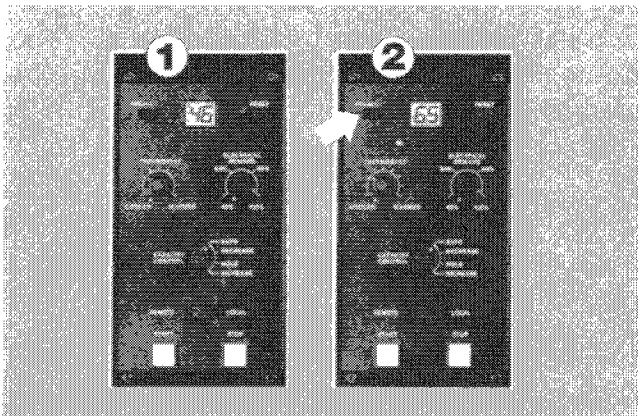
This completes the start-up section of this program.

28. Now, let's see how the microprocessor control system can help you when troubleshooting a component malfunction.

Remember, the two-digit display on the setpoint/display board uses the number codes for a pre-start failure or shutdown to let you know when and where a malfunction occurs.

29. The number codes used in conjunction with the diagnostic codes and troubleshooting guide will help you to find and correct most control problems.

Some component malfunctions may also require performing the controls test and checking out the processor, the input/output and the setpoint/display boards. [The procedures for checking out the boards are on Page 29.]



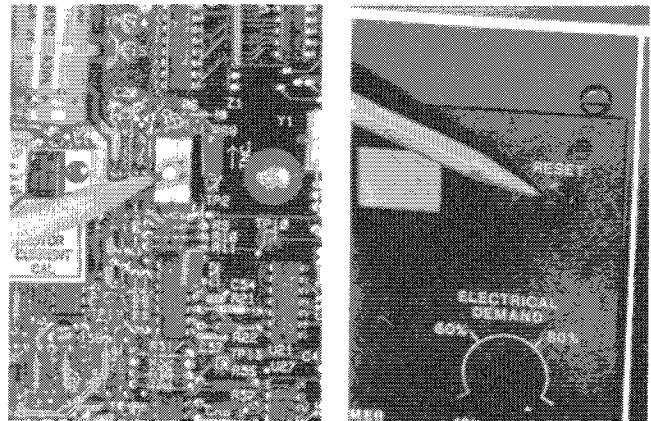
30. Here are the steps to follow when troubleshooting:

First, check the display for a pre-start failure or shutdown code and refer to the diagnostic codes and troubleshooting guide to determine the malfunction and probable cause.

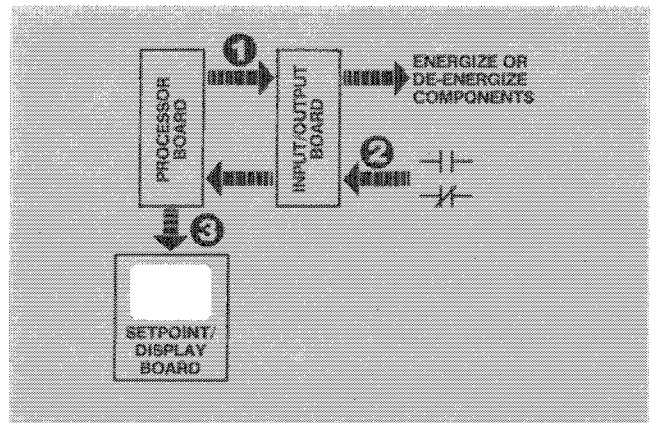
Then, recall the stored codes before turning off control center power or pressing the power-on-reset button.

**CAUTION:** The displayed and stored diagnostic codes will be lost if power is turned off or the power-on-reset button is pressed.

Compare the displayed code with the recalled codes for a pattern or for similarities.

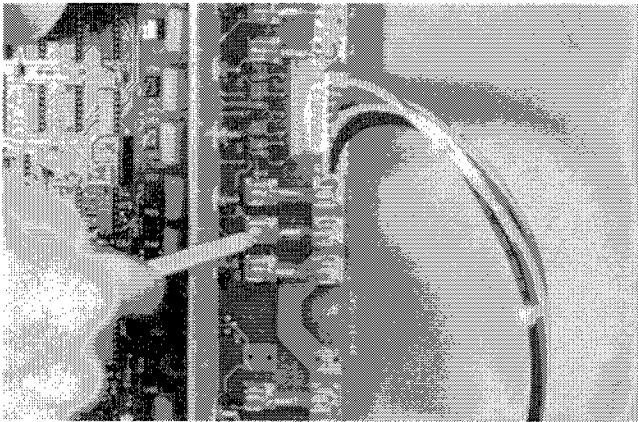


31. Next, you may have to perform the controls test to find and correct the problem. Remember, to enter the controls test, you must first press the power-on-reset (POR) button (on the processor board) and then press the reset button (on the setpoint/display board) within 10 seconds. This test will help you to determine if it is a board or an external component that is faulty. In most cases, if there is a malfunction, you will find that the boards are OK and that it is an external component which is the problem.

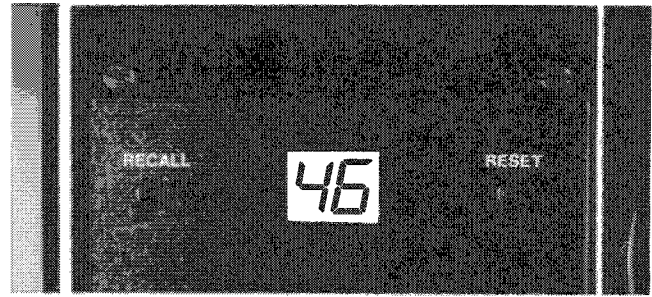


32. To troubleshoot any of the boards or an external component, keep these points in mind:

1. The processor board sends signals to the input/output board to energize or de-energize the components in the 115 volt control circuit.
2. The input/output board senses when a switch or contact opens or closes in the 115 volt circuit and sends a signal back to the processor board. With this information, the processor board knows whether the machine is operating properly or if there is a malfunction.
3. The setpoint/display board is energized by the processor board to display the time remaining until start-up, the start and run status codes, and the pre-start failure and shutdown codes.



33. Also, another point to remember is that there are fuses on the input/output board which protect it from excessive current. So, when you are checking out a problem in the 115 volt control section, don't forget to check the fuses.

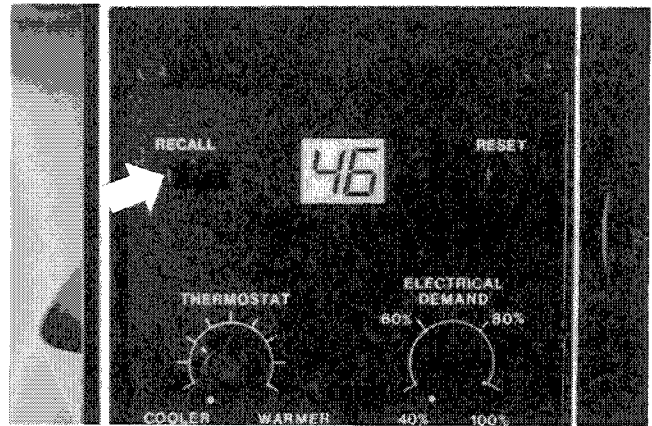


46	Oil Pressure Switch Not Closed Within 15 Seconds After Pump is Energized (Failure to develop pressure)	Check power to pump, check oil level, check oil pressure switch setting, check for dirty oil filters.
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34. Here's an example of how to troubleshoot a malfunction.

Let's assume a shutdown code of "46" is displayed.

The first step is to refer to the diagnostic codes and troubleshooting guide. According to the guide, a "46" means the oil pressure switch did not close within 15 seconds after the oil pump starter relay was energized.



35. Next, recall and compare any previous shutdown codes with the displayed code for the existing problem. This lets you know if the present type of shutdown occurred previously. And, if it did, this tells you that the problem may not have been properly diagnosed and corrected. So, check the service and maintenance log to see if any corrective action was taken previously.

36. Let's assume that we have to perform the controls test to pinpoint the problem.

After entering the controls test, go to step 1.4 (step 14). This is the step which relates to the pre-start failure code of "46".

When you press the reset button again, a "14" should be displayed and the oil pump should start and continue to run.

37. However, if a "14" is displayed and the oil pump starts, but doesn't continue to run, this tells us that the processor board is OK because it is sending out the correct signal, a "14", to the input/output board. And since the pump started, we know the input/output board is OK, because the oil pump starter relay was energized.

38. So, looking back at the diagnostic codes and troubleshooting guide, we can see that the problem may be: low oil level; the oil pressure switch is not set properly; or dirty oil filters.

39. If a "14" is displayed and the oil pump doesn't start, this indicates the processor board is OK because it is sending out the correct signal; but there is a problem with either the input/output board, the fuse for the oil pump circuit or an external component which includes all electrical connections.

To determine where the problem is, you will have to use the same procedures to find the problem that you would use on any unit. This includes being able to follow the wiring diagram, understanding the operating sequence, and knowing where to place the meter probes.

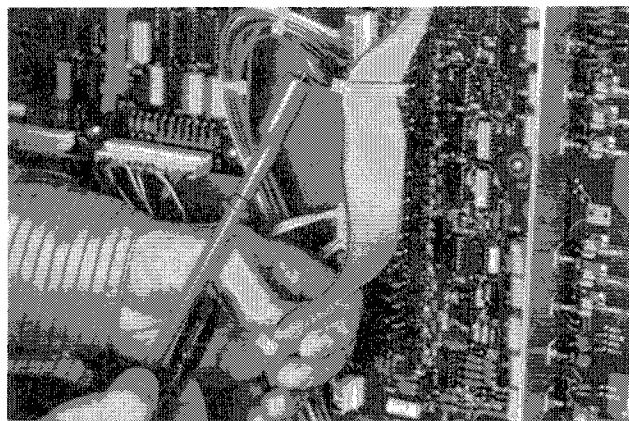
40. For this problem, the first and easiest thing to check is to make sure the ribbon cable and all electrical connections are tight.

**CAUTION:** Before checking the electrical connections, turn off the control power.

41. Next, after turning the power back on, check for voltage from L2 on the control panel terminal strip to plug 2J1, pin terminal 5 on the input/output board.

If you don't have voltage, check the fuse on the board for the oil pump circuit. If the fuse is OK, the input/output board is faulty or the ribbon cable has an open in one of the wires.

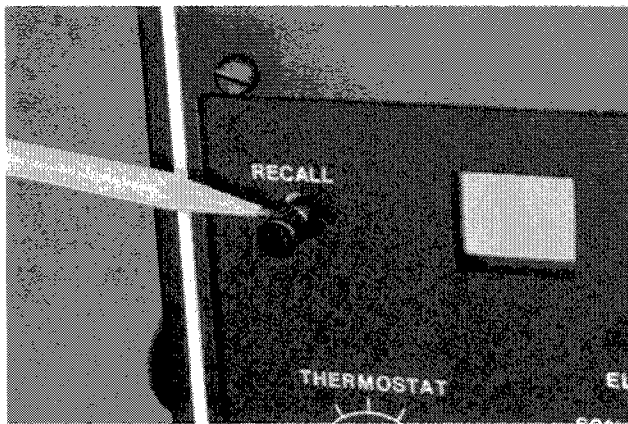
42. First, check the ribbon cable for continuity. If it's OK, the input/output board is faulty and must be replaced.



43. When checking the ribbon cable, you will find that most meter probes will not fit into its plug end connections. So, we recommend placing a piece of thermostat wire into the plug end connections and check across them with your meter.

44. If you have voltage from L2 to pin terminal 5 on plug 2J1, there is a problem with an external component. In this case, it could be the oil pump starter relay, the oil pump, or faulty wiring. Use your standard troubleshooting techniques to pinpoint the problem.

45. When checking step 1.4 (step 14), another problem which may occur is that a number other than "14" is displayed. This means the processor board is not sending out the correct signal and the oil pump will not start. The processor board is faulty and must be replaced.

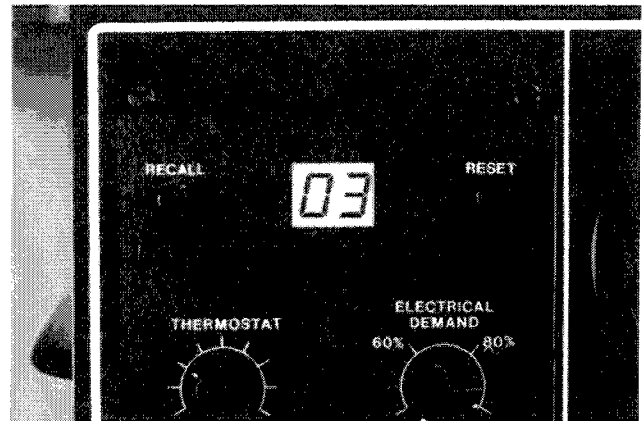


46. We've just covered the steps to follow when checking out a pre-start failure or a shutdown code.

Now, let's assume that the machine was operating, it shutdown, and code 20 or 21 appears on the display; and, when you press the recall button, there are not shutdown codes in memory. This indicates that the power to the control center was interrupted. The interruption may have been caused by a power failure or a faulty control transformer.

47. Also, if any one of the following problems exists, a code may not be displayed:

- A faulty processor board or setpoint/display board or ribbon cable;
- A loose ribbon cable connection between the boards; or,
- A loose 1J4 plug connection from the control transformer to the processor board.



48. If it was a power failure, when power is restored, a "03" will be displayed. Remember, this is the number of minutes until the machine can restart.

At the end of three minutes the display will show a code 20 or 21.

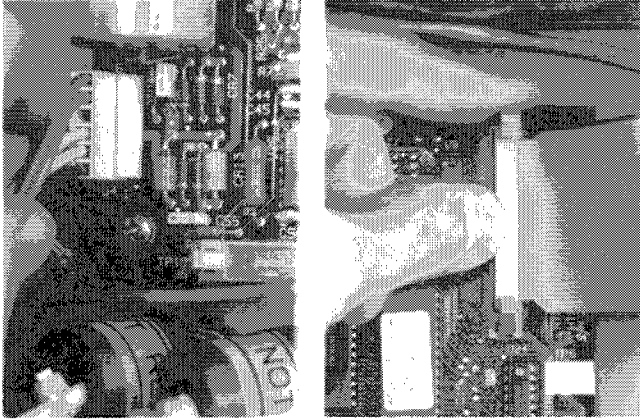
49. When you arrive at the machine and the display indicates that start-up is ready, press the start button. A start code should be displayed, which indicates the control center is energized.

If you get a start code, it's a good idea to stop the machine and perform the controls test to check out the components in the control system.

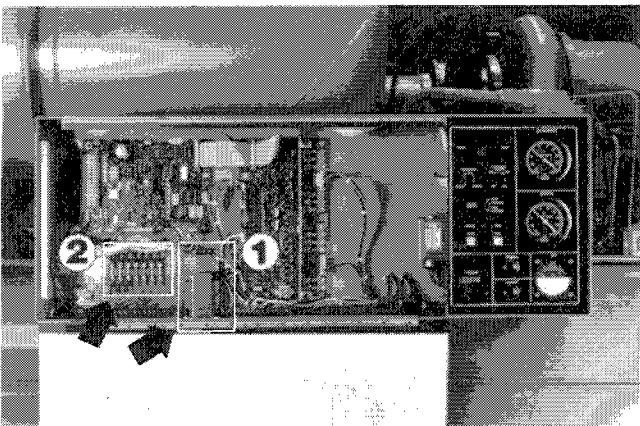
If all the components check out OK during the controls test, start and monitor the machine to make sure it is operating properly.

50. However, if the display is blank one of the following may be faulty:

- the control transformer; the processor board; the setpoint/display board; or the ribbon cable.
- Or there may be a loose ribbon cable connection or 1J4 plug connection.



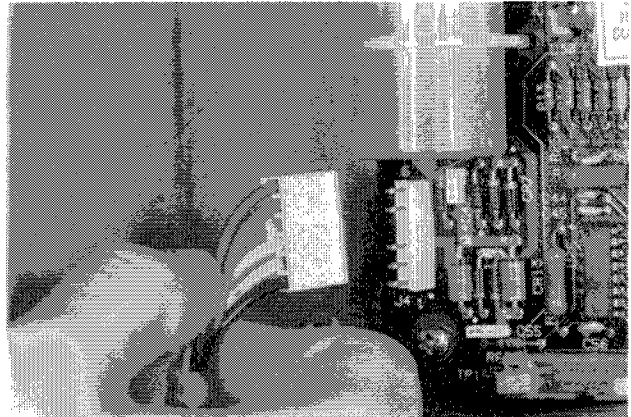
51. First, check the 1J4 plug connection, as shown on the left, and ribbon cable connections, as shown on the right.



52. Next, check the transformer. Here's how:

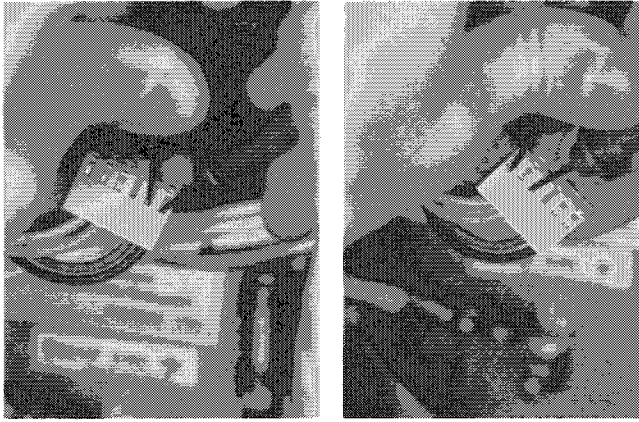
**Step 1** Make sure you have voltage to the primary side. If you don't, check the power supply to the control panel and the fuse connected to the primary side of the transformer.

**Step 2** Check the fuses on the secondary side of the transformer.



53.

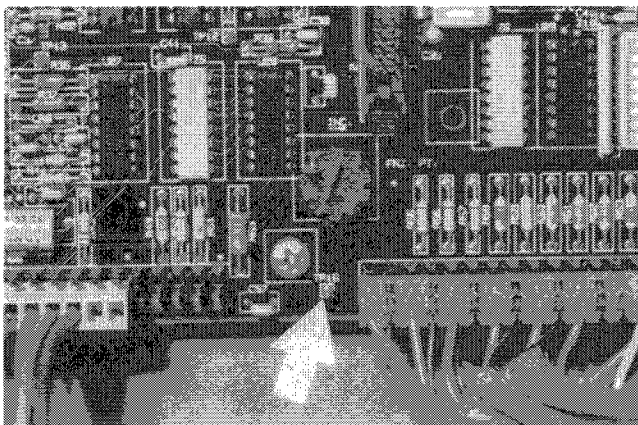
**Step 3** Shut the power off to the control center and remove terminal plug 1J4 from the processor board. We'll be checking the transformer's secondary voltages at the plug. The reason for removing the plug to check the voltage is that this plug is close to the side of the control box and it's easier to place the probes on the plug when it's removed.



54.

**Step 4** Check for 19 volts AC  $\pm 15\%$  between the brown and red leads of the transformer, as shown on the left; and 18 volts  $\pm 15\%$  between the orange and blue leads, as shown on the right. If either voltage is outside of this range, replace the transformer.

After you are through checking out the transformer, shut off the power and reconnect plug 1J4. Then, turn the power back on.



55. Now, if the transformer checks out OK, check out the processor board. To do this, we'll use a digital voltmeter because some of the voltages we are checking are negative.

Place the grounded meter probe on test point 16 (TP16) on the processor board.

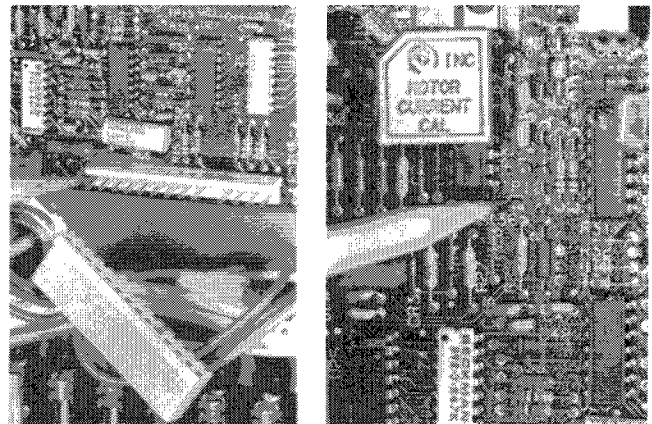
### PROCESSOR BOARD VOLTAGES

VDC			CHECK	
-10	$\pm$	1	PIN TERMINAL	1J3-7
+10	$\pm$	1	PIN TERMINAL	1J3-6
+4.8	to	6	TEST POINT	TP1
+4.8	to	6	TEST POINT	TP2
+4.8	to	6	TEST POINT	TP4
-4.8	to	-6	TEST POINT	TP6
+9	to	14	TEST POINT	TP9
+11	to	17	TEST POINT	TP15

56. With the other meter probe, check for the voltages at the pin terminals and test points shown here. (These are on the processor board.)

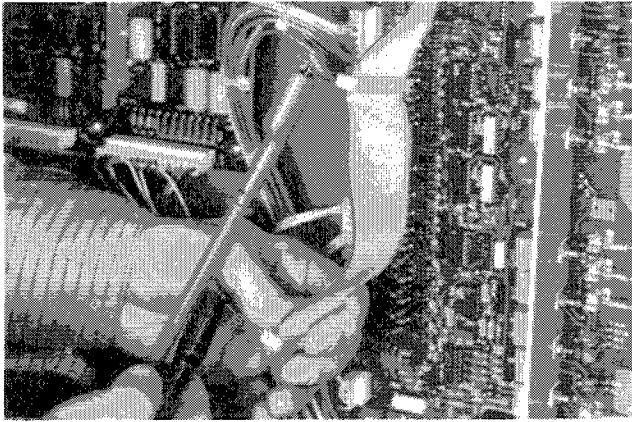
If any of the voltages are outside of the limits, the processor board is faulty and must be replaced.

[The voltages, pin terminals, and test points are listed on Page 29.]



57. When checking any of the boards, the meter probes should only be placed on the terminal connections or test points. A pin type terminal connection is shown on the left and a test point on the right. The test points are marked TP.

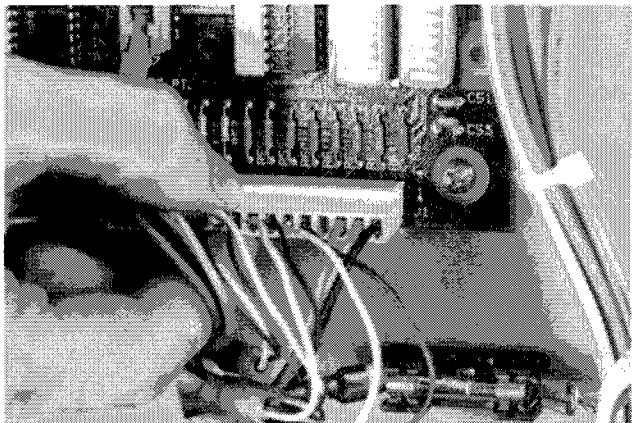
Never place the meter probes across any component on the board; if you do, the board may be damaged.



58. If you find that all the voltages are within the limits when checking the processor board, the next step is to check the ribbon cable for continuity.

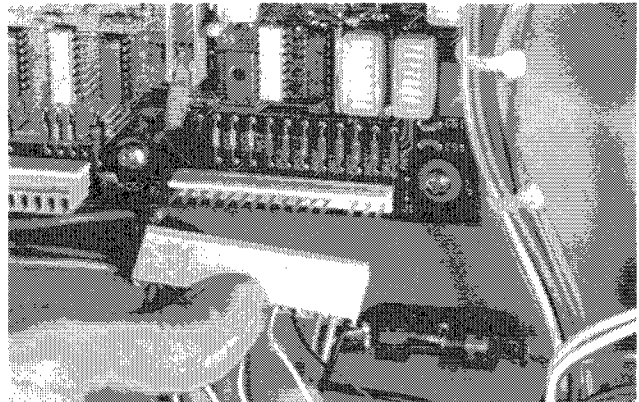
If the ribbon cable checks out OK, the setpoint/display board is faulty and must be replaced.

The check-out procedure that we've just covered can also be used if you can't enter or step through the controls test.

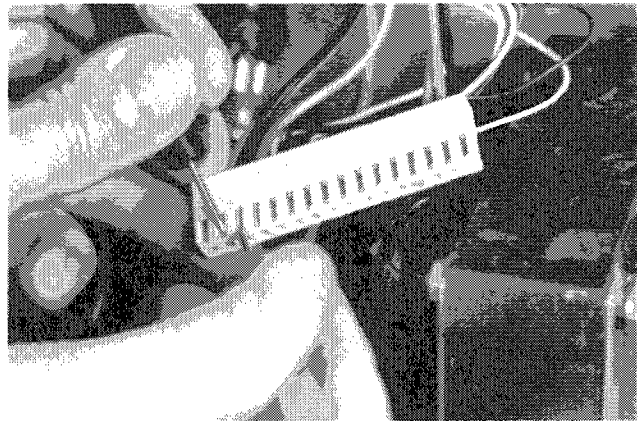


59. When performing the controls test, if a thermistor shows faulty, here's what you should do.

First, check the 1J1 terminal plug connection to make sure it is tight on the pin terminals.



60. If the plug connection is OK, check the resistance of the thermistor. However, before checking the resistance, shut the power off and remove the 1J1 plug connection. Removing the plug will isolate the thermistors and prevent the possibility of a feedback circuit which will give you a false reading.



61. We'll be checking the resistance from the plug, so refer to the wiring diagram to determine where to place the meter probes.

Now, measure the resistance and check the temperature gauge in the area of the thermistor.

**SENSOR  
RESISTANCE  
AND  
TEMPERATURE**

Temperature		Resistance
C	F	Ohms
20	68	6,246.0
21	69.8	5,971.0
22	71.6	5,709.5
23	73.4	5,461.0
24	75.2	5,225.0
25	77	5,000.0
26	78.8	4,786.1
27	80.6	4,582.5
28	82.4	4,388.7
29	84.2	4,204.2

62. Compare the actual measured resistance to the resistance in the chart corresponding to the gauge temperature.

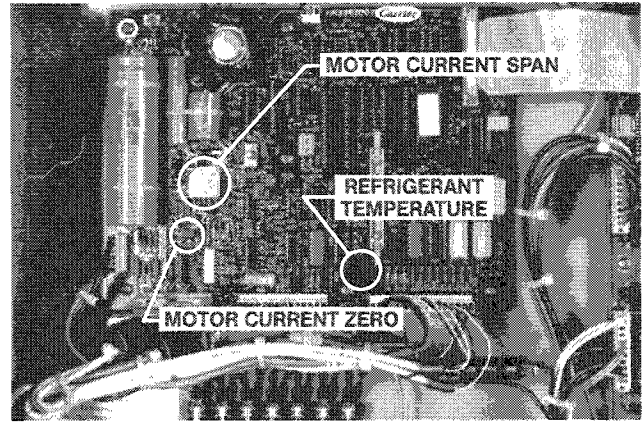
For our example, the measured resistance is 5,100 ohms and the gauge temperature is 77°F (25°C). Referring to the Sensor Resistance versus Temperature Chart, the resistance for 77°F (25°C) is 5,000 ohms.

The measured resistance should be approximately the same as the resistance in the chart; if it isn't, the thermistor is faulty. For our example, the thermistor is OK, 5100 versus 5000 ohms.

[A complete copy of this chart is on Page 27.]

Check the resistance of each side of the thermistor to ground. You should see infinite resistance. If not, the thermistor is grounded and should be replaced.

63. If both the 1J1 plug connection and the thermistor resistance check out OK, the processor board is faulty and must be replaced.



64. To troubleshoot the potentiometers, here's what you should do:

If the refrigerant temperature, motor current span, or motor current zero potentiometer cannot be adjusted to the desired setting, replace the processor board. These potentiometers are an integral part of the board and cannot be replaced separately.

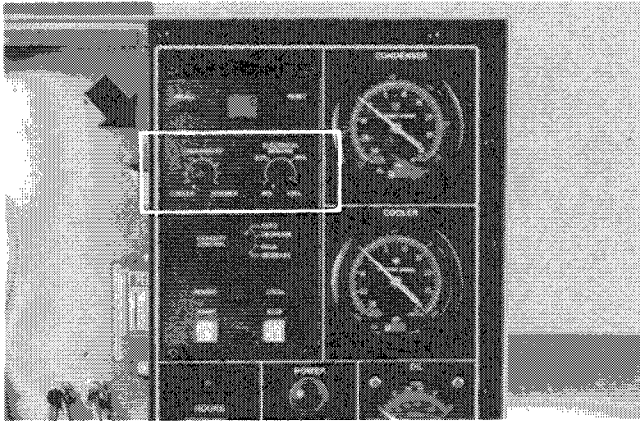
Remember, if you have a 19DR, you'll have an analog expansion board which also has a motor current span and a motor current zero potentiometer. If these potentiometers cannot be adjusted, replace the analog expansion board.

65. If the diffuser feedback potentiometer for a DM compressor shows faulty during the controls test, check the 1J2 plug connection to make sure it is tight on the pin terminals.

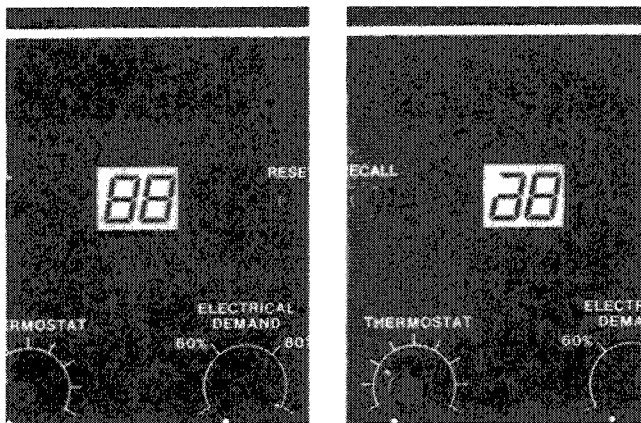
If the plug connection is OK, check the resistance of the potentiometer. Don't forget to shut off the power and remove the plug. Also, refer to the wiring diagram to determine where to place the meter probes.

When you measure the resistance, if it shows the potentiometer is open or shorted, the potentiometer is faulty and must be replaced.

If both the 1J2 plug and resistance check out OK, the processor board is faulty and must be replaced.



66. To check out the electrical demand and the thermostat setpoint potentiometers, perform the controls test. If either potentiometer shows faulty, replace the setpoint/display board.



67. The two-digit display, located on the setpoint/display board, can also be checked during the controls test. If the board is OK, the results of step number 0.1 (step 1) should be an "88". If any part of the number is missing, this will indicate a display failure which may affect the output codes. Although the machine can still operate, we recommend that the setpoint/display board be replaced.

68. This completes our training program on Carrier's 32MP microprocessor control system.

The information in this program along with the Start-up, Operation, and Maintenance Instructions should enable the serviceman to be more efficient in performing maintenance and in servicing this equipment.

## TABLE 1

### Current Transformer Resistor Calculation

To determine resistor needed for .5 Volt signal to processor board use Ohms Law –  $E = I \times R$ .

**EXAMPLE:**

<u>Given</u>	<u>Find</u>
RLA = 600	Resistance = R
$E \left( \begin{smallmatrix} \text{Voltage} \\ \text{Signal} \end{smallmatrix} \right) = .5 \text{ (At 100\% RLA)}$	Current = I
Current Transformer Ratio = 600:5 or 120:1	

**STEP 1** — Calculate current (I) sensed by current transformer at 100% RLA.

	Current Transformer
RLA	Ratio
Current Sensed = 600	÷ 120
Current Sensed = 5 Amps (I)	

**STEP 2** — Calculate Resistance Needed

$$E = I \times R$$
$$.5 = 5 \times R$$
$$\frac{.5}{5} = R$$
$$R = .1 \text{ ohms}$$

For this example we need a .1 ohm resistor.

**STEP 3** — Use an accurate VOM and measure resistance of signal resistor in starter.  
If resistance measured doesn't equal the resistance calculated, contact starter manufacturer for correct resistor.



TABLE 2 — CONFIGURATION (DIP) SWITCH SETTINGS (continued)

SWITCH FUNCTION	SWITCH BANK	SWITCH POSITION	SWITCH STATUS	CONFIGURATION DESCRIPTION
Compressor Identification Code  19DM Compressors Only  Impeller Diameter (Decrease for med. load, med. lift surge problems)	3	2,3,4,5	On-Off-Off-On Off-Off-Off-Off On-Off-Off-Off Off-On-Off-Off On-On-Off-Off On-Off-Off-Off Off-On-Off-Off On-On-Off-Off	42,49,56,63,B2,72,79,86,93,C2 43,50,57,64,B3,73,80,87,94,C3 44,51,58,65,B4,74,81,88,95,C4 45,52,59,66,B5,75,82,89,96,C5 46,53,60,67,B6,76,83,90,97,C6 204,224,254,284,314,354,404,454,504 205,225,255,285,305,315,355,405,455,505 206,226,256,286,306,316,356,406,456,506  DECREASE  ↑  ↓  INCREASE
Compressor Selection Factor  19DM Compressors Only  (Increase zone for high load, low lift surge problems, decrease zone for max. FLA or load problems)	4	3,4,5	Off-Off-Off On-Off-Off Off-On-Off On-On-Off Off-Off-On On-Off-On Off-On-On On-On-On	Zone DECREASE 1 2 3 4 * 5 6 7 8 INCREASE
Compressor Motor Amps Correction Factor (Unseen internal correction to % amperage based on the difference in motor power factor at various loads)  19DM Compressors Only (Decrease setting for low load surge problems)	4	6,7,8	Off-On-Off On-Off-Off Off-Off-Off On-On-Off Off-Off-On On-Off-On Off-On-On On-On-On	DECREASE  ↑ 0.0 * ↓ INCREASE

\* Recommended setting for average conditions.  
\*\* Analog

NOTE: Switch banks and switch positions not designated above are not applicable to this machine and do not require setting. Leave these switches Off.

TABLE 3 — CONTROLS TEST

STEP NUMBER	TEST DESCRIPTION	DISPLAY CODE OR ACTION
0.1	Display 88 to verify proper operation	88 — OK XX — Faulty Setpoint/Display Board
0.2	Display set point of evaporator refrigerant temperature	33 — Water XX — Brine Temperature (adjust with refrigerant temperature set point potentiometer and note set point displayed in LCD).
0.3	Display % RLA of compressor motor current	0 — OK XX — Faulty Calibration (adjust motor current zero potentiometer and note on LCD).
0.4	Display controller identification number (00 to 07)	XX — Confirm
0.5	Display leaving chilled water sensor input status	1 — OK 0 — Faulty Sensor
0.6	Display condenser refrigerant sensor input	1 — OK 0 — Faulty Sensor
0.7	Display compressor discharge sensor input status	1 — OK 0 — Faulty Sensor
0.8	Display evaporator refrigerant temperature sensor input status	1 — OK 0 — Faulty Sensor
0.9	Machines with analog motor winding sensor — Display sensor input status	1 — OK 0 — Faulty Sensor 2 — Faulty Configuration of Dip Switch 1-7
	Machines with digital motor winding sensor — Display sensor input status	2 — OK 0 — Faulty Sensor 1 — Faulty Configuration of Dip Switch 1-7
1.0	Machines with analog thrust bearing sensor — Display sensor input status	1 — OK 0 — Faulty Sensor 2 — Faulty Configuration of Dip Switch 1-8
	Machines with digital thrust bearing sensor — Display sensor input status	2 — OK 0 — Faulty Sensor 1 — Faulty Configuration of Dip Switch 1-8
1.1	Display leaving chilled medium set point potentiometer input status	1 — OK 0 — Faulty Pot.
1.2	Display demand limit set point potentiometer input status	1 — OK 0 — Faulty Pot.
1.3	Machines with DM compressor — Display diffuser wall potentiometer status	1 — OK 0 — Faulty Pot. 2 — Faulty Configuration of Dip Switch 1-1
	All machines except DM — Display configuration status	2 — OK 0 — Faulty Pot. 1 — Faulty Configuration of Dip Switch 1-1
1.4	Energize oil pump starter relay*	14 — Response (Confirm oil pump running)
1.5	Energize leaving chilled water pump starter relay*	15 — Response (Confirm chill water pump running)
1.6	Energize condenser water pump starter relay*	16 — Response (Confirm cond. pump running)
1.7	Energize tower fan starter relay*	17 — Response (Confirm Tower fan energized)
1.8	Energize increase diffuser wall position solenoid and oil pump* (only for machines with DM compressor)	18 — Response (Confirm)
1.9	Energize decrease diffuser wall position solenoid and oil pump* (only for machines with DM compressor)	19 — Response (Confirm)
2.0	Energize increase guide vane position digital output* (capacity control switch in AUTO.)	20 — Response (Confirm)

\* Energize command can be cancelled by depressing reset pushbutton within one second after test number is displayed.  
XX — Any Display that is shown.

TABLE 3 — CONTROLS TEST (continued)

STEP NUMBER	TEST DESCRIPTION	DISPLAY CODE OR ACTION
2.1	Energize decrease guide vane position digital output* (capacity control switch in AUTO.)	21 — Response (Confirm)
2.2	Energize purge pump relay* (where applicable)	22 — Response (Confirm)
2.3	Energize alarm output indicating safety limit has been exceeded*	23 — Response (Confirm)
2.4	Machines with analog motor winding sensor — Display configuration status	1 — OK 0 — Faulty Configuration of Dip Switch 1-7
	Machines with digital motor winding sensor — Display motor high temperature switch status	1 — OK (Closed) 0 — Faulty (Open)
2.5	Machines with analog thrust bearing sensor — Display configuration status	1 — OK 0 — Faulty Configuration of Dip Switch 1-8
	Machines with digital thrust bearing sensor — Display switch status	1 — OK (Closed) 0 — Faulty (Open)
2.6	Display purge operating switch status (where applicable)	1 — OK (Closed) 0 — Faulty (Open)
2.7	Display configuration status	1 — OK 0 — Faulty Jumper or Impeller Switch Open Between 1J2-11 and 1J2-12
2.8	Display spare safety input status	1 — OK (Closed) 0 — Faulty (Open)
2.9	Display chilled water flow switch contact status	1 — OK — Open, Pump Off (Confirm) 0 — Closed — Pump On (Confirm)
3.0	Display condenser water flow switch contact status	1 — OK — Open, Pump Off (Confirm) 0 — Closed — Pump On (Confirm)
3.1	Display oil pressure switch status	1 — OK (Open) 0 — Faulty (Closed)
3.2	Display ICR auxiliary contact status	1 — OK (Closed) 0 — Faulty (Open)
3.3	Display starter run contact	1 — OK (Open) 0 — Faulty (Closed)
3.4	Cycle back to first test (depress reset pushbutton)	0.1
	End controls test (depress POR pushbutton)	03 Minutes

\* Energize command can be cancelled by depressing reset pushbutton within one second after test number is displayed.

TABLE 3a — CONTROLS TEST

Steps 3.4 to 3.8 with optional expanded services panel.

STEP NUMBER	TEST DESCRIPTION	RESULTS DISPLAYED	RESPONSE
3.4	Read optional thermistor #1 status	0 — Faulty 1 — OK 2 — Not used	
3.5	Read optional thermistor #2 status	0 — Faulty 1 — OK 2 — Not used	
3.6	Read temperature reset 4–20ma sensor status	0 — Faulty 1 — OK 2 — Not used	
3.7	Read demand setpoint 4–20ma sensor status	0 — Faulty 1 — OK 2 — Not used	
3.8	Cycle back to 1st test step (depress reset pushbutton)	0.1	
	End controls test (depress POR pushbutton)	03 Minutes	

TABLE 4 — DIAGNOSTIC CODES AND TROUBLESHOOTING GUIDE


TYPE	CODE NO.	DESCRIPTION/MALFUNCTION	PROBABLE CAUSE/REMEDY
TIMER	01-15	Time Remaining Until Restart (Decreases at one-minute intervals)	15-minute or 3-minute start inhibit timers not expired.
START STATUS	20	Ready for Start-Up (Local)	Start inhibit timer expired LOCAL/REMOTE switch in LOCAL position. Machine can only be started by set point/display board start pushbutton.
	21	Ready for Start-Up (Remote Contact)	Start inhibit timer expired LOCAL/REMOTE switch in REMOTE position. Machine can only be started by remote contact closure.
	22	Ready for Start-Up (ESP)	Start inhibit timer expired LOCAL/REMOTE switch in REMOTE position. Machine can only be started by Expanded Services Panel (ESP).
	23*	Lag Chiller Ready for Restart	Lag chiller start inhibit timer expired. Lag chiller waiting to be started by the ESP when required.
	25	Recycle Restart Pending	Leaving chilled water or brine temperature too low for recycle start-up ( $\leq 5\text{ F}$ [2.8 C] above set point).
	26	Start-Up in Progress	Prestart checks being performed, water flows and oil pressure being established.
RUN STATUS	27	Temperature Reset Active	Indicates that either of the temperature reset options is active.
	28	Temperature Capacity Control	Machine operating normally under temperature control.
	29	Ramp Loading Capacity Control	Leaving temperature pulldown rate being limited by ramp loading.
	30	Demand Limit Capacity Control	Compressor motor current > demand limit set point — check motor current calibration.
	31*	Lead/Lag Manually Decoupled (ESP displays 31, lead and lag chillers display present status code)	Lead chiller switched to local. Both chillers under local control. To resume lead/lag operation, return lead machine to remote.
	32*	Lead/Lag Manually Decoupled (ESP displays 32, lead and lag chillers display present status code)	Lead chiller under ESP control. Lag chillers switched to local and under local control. To resume lead/lag operation, return lag machine to remote.
	33*	Lead/Lag Temporarily Decoupled (ESP displays 33, lead and lag chillers display present status code)	Lead chiller communications error. Both chillers under local control. Lead/lag will resume when error is corrected.
	34*	Lead/Lag Temporarily Decoupled (ESP displays 34, lead and lag chillers display present status code)	Lag chiller communications error. Lag chiller under local control. Lead chiller under ESP control. Lead/lag will resume when error is corrected.
	35	Motor Temperature Override	Motor temperature > 200°F (93.3 C): Check motor temperature immediately. Check for proper sensor resistance to temperature reading.
	36	Refrigerant Temperature Override	Refrigerant temperature $\leq 1^\circ\text{F}$ (0.56 C) above trip limit — check refrigerant temperature, check sensor resistance, check refrigerant charge.
	37	Excessive Purging	See description/malfunction Purge Cycles Often in AUTO Position.
	38*	Lead Chiller Redesignation in Process (ESP displays 38, lead and lag chillers display present status code)	ESP reprogrammed to switch lead/lag chillers when one chiller was ON and the other was OFF. Switch will take place when either both are ON or both are OFF.
	39*	Lead/Lag Operation Temporarily Decoupled (ESP displays 39, lead and lag chillers display present status code)	Error that decoupled lead/lag has been corrected. Lead/lag operation will be restored when either both chillers are ON or both chillers are OFF.
	40	Motor Winding Temperature Too High to Start	Motor operating temperature limits exceeded.
PRESTART FAILURE STATUS	41	Motor Than 4 Starts in Past 6 Hours	Start inhibited by 4 Starts/6-Hour counter. Depress reset pushbutton if additional start is required.
	42	Failure of Condenser Pump to Establish Flow	Check pump operation, check power supply and pilot relay, check flow switch, check water valves, check for air in water lines.
	43	Failure of Evaporator Pump to Establish Flow	Check pump operation, check power supply and pilot relay, check flow switch, check water valves, check for air in water lines.
	44	Defective Oil Pump Pressure Switch	Oil pressure switch contact closed with pump de-energized, check contacts. Check setting.

These codes apply only to options available with the ESP (Expanded Services Panel).

\* Applies only to single-compressor chillers when lead/lag is activated by the ESP.

TABLE 4 — DIAGNOSTIC CODES AND TROUBLESHOOTING GUIDE (continued)

TYPE	CODE NO.	DESCRIPTION/MALFUNCTION	PROBABLE CAUSE/REMEDY
PRESTART FAILURE STATUS (cont)	46	Oil Pressure Switch Not Closed Within 15 Seconds After Pump is Energized (Failure to develop pressure)	Check power to pump, check oil level, check oil pressure switch setting, check for dirty oil filters.
	48	Low/High Line Voltage	Control center voltage supply < 94.3 VAC or > 135.7 VAC for one minute. Check voltage supply. Check control center transformer, check circuit loading, consult power utility if line voltage is low. See I/O Board Replacement.
SHUTDOWN STATUS	54*	Lead Chiller Malfunction (ESP displays 54, lead chiller displays error code, lag chiller displays present status code.) Code 54 will be displayed at ESP only when lead/lag option is active. When lead/lag is not active, ESP will display error code.	Lead chiller shutdown on safety. Lag chiller under local control. Check lead chiller status for shutdown code. Correct malfunction and reset lead chiller.
	55*	Lag Chiller Malfunction (ESP displays 55, lag chiller displays error code, lead chiller displays present status code.) Code 55 will be displayed at ESP only when lead/lag option is active. When lead/lag is not active, ESP will display error code.	Lag chiller shutdown on safety. Lead chiller under ESP control. Check lag chiller status for shutdown code. Correct malfunction and reset lag chiller.
	60	Compressor Discharge Temperature > 220 F (104 C)	Check discharge temperature immediately, check sensor resistance, check for proper condenser water flow and temperature, check oil reservoir temperature, check condenser for air or water leaks.
	61	Evaporator Refrigerant Temperature < Limit	Check refrigerant temperature, check sensor resistance, check refrigerant charge.
	62	Motor Winding Temperature Too High	Motor operating temperature limits exceeded.
	63	Thrust Bearing Temperature > 220 F (104 C)	Check oil reservoir temperature, check oil cooler water flow and solenoid, check oil heater thermostat setting, check sensor resistance and connections at compressor junction box, check journal and thrust bearings if other checks OK.
	64	Sensor Out-of-Range The display of Code 64 will alternate with the display of the specific fault code number associated with the error condition.	Perform controls test to check for defective set point potentiometer(s) or open or shorted sensors, check sensor resistance.
	64/1	Leaving Chilled Water Sensor Out-of-Range	
	64/2	Evaporator Refrigerant Sensor Out-of-Range	
	64/3	Condenser Refrigerant Sensor Out-of-Range	
	64/4	Thrust Bearing Sensor Out-of-Range	
	64/5	Motor Winding Sensor Out-of-Range	
	64/6	Discharge Temperature Sensor Out-of-Range	
	64/7	Optional Temperature #1 Sensor Out-of-Range	
	64/8	Optional Temperature #2 Sensor Out-of-Range	
65	Oil Pressure < Limit	Check power to pump, check oil level, check oil pressure switch setting, check for dirty oil filters, check for oil foaming at start-up, reduce ramp loading rate if oil foaming is noted.	
66	Motor Overload Trip	Check motor overload dashpots and setting (do not attempt field calibration), check motor current demand calibration. Check optional compressor motor starter protective devices (e.g., phase loss ground fault, etc).	

 These codes apply only to options available with the ESP (Expanded Services Panel).

\* Applies only to single-compressor chillers when lead/lag is activated by the ESP.

TABLE 4 — DIAGNOSTIC CODES AND TROUBLESHOOTING GUIDE (continued)

TYPE	CODE NO.	DESCRIPTION/MALFUNCTION	PROBABLE CAUSE REMEDY
SHUTDOWN STATUS (cont)	67	Temporary Loss of Line Voltage	Control center voltage < 57.5 VAC for one cycle --- depress reset pushbutton and restart.
	68	Low-Line Voltage	Control center voltage < 94.3 VAC for 5 seconds, check control center voltage, check control center transformer, check circuit loading, consult power company.
	69	High-Line Voltage	Control center voltage 135.7 VAC for one minute. Check control center voltage, check control center transformer, check power company.
	70	Loss of Chilled Water Flow	Check pilot relay, check power to pump, check flow switch, check water valves.
	71	Loss of Condenser Water Flow	Check pilot relay, check power to pump, check flow switch, check water valves.
	72	Excessive Impeller Displacement	Check safety switch for continuity, check ground on wire 70. If open, check thrust clearance --- correct, replace switch. If no switch present, check jumper.
	73	High Condenser Pressure	Check high condenser pressure switch setting, check for proper condenser water flow and temperature, check for fouled tubes.
	74	Failure of Starter to Complete Transition	Check starter, check run contact, check DIP switch configuration for proper starter type.
	75	Excessive Motor Acceleration Time	Check to ensure guide vane is closed at start-up, check starter transfer time, check guide vane linkage. Check DIP switch configuration for proper starter type. Check motor current calibration.
	76	Illegal Configuration	Check for proper unit configuration, check ESP I.D. programing.
	77	Run Transition Contacts Failed to Deactivate On Shutdown	Check run contact 1CR relay, check starter for welded contacts. Check for 0 volts at 18; replace ribbon cable.
	78	Manual Override Shutdown	Stop pushbutton depressed while operating from a remote contact.
	78	Manual Override Shutdown	Machine was started from S/D board, but stop pushbutton on ESP is depressed; or machine was started from ESP but stop pushbutton on S/D board or ESP is depressed; or stop pushbutton on S/D board or ESP is depressed while machine is operating from a remote contact.
	79	Spare Safety Limit Exceeded	Check spare safety contact(s), check spare safety operation.
	80	Recycle with Motor Current > 65% of RLA	Check for proper cooler and condenser water flows and temperatures, check leaving chilled water/brine sensor resistance, check motor current calibration, check guide vane actuator and linkage, increase motor amps.
	81	Loss of Communication	Communication between the basic controller and the ESP not initialized or lost for more than 15 seconds after being initialized. See ESP Operating Instructions.
	82	Loss of Motor Current Signal	Failure to establish or maintain a motor current signal from the starter.
	87	Starter Run Contact Was Opened While Running	Check starter, check run contact, check field wiring
	89/4	Compressor Diffuser Feedback Potentiometer Out-of-Range	Check for open or shorted potentiometer. Check calibration.
	—	—	Chilled Water Temperature Too High (Machine running)

These codes apply only to options available with the ESP (Expanded Services Panel).

\* Applies only to single-compressor chillers when lead/lag is activated by the ESP.

TABLE 4 — DIAGNOSTIC CODES AND TROUBLESHOOTING GUIDE (continued)

TYPE	CODE NO.	DESCRIPTION/MALFUNCTION	PROBABLE CAUSE/REMEDY
—	—	Chilled Water Temperature Too High (Machine running) (cont)	REFRIGERANT LEVEL LOW — Check for leak; repair. Add refrigerant and trim charge.
			LIQUID BYPASS IN WATER BOX — Examine division plates and gaskets for leaks.
			GUIDE VANE FAILS TO OPEN — Check for defective actuator — replace.
			GUIDE VANES FAIL TO OPEN FULLY — Be sure that capacity control switch is in AUTO. position. If vanes will not open with switch at INC, check for excessive cooling load (see above). Check chilled water or brine sensor resistance. Check guide vane linkage. Check limit switch in actuator, check that sensor is connected to proper terminals.
			LAG COMPRESSOR NOT STAGING ON (DUAL COMPRESSOR UNITS) — Check lag compressor status. Check that start requirements have been met.
—	—	Chilled Water or Brine Temperature Too Low (Machine running)	THERMOSTAT SET TOO LOW — Return thermostat to proper setting.
			GUIDE VANES FAIL TO CLOSE — Be sure that capacity control switch is in AUTO. position. Check chilled water sensor resistance, check guide vane linkage. Check for defective actuator — replace, check that sensor is connected to proper terminals.
			DEFECTIVE SENSOR — Check sensor resistance.
			EVAPORATOR REFRIGERANT TEMPERATURE SET POINT IMPROPERLY SET (Brine Chilling Only) — Check refrigerant temperature set point.
—	—	Chilled Water Temperature Fluctuates; Vanes Hunt	DEADBAND TOO NARROW (Erratic Flow or Temperature) — Configure DIP switch for 2 F (1°C) deadband.
			PROPORTIONAL BAND TOO NARROW (Erratic Flow or Temperature) — Configure DIP switch for 15 F (8.3 C) proportional band.
			LOOSE GUIDE VANE LINKAGE — Adjust guide vane linkage.
			DEFECTIVE VANE ACTUATOR — Replace actuator.
—	—	Oil Reservoir Temperature Too Low	DEFECTIVE SENSOR — Check sensor resistance.
			OIL COOLER WATER FLOW TOO HIGH — Throttle water to reduce flow.
			THERMOSTAT IMPROPERLY SET OR DEFECTIVE — Check voltage across thermostat while adjusting; if contacts do not close, replace thermostat.
—	—	Oil Reservoir Temperature Too High	OIL HEATER DEFECTIVE — If light indicates power but unit does not heat, check unit for open or short. Replace unit if required.
			THERMOSTAT IMPROPERLY SET — Adjust thermostat.
			OIL COOLER WATER FLOW TOO LOW — Open plug valve.
—	—	Purge Cycles Often in AUTO. Position	OIL COOLER SOLENOID VALVE OPERATING IMPROPERLY — Check electrical operation of solenoid. Inspect valve; if screen is fouled, clean and install a 20-mesh strainer ahead of valve.
			OIL COOLER COIL FOULED — Clean coil; replace cooler if required.
			Purge valves not tightly closed. Check valve settings. Close applicable valves securely.
			Solenoid valve leaking. Allow smoke to drift past connection B. If smoke is drawn into line, repair or replace valves.
—	—	Excessive Refrigerant Loss	Incorrect purge operating switch setting. Check switch per Table 6 with metered supply of air. Recalibrate or replace as required.
			Excessive air leakage into machine. Check machine for leaks. Purge condensing chamber float valve stuck in closed position or return line plugged. (Refrigerant level will be above sight glass.)
			Purge liquid supply orifice blocked or excessive flashing in the line ahead of the orifice.
			Purge pump cycles often. See Purge Cycles Often in AUTO. Position, above.

TABLE 4 — DIAGNOSTIC CODES AND TROUBLESHOOTING GUIDE (continued)

TYPE	CODE NO.	DESCRIPTION/MALFUNCTION	PROBABLE CAUSE/REMEDY
—	—	Purge Does Not Operate in AUTO. Position.	<p>Normal. Purge pump does not operate unless purge pressure is within 2 to 4 psi (14 to 28 kPa) of condenser pressure. Check gage readings. See Purge Operation.</p> <p>Blown fuse. (On some units.) Check 15-amp fuse inside purge electrical switch box (on some units).</p> <p>Loose connections or broken wires. Check purge control switch connections.</p> <p>Check circuit to purge motor, indicator light, solenoid switch and solenoid valve by switching to MANUAL.</p> <p>Check purge operating switch and K1 relay connections.</p> <p>Purge inhibited; check display for code.</p> <p>Incorrect purge or operating switch settings. Check switch per Table 7 with metered supply of air. Recalibrate or replace as required.</p> <p>Purge condensing chamber float valve stuck in open position (indicated by low refrigerant level).</p>
—	—	Oil pump energized at power-up or P.O.R.	Dip switch (1-2) configured for non-gearred machine (Normal operation for that type).

TABLE 5 — SENSOR RESISTANCE AND TEMPERATURE (F)

TEMP (F)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (F)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (F)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (F)	RESISTANCE (Ohms)	VOLTAGE DROP (v)
-25.0	98009.6	4.684	38.0	13825.5	3.373	101.0	2834.9	1.500	164.0	765.3	0.527
-24.0	94707.1	4.673	39.0	13449.2	3.343	102.0	2773.2	1.476	165.0	749.5	0.518
-23.0	91521.5	4.662	40.0	13084.2	3.312	103.0	2713.1	1.453	166.0	734.2	0.509
-22.0	88448.9	4.651	41.0	12730.1	3.281	104.0	2654.7	1.430	167.0	719.2	0.501
-21.0	85485.5	4.640	42.0	12386.6	3.250	105.0	2597.8	1.407	168.0	704.6	0.493
-20.0	82627.2	4.628	43.0	12053.3	3.219	106.0	2542.3	1.385	169.0	690.4	0.484
-19.0	79870.6	4.616	44.0	11730.0	3.187	107.0	2488.3	1.362	170.0	676.6	0.476
-18.0	77212.0	4.604	45.0	11416.1	3.156	108.0	2435.8	1.341	171.0	663.3	0.468
-17.0	74647.9	4.591	46.0	11111.5	3.124	109.0	2384.5	1.319	172.0	650.3	0.461
-16.0	72175.1	4.578	47.0	10815.8	3.093	110.0	2334.6	1.298	173.0	637.7	0.453
-15.0	69790.3	4.565	48.0	10528.7	3.061	111.0	2285.9	1.277	174.0	625.5	0.446
-14.0	67490.4	4.551	49.0	10250.0	3.029	112.0	2238.5	1.256	175.0	613.8	0.438
-13.0	65272.4	4.537	50.0	9979.3	2.997	113.0	2192.2	1.236	176.0	602.3	0.431
-12.0	63133.3	4.523	51.0	9716.5	2.965	114.0	2147.0	1.216	177.0	591.3	0.424
-11.0	61070.3	4.509	52.0	9461.3	2.933	115.0	2103.0	1.196	178.0	580.7	0.417
-10.0	59080.6	4.494	53.0	9213.4	2.901	116.0	2060.0	1.176	179.0	570.3	0.410
-9.0	57161.7	4.479	54.0	8972.6	2.869	117.0	2018.0	1.157	180.0	560.5	0.403
-8.0	55310.9	4.463	55.0	8738.6	2.837	118.0	1977.0	1.138	181.0	550.9	0.397
-7.0	53525.8	4.448	56.0	8511.4	2.805	119.0	1936.9	1.120	182.0	541.7	0.390
-6.0	51804.0	4.431	57.0	8290.6	2.772	120.0	1897.8	1.101	183.0	532.9	0.384
-5.0	50143.2	4.415	58.0	8076.1	2.740	121.0	1859.5	1.083	184.0	524.4	0.378
-4.0	48541.1	4.398	59.0	7867.7	2.708	122.0	1822.1	1.065	185.0	516.2	0.371
-3.0	46995.6	4.381	60.0	7665.1	2.676	123.0	1785.5	1.048	186.0	508.4	0.365
-2.0	45504.7	4.363	61.0	7468.3	2.644	124.0	1749.7	1.030	187.0	500.8	0.360
-1.0	44066.3	4.345	62.0	7277.1	2.612	125.0	1714.7	1.013	188.0	493.6	0.354
0.0	42678.5	4.327	63.0	7091.2	2.581	126.0	1680.4	0.997	189.0	486.5	0.348
1.0	41339.3	4.308	64.0	6910.6	2.549	127.0	1646.8	0.980	190.0	479.9	0.342
2.0	40047.1	4.289	65.0	6735.1	2.517	128.0	1613.8	0.964	191.0	473.4	0.337
3.0	38800.0	4.270	66.0	6564.4	2.486	129.0	1581.6	0.948	192.0	467.2	0.332
4.0	37596.4	4.250	67.0	6398.6	2.454	130.0	1550.0	0.932	193.0	461.2	0.326
5.0	36434.7	4.230	68.0	6237.5	2.423	131.0	1519.0	0.917	194.0	455.6	0.321
6.0	35313.3	4.209	69.0	6080.8	2.391	132.0	1488.6	0.902	195.0	450.0	0.316
7.0	34230.7	4.188	70.0	5928.6	2.360	133.0	1458.8	0.887	196.0	444.5	0.311
8.0	33185.4	4.167	71.0	5780.6	2.329	134.0	1429.6	0.872	197.0	439.2	0.306
9.0	32176.2	4.145	72.0	5636.8	2.299	135.0	1400.9	0.857	198.0	434.4	0.301
10.0	31201.5	4.123	73.0	5497.0	2.268	136.0	1372.7	0.843	199.0	429.2	0.297
11.0	30260.1	4.101	74.0	5361.2	2.237	137.0	1345.1	0.829	200.0	424.1	0.292
12.0	29350.9	4.078	75.0	5229.1	2.207	138.0	1318.0	0.815	201.0	419.4	0.288
13.0	28472.5	4.055	76.0	5100.8	2.177	139.0	1291.3	0.802	202.0	414.6	0.283
14.0	27623.8	4.032	77.0	4976.0	2.147	140.0	1265.2	0.788	203.0	410.2	0.279
15.0	26803.7	4.008	78.0	4854.8	2.117	141.0	1239.5	0.775	204.0	405.3	0.274
16.0	26011.2	3.984	79.0	4736.9	2.088	142.0	1214.3	0.762	205.0	400.8	0.270
17.0	25245.1	3.959	80.0	4622.4	2.058	143.0	1189.5	0.750	206.0	396.2	0.266
18.0	24504.6	3.934	81.0	4511.1	2.029	144.0	1165.2	0.737	207.0	391.2	0.262
19.0	23788.7	3.909	82.0	4402.9	2.000	145.0	1141.3	0.725	208.0	386.4	0.258
20.0	23096.4	3.883	83.0	4297.7	1.972	146.0	1117.8	0.713	209.0	381.6	0.254
21.0	22426.9	3.858	84.0	4195.5	1.943	147.0	1094.8	0.701	210.0	376.7	0.250
22.0	21779.3	3.831	85.0	4096.1	1.915	148.0	1072.2	0.689	211.0	371.6	0.247
23.0	21152.8	3.805	86.0	3999.6	1.887	149.0	1049.9	0.678	212.0	366.1	0.243
24.0	20546.7	3.778	87.0	3905.7	1.859	150.0	1028.1	0.666	213.0	360.7	0.239
25.0	19960.2	3.751	88.0	3814.4	1.832	151.0	1006.8	0.655	214.0	355.6	0.236
26.0	19392.5	3.723	89.0	3725.8	1.805	152.0	985.8	0.644	215.0	349.8	0.232
27.0	18843.0	3.696	90.0	3639.5	1.778	153.0	965.2	0.634	216.0	343.7	0.229
28.0	18311.0	3.668	91.0	3555.7	1.751	154.0	945.0	0.623	217.0	337.6	0.225
29.0	17795.8	3.639	92.0	3474.2	1.725	155.0	925.3	0.613	218.0	331.7	0.222
30.0	17297.0	3.611	93.0	3395.0	1.699	156.0	905.9	0.602	219.0	325.0	0.219
31.0	16813.8	3.582	94.0	3318.0	1.673	157.0	887.0	0.592	220.0	318.4	0.215
32.0	16345.7	3.553	95.0	3243.1	1.647	158.0	868.3	0.582	221.0	311.4	0.212
33.0	15892.2	3.523	96.0	3170.3	1.622	159.0	850.2	0.573	222.0	304.4	0.209
34.0	15452.7	3.494	97.0	3099.4	1.597	160.0	832.4	0.563	223.0	296.9	0.206
35.0	15026.7	3.464	98.0	3030.5	1.572	161.0	815.1	0.554	224.0	289.4	0.203
36.0	14613.9	3.434	99.0	2963.5	1.548	162.0	798.1	0.545	225.0	282.1	0.200
37.0	14213.6	3.404	100.0	2898.4	1.523	163.0	781.5	0.536			
38.0	13825.5	3.373	101.0	2834.9	1.500	164.0	765.3	0.527			

TABLE 5 — SENSOR RESISTANCE AND TEMPERATURE (C)

TEMP (C)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (C)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (C)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (C)	RESISTANCE (Ohms)	VOLTAGE DROP (v)	TEMP (C)	RESISTANCE (Ohms)	VOLTAGE DROP (v)
-32.0	100049.0	4.690	-4.0	20075.9	3.756	24.0	5203.2	2.201	52.0	1694.0	1.003	80.0	602.4	0.431
-31.5	97006.4	4.680	-3.5	19560.8	3.732	24.5	5088.1	2.174	52.5	1663.5	0.988	80.5	592.4	0.425
-31.0	94060.8	4.671	-3.0	19060.6	3.707	25.0	4976.0	2.147	53.0	1633.5	0.974	81.0	582.8	0.418
-30.5	91209.3	4.661	-2.5	18574.8	3.682	25.5	4866.8	2.120	53.5	1604.1	0.959	81.5	573.4	0.412
-30.0	88449.0	4.651	-2.0	18102.9	3.656	26.0	4760.2	2.094	54.0	1575.2	0.945	82.0	564.4	0.406
-29.5	85777.0	4.641	-1.5	17644.5	3.631	26.5	4656.4	2.067	54.5	1546.9	0.931	82.5	555.7	0.400
-29.0	83190.7	4.630	-1.0	17199.1	3.605	27.0	4555.2	2.041	55.0	1519.0	0.917	83.0	547.2	0.394
-28.5	80687.1	4.620	-0.5	16766.3	3.579	27.5	4456.6	2.015	55.5	1491.6	0.903	83.5	539.1	0.388
-28.0	78263.9	4.609	0.0	16345.7	3.553	28.0	4360.4	1.989	56.0	1464.7	0.890	84.0	531.2	0.383
-27.5	75918.3	4.597	0.5	15936.9	3.526	28.5	4266.7	1.963	56.5	1438.3	0.876	84.5	523.6	0.377
-27.0	73648.0	4.586	1.0	15539.5	3.500	29.0	4175.4	1.938	57.0	1412.3	0.863	85.0	516.2	0.371
-26.5	71450.6	4.574	1.5	15153.1	3.473	29.5	4086.3	1.912	57.5	1386.8	0.850	85.5	509.2	0.366
-26.0	69323.7	4.562	2.0	14777.5	3.446	30.0	3999.6	1.887	58.0	1361.6	0.837	86.0	502.3	0.361
-25.5	67265.0	4.550	2.5	14412.2	3.419	30.5	3915.0	1.862	58.5	1336.9	0.825	86.5	495.7	0.355
-25.0	65272.4	4.537	3.0	14056.9	3.392	31.0	3832.5	1.837	59.0	1312.6	0.812	87.0	489.4	0.350
-24.5	63343.7	4.525	3.5	13711.4	3.364	31.5	3752.1	1.813	59.5	1288.7	0.800	87.5	483.2	0.345
-24.0	61476.9	4.512	4.0	13375.3	3.337	32.0	3673.7	1.789	60.0	1265.2	0.788	88.0	477.4	0.340
-23.5	59670.0	4.499	4.5	13048.3	3.309	32.5	3597.3	1.764	60.5	1242.1	0.776	88.5	471.6	0.335
-23.0	57920.9	4.485	5.0	12730.1	3.281	33.0	3522.9	1.741	61.0	1219.3	0.765	89.0	466.1	0.331
-22.5	56227.9	4.471	5.5	12420.5	3.253	33.5	3450.2	1.717	61.5	1196.9	0.753	89.5	460.8	0.326
-22.0	54589.1	4.457	6.0	12119.2	3.225	34.0	3379.4	1.693	62.0	1174.8	0.742	90.0	455.6	0.321
-21.5	53002.7	4.443	6.5	11826.0	3.197	34.5	3310.4	1.670	62.5	1153.2	0.731	90.5	450.6	0.317
-21.0	51467.0	4.428	7.0	11540.5	3.169	35.0	3243.1	1.647	63.0	1131.8	0.720	91.0	445.7	0.312
-20.5	49980.4	4.413	7.5	11262.7	3.140	35.5	3177.5	1.624	63.5	1110.9	0.709	91.5	440.9	0.308
-20.0	48541.1	4.398	8.0	10992.1	3.112	36.0	3113.4	1.602	64.0	1090.2	0.698	92.0	436.3	0.303
-19.5	47147.7	4.383	8.5	10728.8	3.083	36.5	3051.0	1.579	64.5	1069.9	0.688	92.5	431.8	0.299
-19.0	45798.6	4.367	9.0	10472.3	3.054	37.0	2990.1	1.557	65.0	1050.0	0.678	93.0	427.4	0.295
-18.5	44492.4	4.351	9.5	10222.6	3.026	37.5	2930.7	1.536	65.5	1030.3	0.667	93.5	423.0	0.291
-18.0	43227.6	4.334	10.0	9979.3	2.997	38.0	2872.8	1.514	66.0	1011.0	0.657	94.0	418.8	0.287
-17.5	42002.9	4.318	10.5	9742.5	2.968	38.5	2816.2	1.492	66.5	992.1	0.648	94.5	414.5	0.283
-17.0	40816.9	4.301	11.0	9511.7	2.939	39.0	2761.1	1.471	67.0	973.4	0.638	95.0	410.3	0.279
-16.5	39668.3	4.283	11.5	9287.0	2.911	39.5	2707.2	1.450	67.5	955.1	0.628	95.5	406.0	0.275
-16.0	38555.9	4.266	12.0	9068.0	2.882	40.0	2654.7	1.430	68.0	937.1	0.619	96.0	401.8	0.271
-15.5	37478.4	4.248	12.5	8854.7	2.853	40.5	2603.4	1.409	68.5	919.4	0.609	96.5	397.6	0.267
-15.0	36434.7	4.230	13.0	8646.9	2.824	41.0	2553.3	1.389	69.0	902.1	0.600	97.0	393.3	0.264
-14.5	35423.7	4.211	13.5	8444.5	2.795	41.5	2504.4	1.369	69.5	885.1	0.591	97.5	389.0	0.260
-14.0	34444.2	4.193	14.0	8247.2	2.766	42.0	2456.6	1.349	70.0	868.4	0.582	98.0	384.7	0.257
-13.5	33495.2	4.174	14.5	8055.0	2.737	42.5	2410.0	1.330	70.5	852.0	0.574	98.5	380.3	0.253
-13.0	32575.6	4.154	15.0	7867.7	2.708	43.0	2364.4	1.311	71.0	836.0	0.565	99.0	375.8	0.250
-12.5	31684.6	4.135	15.5	7685.1	2.680	43.5	2319.9	1.292	71.5	820.2	0.557	99.5	371.1	0.246
-12.0	30821.0	4.115	16.0	7507.2	2.651	44.0	2276.3	1.273	72.0	804.8	0.548	100.0	366.5	0.243
-11.5	29984.0	4.094	16.5	7333.9	2.622	44.5	2233.8	1.254	72.5	789.8	0.540	100.5	361.6	0.240
-11.0	29172.7	4.074	17.0	7164.9	2.593	45.0	2192.2	1.236	73.0	775.0	0.532	101.0	356.7	0.236
-10.5	28386.3	4.053	17.5	7000.3	2.565	45.5	2151.5	1.218	73.5	760.6	0.524	101.5	351.5	0.233
-10.0	27623.8	4.032	18.0	6839.8	2.536	46.0	2111.7	1.200	74.0	746.5	0.516	102.0	346.3	0.230
-9.5	26884.4	4.010	18.5	6683.4	2.508	46.5	2072.8	1.182	74.5	732.6	0.508	102.5	341.1	0.227
-9.0	26167.5	3.989	19.0	6530.9	2.479	47.0	2034.7	1.165	75.0	719.2	0.501	103.0	335.3	0.224
-8.5	25472.2	3.967	19.5	6382.3	2.451	47.5	1997.4	1.148	75.5	706.1	0.493	103.5	329.7	0.221
-8.0	24797.8	3.944	20.0	6237.5	2.423	48.0	1960.9	1.131	76.0	693.3	0.486	104.0	323.8	0.218
-7.5	24143.6	3.922	20.5	6096.3	2.395	48.5	1925.1	1.114	76.5	680.8	0.479	104.5	317.9	0.215
-7.0	23509.0	3.899	21.0	5958.7	2.367	49.0	1890.1	1.098	77.0	668.6	0.472	105.0	311.6	0.212
-6.5	22893.2	3.876	21.5	5824.6	2.339	49.5	1855.7	1.081	77.5	656.8	0.465	105.5	305.3	0.209
-6.0	22295.6	3.852	22.0	5693.9	2.311	50.0	1822.1	1.065	78.0	645.2	0.458	106.0	298.6	0.206
-5.5	21715.7	3.829	22.5	5566.4	2.283	50.5	1789.1	1.049	78.5	634.0	0.451	106.5	292.1	0.204
-5.0	21152.8	3.805	23.0	5442.2	2.256	51.0	1756.8	1.034	79.0	623.2	0.444	107.0	285.2	0.201
-4.5	20606.4	3.781	23.5	5321.2	2.228	51.5	1725.1	1.019	79.5	612.6	0.437			
-4.0	20075.9	3.756	24.0	5203.2	2.201	52.0	1694.0	1.003	80.0	602.4	0.431			

## TABLE 6

### Check out procedures for the:

1. Processor Board;
2. Input/Output Board; and
3. Setpoint/Display Board.

#### CAUTION

THESE BOARDS CAN BE DAMAGED BY STATIC ELECTRICITY. WHEN CHECKING OR HANDLING THE BOARDS, DISCHARGE ANY STATIC ELECTRICITY FROM YOUR BODY BY TOUCHING A GROUNDED METAL OBJECT.

When checking the 3 boards to determine if replacement is required there are reference voltages which should be checked. To check the voltages, connect the ground side of a digital voltmeter to test point 16 on the processor board and place the other meter probe on the test points and the pin terminals listed.

### 1. Processor Board Check Out

The processor board should be replaced if any of the following problems exist.

1.1 The voltages at any of the following pin terminals or test points are outside of the range listed.

-10 ± 1 VDC	Pin Terminal	*1J3-7	Processor Board
+10 ± 1 VDC	Pin Terminal	*1J3-6	Processor Board
+4.8 to 6 VDC	Test Point	TP1	Processor Board
+4.8 to 6 VDC	Test Point	TP2	Processor Board
+4.8 to 6 VDC	Test Point	TP4	Processor Board
-4.8 to -6 VDC	Test Point	TP8	Processor Board
+9 to 14 VCC	Test Point	TP9	Processor Board
+11 to 17 VCC	Test Point	TP15	Processor Board

\*Remove plug 1J3 to place meter probe on pin terminal.

- 1.2 All analog or digital type inputs malfunction during the controls test. Analog refers to thermistor, and digital refers to contact and switch inputs.
- 1.3 The display on the setpoint/display board and outputs from the input/output board malfunction at the same time during the controls test. For example, when checking the operation of the oil pump with step "1.4" of the controls test, a number other than "14" is displayed and the oil pump doesn't start.
- 1.4 The control sequence is not followed. For example, the condenser water pump starts before the chilled water pump, on a machine with automatically controlled pumps.
- 1.5 An out of range sensor reading for a thermistor or diffuser feedback potentiometer is displayed, but the thermistor resistance is within limits or the feedback potentiometer is not open or shorted, and the terminal plug connections are tight.
- 1.6 The current span cannot be adjusted with the current span potentiometer.
- 1.7 The motor current cannot be zeroed with the current zero potentiometer during the controls test.
- 1.8 The circuit board or any component on the circuit board is damaged.

### 2. Input/Output Board Check Out

The input/output board should be replaced if any of the following problems exist and the processor board has been checked and is OK.

2.1 The voltages at any of the following test points is outside of the range listed.

-5 ± .2 VDC	Test Point	TP1	(Input/Output Board)
+5 ± .2 VDC	Test Point	TP2	(Input/Output Board)
+5 ± .2 VDC	Test Point	TP4	(Input/Output Board)

- 2.2 An input channel on the input/output board malfunctions during the controls test when the signal from the device connected to it is correct. For example, the display indicates that a flow switch is open when the flow switch is closed and voltage is at the input channel.
- 2.3 An output channel on the input/output board malfunctions during the controls test when the display indicates that a signal is being sent from the processor board to energize a component and the fuses on the input/output board are OK. For example, the display indicates that the processor board is sending a signal to energize the water pump relay, but there is no voltage to the relay.

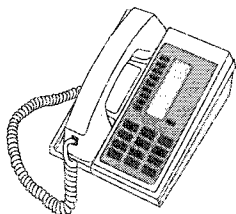
## TABLE 6 (Cont'd)

- 2.4 A safety trip occurs due to a high, low or loss of voltage signal from the input/output board when the power supply is within the limits.
- 2.5 A 115 VAC open or close signal is applied to the guide vane actuator on a 19EB, FA, DK and DM.
- 2.6 The circuit board or any component on the circuit board is damaged.

### 3. Setpoint/Display Check Out

The setpoint/display board should be replaced if any of the following problems exist and the processor board has been checked and is OK.

- 3.1 The voltage at the start or stop pushbutton exceeds  $+5 \pm .2$  VDC. Note: there are two wires connected to each button. One wire on each of the buttons will always be at zero volts.
- 3.2 The display does not show an "88" for the results of controls test step number "0.1".
- 3.3 The electrical demand or the thermostat setpoint potentiometer status indicates faulty during the controls test.



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## Start-Up, Operation and Maintenance Instructions

For use with dual-compressor chillers and single-compressor chillers,  
including lead/lag sequencing of 2 single-compressor chillers.

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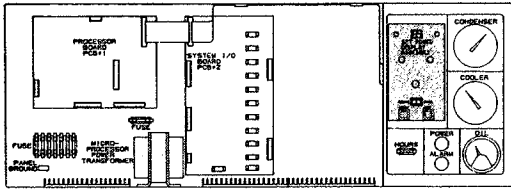
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## BASIC 3200MP CONTROLLER

### FEATURES

The microprocessor control system matches the cooling capacity of the machine to the cooling load while providing machine protection. The system controls cooling load within the set point deadband. Machine protection is provided by monitoring certain digital and analog inputs and executing capacity overrides or safety shutdowns.

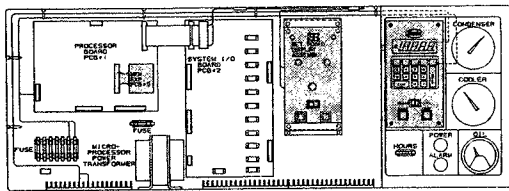
REFER TO BASIC 3200MP CONTROLS SECTION OF CHILLER START-UP, OPERATION AND MAINTENANCE INSTRUCTIONS.



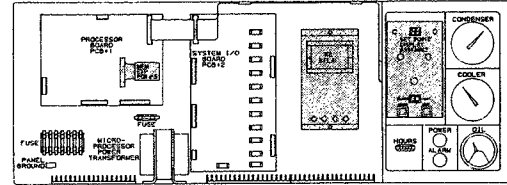
SINGLE- OR DUAL-COMPRESSOR CHILLER

## BASIC CONTROLLER + ESP

(Two Choices)

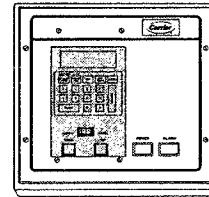


SINGLE- OR DUAL-COMPRESSOR CHILLER AND MACHINE-MOUNTED ESP



SINGLE- OR DUAL-COMPRESSOR CHILLER

OR



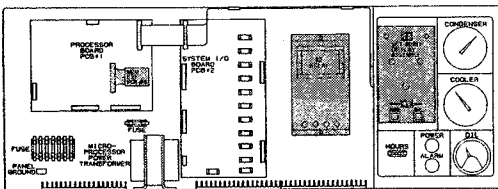
REMOTE ESP

### FEATURES

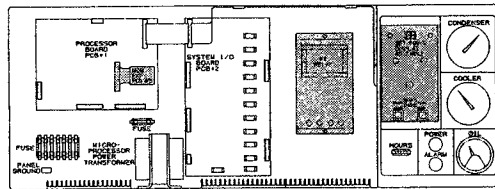
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## BASIC CONTROLLER + ESP WITH LEAD/LAG OPTION

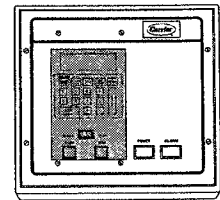
(Two Single-Compressor Chillers and Remote ESP)



SINGLE-COMPRESSOR CHILLER



SINGLE-COMPRESSOR CHILLER



REMOTE ESP

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## ESP FEATURES

The ESP can be machine mounted or remote. It permits the operator to read machine operating parameters and status codes and enter machine set points through the keypad. Temperature values may be displayed in Centigrade or Fahrenheit. Other features include:

1. Programming of automatic chilled water temperature reset (choose one of 4 ways available).
2. Programming of automatic demand limit (choose one of 2 ways available).
3. Programming of automatic restart after power failure.
4. Programming of ramp loading rate slower than that established by the Basic 3200MP Controller.
5. Activation of a remote contact to start/stop the chiller (time clock, energy management system, etc.).
6. Chiller operation/monitoring from a remote location (remote ESP only).

Programming of 2-chiller lead/lag sequencing is available as an option (single-compressor chillers with remote ESP only).

## ABBREVIATIONS

<b>CPU</b>	— Central Processing Unit
<b>DIP</b>	— Dual Inline Package
<b>ESP</b>	— Expanded Services Panel
<b>K/D</b>	— Keypad/Display Panel (ESP)
<b>L/R</b>	— Local/Remote Switch (Basic 3200MP)
<b>MX</b>	— Memory Expansion Board (Basic 3200MP)
<b>POR</b>	— Power-On Reset
<b>P/R</b>	— Panel/Remote Switch (ESP)
<b>RLA</b>	— Rated Load Amps
<b>S/D</b>	— Set Point/Display Panel (Basic 3200MP)

## DEFINITIONS

**Analog Signal** — A representation of a value that varies in proportion to the monitored source. It quantifies values between operating limits.

Example: A temperature sensor is an analog device because its resistance changes in proportion to the temperature, generating many values.

**Digital (Discrete) Signal** — A 2-position representation of the value of a monitored source.

Example: A switch is a digital device because it only indicates whether a value is above or below a fixed point by generating an ON/OFF, HIGH/LOW or OPEN/CLOSE signal.

**Basic 3200MP Controller** — The standard machine-mounted 3200MP chiller control system not including the ESP package.

**Address** — A location in the ESP format (memory) in which data can be programmed.

**Active Programming Sequence** — The programming sequence begun by entering the address format access code and acknowledged by display of the acceptance code.

**Set Point** — The value of a parameter such as chilled water or brine temperature, demand limit, etc., which is set by the operator.

**Control Point** — The value of a parameter such as chilled water or brine temperature to which the control is operating, including reset. (Control Point = Set Point + Reset.)

**Present Status Code** — The current machine diagnostic code displayed by the ESP when it is not in an active programming sequence.

NOTE: A complete diagnostic codes table can be found in the Start-Up, Operation and Maintenance Instructions for each chiller model. Codes related to the ESP are listed in the Chiller Troubleshooting section of this book.

**Chiller Identification Number** — Operator-assigned number from 0 to 7 configured with the Basic 3200MP Controller DIP switches. The ESP uses this number to establish communications with the Basic Controller and identify the lead, lag and main chiller in a lead/lag system.

**Control Activation** — Programming of the activation code at the address location for a control function.

**Main Chiller (Lead/Lag System of 2 Single-Compressor Chillers)** — The chiller designated by the ESP to execute control functions if lead/lag is not activated. The chiller selected by the ESP as designated will depend on the part no. of the memory expansion (MX) EPROM being used. The EPROM part no. is shown on sticker on the EPROM located on the MX board. With EPROM part no. HK98EZ015 or higher, the chiller at Address #3 (lead chiller) will be designated as the main chiller. For EPROM with part no. HK98EZ014 or lower, the chiller at Address #1 will be designated as the main chiller, even though the chiller at Address #1 may not have been selected as the lead chiller when the identification numbers were programmed.

For example, assume the following chiller identification numbers have been programmed in the ESP address format (Chiller identification numbers are assigned by the user).

Chiller at Address #1	Chiller ID No. 04
Chiller at Address #2	Chiller ID No. 05
Chiller at Address #3 (Lead Chiller)	Chiller ID No. 05

For EPROM part no. HK98EZ015 or higher: When lead/lag is not activated, chiller with ID number 05 will be designated as the main chiller because it is at Address #3.

For EPROM part no. HK98EZ014 or lower: When lead/lag is not activated, chiller with ID number 04 will be designated as the main chiller because it is at Address #1.

**Lead Chiller** — The principal machine in an activated lead/lag system. The lead chiller is the first machine started and remains on until cooling is no longer required.

**Lag Chiller** — The secondary or accessory machine in an activated lead/lag system. The lag chiller only operates when the cooling requirement exceeds the capability of the lead chiller.

## EXPANDED SERVICES PANEL PACKAGE

**General** — The ESP provides expanded control capability by offering functions not included as part of the Basic 3200MP Controller.

The ESP package consists of 2 distinct hardware elements: The expanded services panel (ESP) and a memory expansion board (MX). (See Fig. 1.) The ESP can be mounted on the machine or remote from the machine. The memory expansion board is mounted on the Basic 3200MP Controller processor board. (Refer to ESP Installation Instructions.)

**ESP Keypad/Display Panel** — The ESP keypad/display panel (K/D) (Fig. 2) serves as a data entry port and as a status display. It contains a 4.5 digit liquid crystal display (LCD), a 17-position keypad consisting of 10 numerical and 7 special function keys, a 2-position rocker switch for selecting panel/remote programming authority (P/R switch), and chiller system start and stop switches. Display of temperature values in Centigrade or Fahrenheit is determined by a setting of the DIP switch on the Basic 3200MP Controller.

**Memory Expansion Board** — The memory expansion board (MX) is mounted on and connected to the Basic 3200MP Controller processor board. It contains information provided by the ESP and the Basic Controller for implementing control functions. A memory expansion board must be installed on each machine in a lead/lag system.

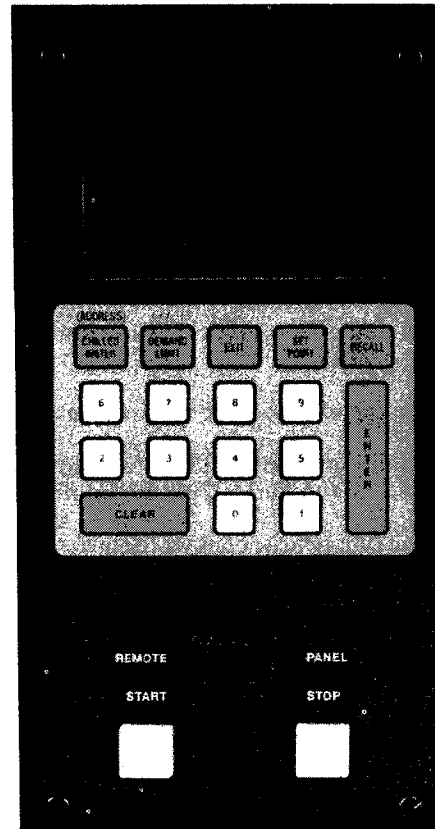
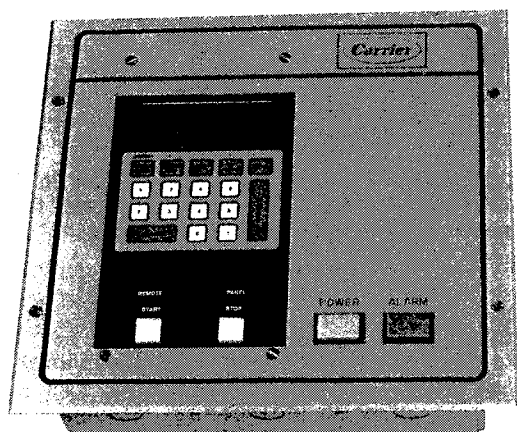
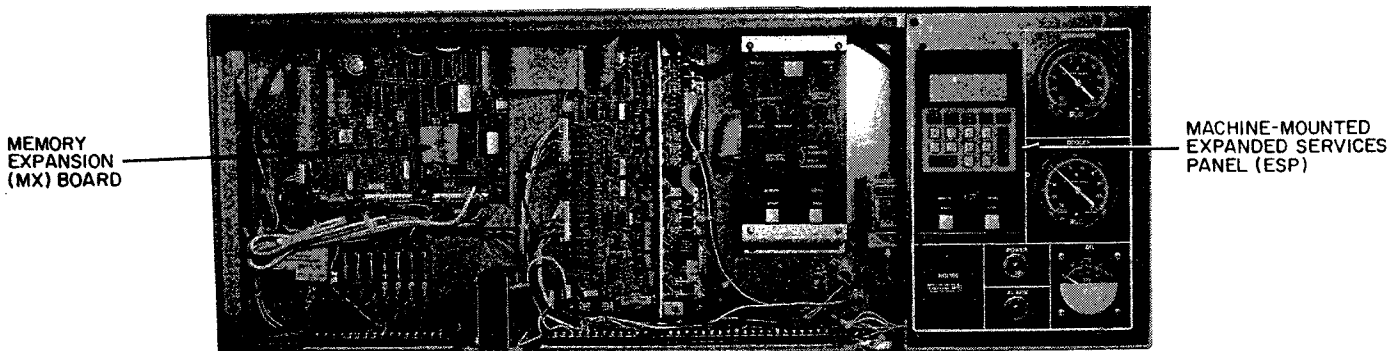
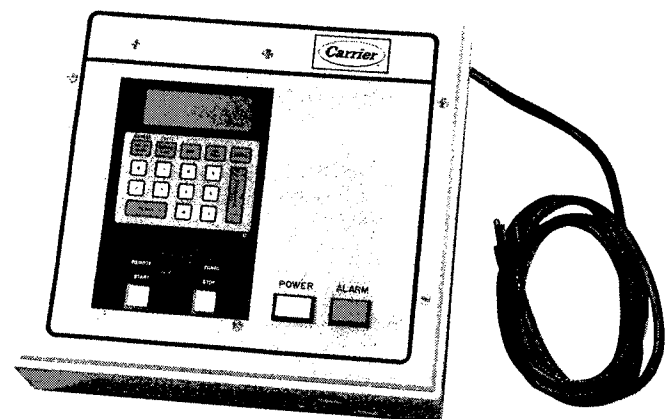


Fig. 2 — ESP Keypad/Display Panel



REMOTE ESP  
(Recessed Enclosure for Flush Wall Mounting)



REMOTE ESP  
(Surface Enclosure for Desktop or Wall Surface Installation)

Fig. 1 — Expanded Services Panel Package

## ESP CAPABILITY

The following functions are provided with the ESP package. References to lead/lag apply only when the lead/lag option is specified.

**Display Functions** — Display functions permit use of the keypad to read chilled water set point, demand limit set point, machine operating parameters, present status codes, and stored shutdown status codes. Parameter codes and present status codes for both chillers in a lead/lag system can be displayed when lead/lag is activated.

**Control Functions** — Control functions permit the operator to enter machine set points and activate controls. Functions include:

**CHILLED WATER SET POINT ADJUSTMENT** — Permits keypad adjustment of leaving chilled water temperature set point from 35 F to 120 F (2 C to 49 C) or leaving brine temperature set point from 0° F to 120 F (-18 C to 49 C) without changing the position of the thermostat on the S/D board.

**DEMAND LIMIT SET POINT ADJUSTMENT** — Permits keypad limiting of % motor current to any value down to 40% of RLA without changing the position of the demand limit setting on the S/D board.

**AUTO. CHILLED WATER RESET BASED ON COOLER TEMPERATURE DIFFERENCE** — Permits up to  $\pm 30$  F (17 C) of automatic reset of the leaving chilled water or brine temperature set point, based on a range of 0° F to 20 F (0° C to 11 C) difference between entering and leaving chilled water or brine temperature.

**AUTO. RETURN CHILLED WATER TEMPERATURE CONTROL** — Automatically resets the leaving chilled water or brine temperature up to  $\pm 30$  F (17 C) from entering temperature control point to provide the desired entering chilled water temperature. Reset is based on the difference between entering and leaving chilled water or brine temperature. Entering temperature control point is established by the chilled water temperature set point entered through the keypad. The maximum rate of change in leaving temperature is limited to 1/8° F (0.07 C) per minute.

**AUTO. CHILLED WATER TEMPERATURE RESET BASED ON 4-20 mA INPUT SIGNAL** — Permits up to  $\pm 30$  F (17 C) of automatic reset to the leaving chilled water or brine temperature set point, based on the input from a 4-20 mA signal.

**AUTO. CHILLED WATER TEMPERATURE RESET BASED ON A REMOTE TEMPERATURE SENSOR INPUT** — Permits up to  $\pm 30$  F (17 C) of automatic reset to the leaving chilled water or brine temperature set point, based on the input from a remote temperature sensor.

**AUTO. POWER DEMAND LIMIT BASED ON CONTACT CLOSURE** — Permits automatic stepped limiting of % motor current down to 40% of RLA based on closure of up to 3 discrete contacts.

**AUTO. POWER DEMAND LIMIT BASED ON A 4-20 mA INPUT SIGNAL** — Permits automatic linear limiting of % motor current within a range of 100% down to 40% of RLA based on a 4-20 mA signal.

**AUTO. RESTART AFTER POWER FAILURE** — Permits the ESP to automatically restart the machine. For lead/lag systems, the machine started will be the lead chiller if lead/lag is activated or the main chiller if lead/lag is deactivated.

**RAMP LOADING RATE ADJUSTMENT** — Permits selection of ramp loading rate that is slower (in degrees/minute) than the value established by the Basic 3200MP Controller DIP switches. When lead/lag is activated, ramp loading only applies to the lead machine.

**REMOTE CONTACT START/STOP** — Permits use of a switch from a time clock or other device for start-stop control of the machine. For lead/lag systems, the machine controlled will be the lead chiller when lead/lag is activated or the main chiller when lead/lag is deactivated.

**LEAD/LAG OPTION** — Permits selection of the lead chiller and the programming of temperature vs time inputs for starting the lag chiller and the programming of capacity of chiller at Address #1 for turning off the lag chiller.

## ESP START-UP

### Initialization

#### ⚠ WARNING

To prevent equipment damage, the machine must be started up and operated according to the Basic 3200MP Controls section of the chiller Start-Up, Operation and Maintenance Instructions before the ESP is initialized.

Refer to Fig. 3. After installation of the ESP is completed, energize the chillers.

1. Position L/R switch on Basic 3200MP Controller on chiller(s) to REMOTE.
2. Position P/R switch on ESP to PANEL.
3. Depress Power-On Reset (POR) pushbutton on the Basic 3200MP Controller(s).
4. Depress POR pushbutton on the ESP.

**NOTE:** The POR pushbutton on remote ESP panels is inaccessible; to effect a POR, use the power button on the enclosure to interrupt then re-establish control power to the ESP.

If the ESP displays a code 81 (loss of communication) check to be sure that the ESP has been installed properly and that the above start-up instructions have been followed.

Once initialized, if power to the ESP is lost or it is disconnected while the chiller is operating under ESP control (L/R switch on chiller Basic 3200MP Controller set to REMOTE), a shutdown will occur. If power is maintained at the ESP but the communication line is disconnected, or if communication with the Basic

3200MP Controller is lost for more than 15 seconds while operating in remote, Code 81 will be displayed at the ESP and the Basic 3200MP Controller and a safety shutdown will be initiated. When the Basic 3200MP Controller L/R switch is set to LOCAL, the ESP will usually show the same display as the S/D board. If communication is lost while the machine is operating in local, Code 81 will only be displayed at the ESP and the machine will continue to operate.

**Initial Programming** — Before the ESP can be operated, the chiller identification number, the chilled water set point and demand limit set point must be programmed in the ESP address format. Refer to Fig. 4.

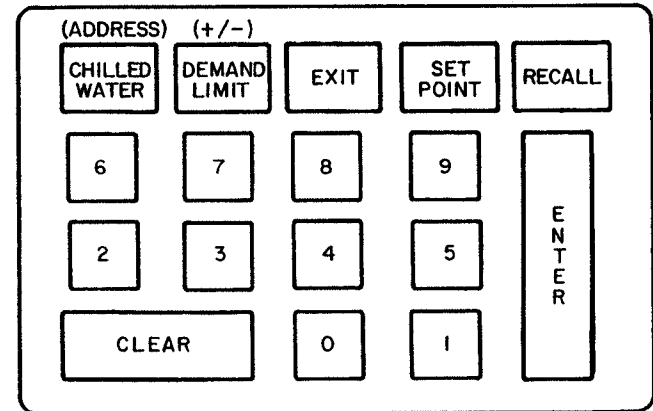


Fig. 4 — Close-Up View of ESP Keypad

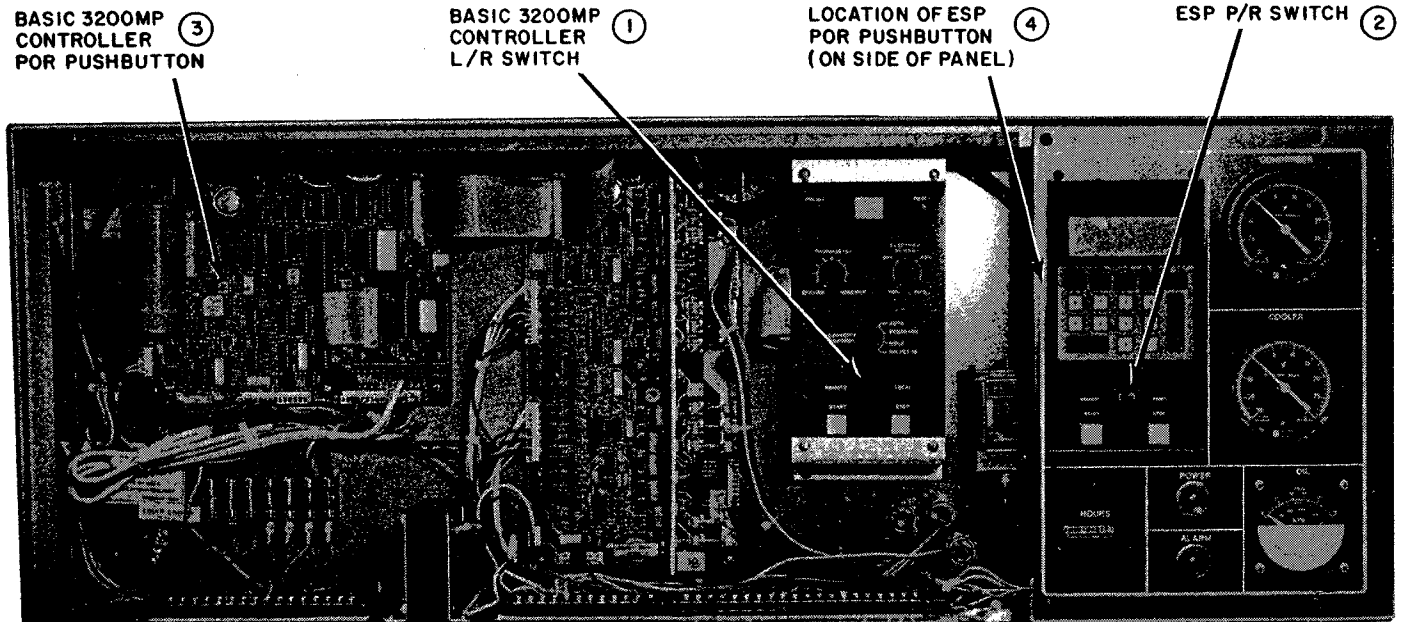


Fig. 3 — Initialization Procedure

**PROGRAMMING CHILLER IDENTIFICATION NUMBER** — To program this number, position the P/R switch to PANEL, input 0000 (4 zeros) then depress the ENTER key. Acceptance of the access code will be acknowledged by the display of +18888 and the ESP will enter an active programming sequence.

In a non-lead/lag system, the same chiller ID no. must be programmed at Address #1 and Address #3. For programming of chiller identification numbers in a lead/lag system, see page 19.

**Programming Chiller Identification Number**  
Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	*	Chiller Present Status
0000	0000	Each zero appears with each keystroke
ENTER	+18888	Access open — Programming can begin
RECALL	01	Address for chiller identification number
	XX	Present value
SET POINT		Blank display — Ready for new data†
2	2	New chiller identification number
ENTER	2	Entry of new data accepted
RECALL	02	Next address
RECALL	03	Address for chiller identification number
	XX	Present value
SET POINT		Blank display — Ready for new data†
2	2	New chiller identification number (same number as programmed in Address #1)
ENTER	2	Entry of new data accepted
EXIT	*	Chiller present status (new data registered)

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

XX — Value may be zero or any variable within the input range.

**PROGRAMMING CHILLED WATER SET POINT** — The chilled water set point can be from 35 F to 120 F (2 C to 49 C) for water or from 0° F to 120 F (-18 C to 49 C) for brine.

**Programming Chilled Water Set Point**  
Place P/R Switch on ESP to PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	*	Chiller present status
CHILLED WATER	1111	
ENTER	XX	Present chilled water set point
SET POINT		Blank display — ready for new data†
44	44	New chilled water set point.
ENTER	44	Entry of new data accepted
EXIT	*	Chiller present status (new data registered)

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

XX — Value may be zero, or any variable within the input range.

**PROGRAMMING DEMAND LIMIT SET POINT** — The demand limit set point can be from 40% to 100% RLA.

**Programming Demand Limit Set Point**  
Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	*	Chiller present status
DEMAND LIMIT	2222	
ENTER	XX	Present demand limit set point (% RLA)
SET POINT		Blank display — Ready for new data†
100	100	New demand limit set point
ENTER	100	Entry of new data accepted
EXIT	*	Chiller present status (new data registered)

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

XX — Value may be zero or any variable within the input range.

After the above steps have been completed, the ESP will display the present status code. If code 76 (invalid configuration) continues to be displayed, the chiller identification number set with DIP switches in the chiller Basic 3200MP Controller and the chiller identification number programmed at Address #1 and at Address #3 do not agree. The numbers must agree before system operation can begin.

When the ESP has been started up and the initial programming has been performed, the chiller can be started.

## ESP DISPLAY FUNCTIONS OPERATION

**General** — When performing display functions, the 7 special function keys are used as shown in Fig. 5. (Parentheses indicate secondary functions used only for programming. These are explained in the ESP Address Format section.)

### SPECIAL FUNCTION KEYS

SPECIAL KEY	FUNCTION
Chilled Water (Address)	Displaying/selecting chilled water set point.
Demand Limit ( ± )	Displaying/selecting demand limit set point.
Exit	Registering program inputs and returning display to present status code.
Set Point	Inputting new set point.
Recall	Displaying stored shutdown status codes or selected machine parameters.
Enter	Entering program data or codes.
Clear	Clearing errors, out-of-range inputs or illegal keystrokes when the display or the "+" sign in the display is blinking. Returns the display to the last valid keystroke.

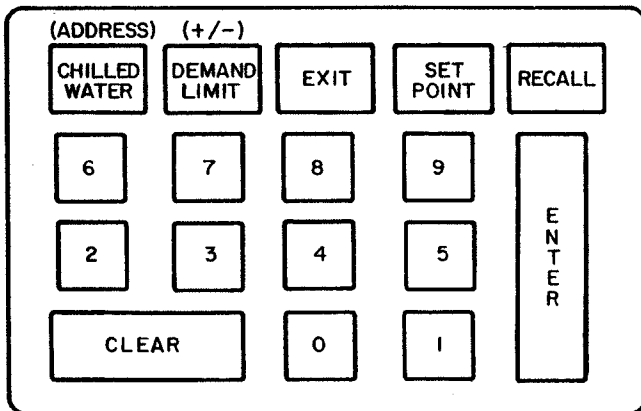


Fig. 5 — Display Functions

**NOTE:** Any time a mistaken entry is made it can be erased by depressing CLEAR. This includes entry errors that result in a blinking display or a blinking "E." If there is any doubt about the values being shown on the display, press EXIT and the present status code will be displayed.

**DISPLAYING PRESENT STATUS CODE** — While a chiller is connected to the ESP, the ESP will display the chiller present status code.

**DISPLAYING CHILLED WATER SET POINT** — To display the chilled water set point, depress the CHILLED WATER key, followed by the ENTER key. Depress the EXIT key to return to display of the present status code.

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
CHILLED WATER	1111	
ENTER	42	Displays chilled water set point (42°)
EXIT	28	Chiller present status code

**DISPLAYING DEMAND LIMIT SET POINT** — To display the demand limit set point, depress the DEMAND LIMIT key, followed by the ENTER key. Depress the EXIT key to return to display of the present status code.

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
DEMAND LIMIT	2222	
ENTER	100	Displays demand limit set point (100%)
EXIT	28	Chiller present status code

### DISPLAYING STORED SHUTDOWN STATUS CODES

**NOTE:** Shutdown codes are stored in permanent memory. Codes will not be lost if the ESP experiences a power failure.

The ESP will store shutdown codes for the last 5 chiller shutdowns. To display the stored shutdown codes, depress the RECALL key followed by the ENTER key. The codes will be displayed with the most recent shutdown code displayed first, followed by the other 4 in reverse chronological order. After the fifth most recent code has been displayed, the ESP will blank for ten seconds, and then the sequence will repeat. Depress the EXIT key to return to display of the chiller present status code.

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
RECALL	5555	
ENTER	66	Displays most recent shutdown code (66)
	74	Displays second most recent shutdown code which was 74. Blank for 1/2 second before displaying next code
	74	Displays third most recent which was also 74. Blank for 1/2 second before displaying next code
	68	Displays fourth most recent which was also 68. Blank for 1/2 second before displaying next code
	74	Displays fifth most recent which was 74 again. Blank for 1/2 second before displaying next code
	66	Displays most recent shutdown code (66)
EXIT	28	Returns to displaying chiller present status code*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

To read stored shutdown codes for a dual-compressor chiller, depress ENTER for each code. Codes appear in the same pattern as described above until the fifth most recent code appears; then the sequence will repeat. Press EXIT to return to display of the chiller present status code.

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
RECALL	5555	
ENTER	66	Displays most recent shutdown code (66)
ENTER	74	Displays second most recent shutdown code which was 74. Blank for 1/2 second before displaying next code
ENTER	74	Displays third most recent which was also 74. Blank for 1/2 second before displaying next code
ENTER	68	Displays fourth most recent which was also 68. Blank for 1/2 second before displaying next code
ENTER	74	Displays fifth most recent which was 74 again. Blank for 1/2 second before displaying next code
EXIT	28	Returns to displaying chiller present status code*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

**DISPLAYING MACHINE OPERATING PARAMETERS** — To display machine operating parameters, press RECALL, keystroke the parameter code from the Machine Operating Parameters table (Table 1), then press ENTER. A number input before depressing the ENTER key signals the entry of a machine parameter code and not shutdown status recall request. For example, to display the motor bearing temperature:

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28*	Present status code
RECALL	5555	
4	4	Parameter code for bearing temperature
ENTER	156	Bearing temperature is 156°
EXIT	28	Displays chiller present status code*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

If a code is entered for a parameter without a sensor, the display will blink until the CLEAR key is depressed. If reading a parameter that goes out-of-range, or a parameter with a sensor out-of-range, the ESP displays "EE." If reading a parameter and no keypad activity takes place for more than 60 seconds, the "+" sign in the display will blink until the CLEAR key is depressed. This is a reminder that the value being displayed is a parameter and not a present status code.

**Table 1 — Machine Operating Parameters (Non-Lead/Lag System)**

SINGLE-COMPRESSOR CHILLERS WITH EPROM PART NO. HK98EZ014 OR LOWER

PARAMETER CODE	PARAMETER TO BE DISPLAYED
0	Leaving Chilled Water Temperature
1	Motor Current % RLA
2	Evaporator Refrigerant Temperature
3	Condenser Refrigerant Temperature
4	Bearing Temperature
5	Motor Winding Temperature
6	Compressor Discharge Temperature
7	Line Voltage
8	Spare Sensor #1 Temperature

SINGLE-COMPRESSOR CHILLERS WITH EPROM PART NO. HK98EZ015 OR HIGHER

PARAMETER CODE	PARAMETER TO BE DISPLAYED
10	Leaving Chilled Water Temperature
11	Motor Current % RLA
12	Evaporator Refrigerant Temperature
13	Condenser Refrigerant Temperature
14	Bearing Temperature
15	Motor Winding Temperature
16	Compressor Discharge Temperature
17	Line Voltage
18	Spare Sensor #1 Temperature

DUAL-COMPRESSOR CHILLERS

PARAMETER CODE		PARAMETER TO BE DISPLAYED
Compr A	Compr B	
0	10	Leaving Chilled Water Temperature*
1	11	Motor Current % RLA
2	12	Evaporator Refrigerant Temperature*
3	13	Condenser Refrigerant Temperature*
4	14	Bearing Temperature
5	15	Motor Winding Temperature
6	16	Compressor Discharge Temperature
7	17	Line Voltage*
8	18	Spare Sensor #1 Temperature*

\*Parameters for the chiller, rather than individual compressors, use the same sensor for and display the same value for compressor A or B.

### Lead/Lag Display Functions

**DISPLAYING STATUS OF LAG MACHINE** — When lead/lag is activated, the ESP normally displays the status code of the lead machine. To display the status of the lag machine, keystroke the lag chiller ID, then press ENTER. To return to display of the lead chiller present status code, press EXIT.

For example, if the lag chiller (ID no. 6) is in the start-up process:

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Lead chiller present operating status*
6	6	ID of lag chiller
ENTER	26	Lag chiller present operating status (prestart)†
EXIT	28	Lead chiller operating status*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†Chiller present status code may be any in the Diagnostic Codes table except for timer or start status types.

**DISPLAYING STORED SHUTDOWN STATUS CODES FOR LEAD/LAG SYSTEM** — If lead/lag is activated, the lead chiller ID number will appear first followed by the 5 stored codes for the lead chiller. The ESP will pause and then display the lag chiller ID number followed by the 5 stored codes for the lag chiller. This pattern is repeated until EXIT is depressed.

**Table 2 — Machine Operating Parameters for Lead/Lag System**

**SINGLE-COMPRESSOR CHILLERS**

PARAMETER CODE					PARAMETER TO BE DISPLAYED
EPROM PART NO. HK98EZ014 OR LOWER		EPROM PART NO. HK98EZ015 OR HIGHER			
Deactivated Lead/Lag (Main Chiller)	Activated Lead/Lag		Activated or Deactivated Lead/Lag		
	Lead Chiller	Lag Chiller	Lead (Main) Chiller	Lag Chiller	
0	10	20	10	20	Leaving Chilled Water Temperature Motor Current % RLA Evaporator Refrigerant Temperature Condenser Refrigerant Temperature Bearing Temperature Motor Winding Temperature Compressor Discharge Temperature Line Voltage Spare Sensor #1 Temperature Temperature at Common Point (Mixed Temp)
1	11	21	11	21	
2	12	22	12	22	
3	13	23	13	23	
4	14	24	14	24	
5	15	25	15	25	
6	16	26	16	26	
7	17	27	17	27	
8	18	28	18	28	
9	19	29	19	29	

**DISPLAYING LEAD/LAG MACHINE OPERATING PARAMETERS**

MX Board with EPROM Part No. HK98EZ014 or Lower — When lead/lag is activated, machine operating parameter codes for the lead and lag chiller can be displayed. (Refer to Table 2.) In addition, the mixed water temperature at the common point can be read. If lead/lag is deactivated, the ESP will not accept lead/lag parameter codes and the display will blink. The parameter values for the main chiller can be read when lead/lag is deactivated by entering the main chiller parameter codes listed in Table 2.

MX Board with EPROM Part No. HK98EZ015 or Higher — All machine operating parameters for the lead and lag machine can be displayed at anytime regardless of whether lead/lag is activated. Codes for the lead machine or main chiller are always 10 through 19; codes for the lag machine are always 20 through 29.

**CONTROL FUNCTION PROGRAMMING**

**General** — Programming to utilize ESP control functions is the same for all chillers, except for those features directly related to 2-chiller lead/lag sequencing. Programming ESP with the lead/lag options is covered separately.

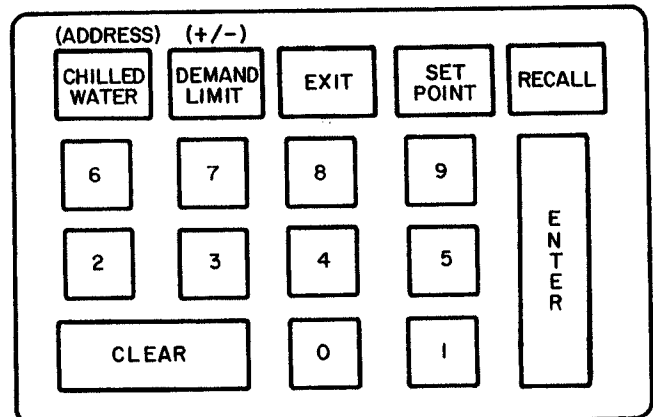
In order to program and activate a control function, the ESP must be initialized and ready to operate the system, as explained under ESP Start-Up. A chiller identification number, the chilled water set point and the demand limit set point must be entered into the ESP as described in the Initial Programming section. All programming follows the same general rules:

1. All programming begins with the ESP displaying the unit present status. If the unit present status is not being displayed, press EXIT. Entry into the program mode is gained by depressing "zero" four times followed by ENTER. The display response (+18888) indicates that programming can proceed.
2. Any time a mistaken entry is made it can be deleted by entering CLEAR. This includes entries that result in a blinking display or a blinking "E."
3. If in doubt about an entry or lost in a programming sequence, depress CLEAR, then EXIT to return to the display of the present status code and begin the programming sequence again.
4. If an attempt is made to enter data that is out of limits or to activate an option for which the data is missing, the data or activation code will be rejected and simply blink. Press CLEAR to return to the previous programming step (i.e., SET POINT blank screen).

**ESP Address Format (Table 3)** — To program the ESP, the 7 special function keys (see Fig. 6) are used along with the 10 numerical keys. The CHILLED WATER (ADDRESS) key and DEMAND LIMIT ( $\pm$ ) key have secondary functions as shown in parentheses. When used for ESP address format programming, these keys always perform the secondary function. The RECALL key also has 2 functions as shown in the table in Fig. 6. The shaded areas indicate the functions these keys perform when used for programming in the ESP address format.

**SPECIAL FUNCTION KEYS**

SPECIAL KEY	FUNCTION
Chilled Water Address	Displaying/selecting chilled water set point. Address: Selecting an address in the ESP address format.
Demand Limit	Displaying/selecting demand limit set point. (-): Selecting negative data inputs.
Exit	Registering program inputs and returning display to present status.
Set Point	Inputting new set point or
Recall	Displaying stored shutdown status codes or selected machine parameters.



**Fig. 6 — Special Function Keys for Programming ESP Address Format**

Temperature set points may be entered and will be displayed in Centigrade or Fahrenheit according to setting of DIP switch on Basic 3200MP Controller.

**NOTE:** Out-of-range inputs or invalid keystrokes will cause the display to blink until the CLEAR key is depressed. The CLEAR key may also be used to delete keystroke errors while programming; in this case, the display returns to the last valid keystroke. If in doubt or lost, depress EXIT and start over.

To access the ESP address format, position the P/R switch to PANEL input code 0000 (4 zeros) while the machine's present status code is being displayed, then depress the ENTER key. (See example below.) Acceptance of the access code will be acknowledged by the display of +18888 and the ESP will enter an active programming sequence. Once in the programming sequence, there are 2 ways to call up an address in the format to program data:

1. Depressing the RECALL key advances through the format one address number (location) at a time. After each depression, the number of the new address will be displayed for 1/2 second followed by its contents (data).
2. The CHILLED WATER (ADDRESS) key permits direct call-up of address numbers in the format by depressing the key, inputting the number of the desired address, then depressing the ENTER key. The number of the selected address will be displayed for 1/2 second followed by its contents.
3. After selecting the desired address, data can be programmed at the location by depressing the SET POINT key, inputting the desired data, then depressing the ENTER key. The display will blank for 1/2 second and then the new data will be displayed. Negative data is programmed by depressing the DEMAND LIMIT ( $\pm$ ) key after depressing the SET POINT key.

The ESP must be displaying the machine's present status code before a programming sequence can begin. If the ESP is not displaying the present status code or there is some doubt, depress the EXIT key. Once a programming sequence begins and no keypad activity takes place for over 60 seconds, the "+" sign in the display will blink until the CLEAR key is depressed. To input data, the P/R switch must be in the PANEL position. After program variables are entered, the EXIT key must be depressed to register the data in the ESP's memory and return to the display of the machine's present status code. The L/R switch may be in either position when programming.

In addition to data input through the keypad, the ESP uses configuration inputs established by the Basic 3200MP Controller DIP switches. If a DIP switch is reconfigured on the Basic 3200MP Controller, a POR must be performed at the Basic 3200MP Controller and at the ESP to register the change. If the DIP switch changes involve the chiller ID number, the new ID must be programmed in the ESP address format.

### Programming the ESP Address Format

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Machine operating status code.* P/R switch must be in PANEL to proceed with programming the access code
<b>0000</b>	0000	
<b>ENTER</b>	+18888	Access code accepted, programming sequence begins
<b>RECALL</b>	01 0	Shows address 01 for 2 seconds then displays contents of address 01 (Chiller identification number is 0)
<b>SET POINT</b>		Display blanks to accept data input
<b>5</b>	5	
<b>ENTER</b>	5	Display blanks for 1/2 second and then shows new chiller identification number for address 01 is "5"
<b>CHILLED WATER (Address)</b>		Display blanks to accept direct address input
<b>19</b>	19	Input
<b>ENTER</b>	19 -20	Displays new address (19) for 2 seconds and then its contents (Remote temperature value = -20)
<b>SET POINT</b>		Display blanks to accept new remote temperature set point
<b>DEMAND LIMIT (<math>\pm</math>)</b>	—	Negative data coming
<b>25</b>	-25	
<b>ENTER</b>	-25	Display blanks for 1/2 second and then accepts new data (New remote temperature value is -25)
<b>EXIT</b>	28	Registers inputs and returns display to chiller present status code*

\*Chiller present status code may be any in the Diagnostics Codes table, or blank when unit is ready to start.

## Common Programming for All Chillers

**AUTOMATIC LEAVING CHILLED WATER TEMPERATURE SET POINT RESET** — The ESP offers 4 ways to reset the leaving chilled water temperature set point. Only one of the 4 ways can be activated at a time. The method chosen will depend on system design and requirements. In all cases, set point reset can be positive or negative. The set point can be lowered to provide compensating capacity as building load increases, or raised as the building load decreases. Building load sensing can be done with the actual chiller load, outdoor or other remote temperature or an energy management system control device.

**AUTO. CHILLED WATER RESET BASED ON COOLER TEMPERATURE DIFFERENCE** — Permits up to  $\pm 30^\circ\text{F}$  ( $17^\circ\text{C}$ ) of automatic reset to the leaving chilled water or brine temperature set point, based on a range of  $0^\circ\text{F}$  to  $20^\circ\text{F}$  ( $0^\circ\text{C}$  to  $11^\circ\text{C}$ ) difference between entering and leaving chilled water or brine temperature.

Figure 7 shows a desire to maintain the set point (no reset) at a  $10^\circ\text{F}$  difference between entering and leaving cooler water temperature, and to reset to a control point  $3^\circ\text{F}$  below the set point when the cooler water temperature difference rises to  $15^\circ\text{F}$ .

This function must be programmed and activated.

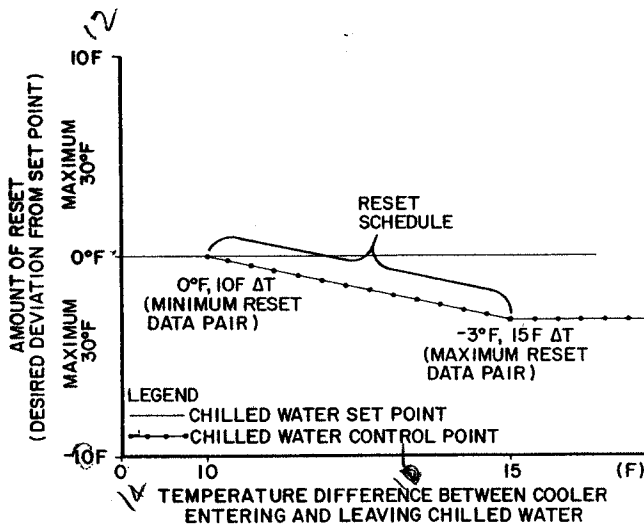


Fig. 7 — Reset Schedule Based on Cooler Temperature Difference

## Programming Auto. Chilled Water Reset Based on Cooler Temperature Difference

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for reset temperature A
8	8	
ENTER	08 03	Address for reset temperature A Present reset temperature
SET POINT		Blank display; ready for data†
0	0	Zero °F; no reset
ENTER	0	Data accepted
RECALL	09 00	Address for cooler ΔT Present value
SET POINT		Blank display; ready for data†
10	10	10 degrees ΔT corresponding to reset temperature A above
ENTER	10	Data accepted
RECALL	10 00	Address for reset temperature B Present temperature
SET POINT		Blank display; ready for data†
DEMAND LIMIT (±)	—	New data will be a negative value
3	-3	3 degrees reset temperature B
ENTER	-03	Data accepted
RECALL	11 00	Address for cooler ΔT Present value
SET POINT		Blank display; ready for data†
15	15	15 degrees ΔT corresponding to reset temperature B above
ENTER	15	Data accepted
EXIT	26	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

## Activating Auto. Chilled Water Reset Based on Cooler Temperature Difference

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
12	12	
ENTER	12 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	26	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**AUTO. RETURN CHILLED WATER TEMPERATURE CONTROL** — Resets the leaving chilled water or brine temperature up to  $\pm 30$  F (17 C) to provide desired entering chilled water temperature. The amount of reset is based on the difference between entering and leaving chilled water or brine temperature. *The entering temperature control point used in this function is the leaving chilled water temperature set point entered through the keypad. When the function is activated, the set point entered through the keypad automatically becomes the entering temperature control point.* The maximum rate of change in leaving temperature is limited to  $1/8^\circ$  F (0.07 C) per minute.

The only programming necessary is to set the leaving chilled water set point to the desired entering water temperature and activate the control. The set point must be entered at ESP Start-Up (see Initial Programming section). To program a new set point, follow example below.

### Programming Chilled Water Set Point

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
CHILLED WATER	1111	
ENTER	47	Present chilled water set point
SET POINT		Blank display — Ready for new data†
54	54	New chilled water set point
ENTER	54	Entry of new data accepted
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.  
†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

### Activating Auto. Return Chilled Water Temperature Control

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	26	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
13	13	
ENTER	13 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	26	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**AUTO. CHILLED WATER TEMPERATURE RESET BASED ON A 4-20 mA INPUT SIGNAL** — Permits up to  $\pm 30$  F (17 C) of automatic reset to the leaving chilled water or brine temperature set point, based on the input from a 4-20 mA signal.

Figure 8 shows a desire to control to  $0^\circ$  F above the set point at the lower control signal and to  $10^\circ$  F above the set point at the upper control signal. Reset can be positive or negative; positive reset is shown.

This function must be programmed and activated.

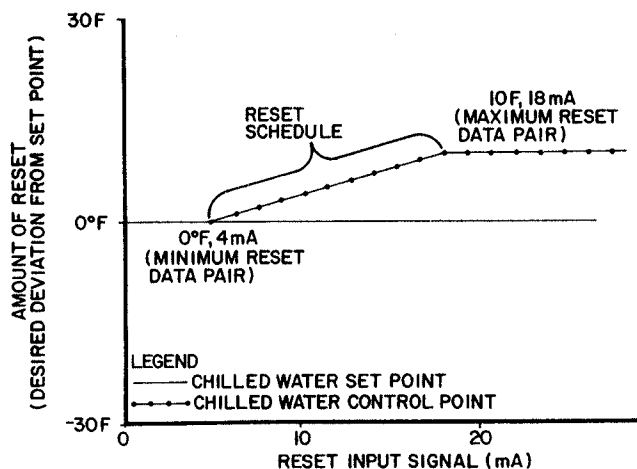


Fig. 8 — Reset Schedule Based on 4-20 mA Input Signal

### Programming Auto. Chilled Water Temperature Reset Based on 4-20 mA Input Signal

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for reset temperature A
14	14	
ENTER	14 00	Address for reset temperature A Present reset temperature The desired reset temperature is the same as the present reset temperature (zero degrees), therefore, it is not necessary to enter new data. Proceed to the next address by pressing RECALL
RECALL	15 00	Address for input signal A Present value
SET POINT		Blank display; ready for data
4	4	4 mA input signal corresponding to reset temperature A above
ENTER	04	Data accepted
RECALL	16 00	Address for reset temperature B Present reset temperature
SET POINT		Blank display; ready for data†
10	10	10 degrees reset temperature B
ENTER	10	Data accepted
RECALL	17 00	Address for input signal B Present value
SET POINT		Blank display; ready for data†
18	18	20 mA input signal corresponding to reset temperature B above
ENTER	18	Data accepted
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

## Activating Auto. Chilled Water Temperature Reset Based on a 4-20 mA Input Signal

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
18	18	
ENTER	18 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	28	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

## AUTO. CHILLED WATER TEMPERATURE RESET BASED ON A REMOTE TEMPERATURE SENSOR INPUT — Permits up to $\pm 30$ F (17 C) of automatic reset to the leaving chilled water or brine temperature set point, based on the input from a remote temperature sensor.

In many cases it is desirable to raise or lower the chilled water temperature as a function of another temperature, i.e., outdoor temperature. Properly located, the remote sensor may be more responsive to factors influencing building load than the chilled water sensor, or the remote sensor may be used to provide anticipation in the system load.

Figure 9 shows a pattern of reset temperature control with a change in outdoor temperature from night set back (10° F positive reset) to high load (5° F negative reset) in a typical day.

This set point must be programmed and activated.

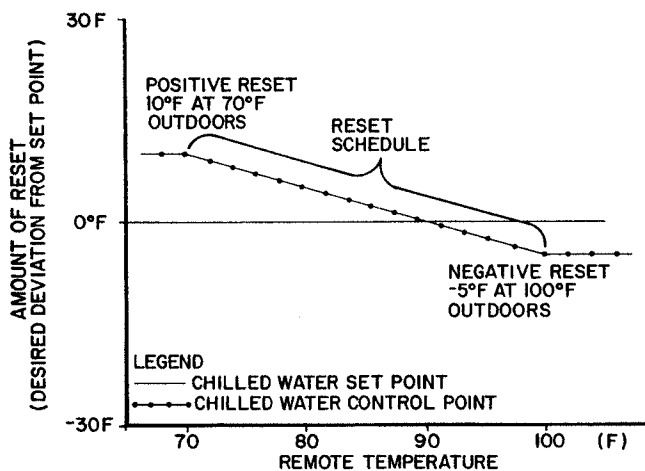


Fig. 9 — Reset Schedule Based on Remote Temperature Sensor

## Programming Auto. Chilled Water Temperature Reset Based on a Remote Temperature Sensor Input

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for reset temperature A
19	19	
ENTER	19 00	Address for reset temperature A Present reset temperature
SET POINT		Blank display; ready for data†
DEMAND LIMIT ( $\pm$ )	—	New data will be a negative value
5	-5	5 degrees negative reset temperature A
ENTER	-05	Data accepted
RECALL	20 00	Address for remote temperature A Present temperature
SET POINT		Blank display; ready for data†
100	100	100F remote temperature corresponding to reset temperature A above
ENTER	100	Data accepted
RECALL	21 00	Address for reset temperature B Present reset temperature
SET POINT		Blank display; ready for data†
10	10	10 degrees positive reset temperature B
ENTER	10	Data accepted
RECALL	22 00	Address for remote temperature B Present value
SET POINT		Blank display; ready for data†
70	70	70F remote temperature corresponding to reset temperature B above
ENTER	70	Data accepted
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

## Activating Auto. Chilled Water Temperature Reset Based on a Remote Temperature Sensor Input

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
23	23	
ENTER	23 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	28	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**AUTOMATIC POWER DEMAND LIMIT** — The ESP offers 2 ways to limit electrical demand. Only one of the two can be activated at a time. The demand limiting control chosen will depend on energy management system design, power company rate schedules and the equipment available. Demand limiting can be based on a single contact closure from a timer to a programmed energy management system. Multiple steps of demand limiting with contact closures are available.

**AUTO. POWER DEMAND LIMIT BASED ON CONTACT CLOSURE** — Permits automatic stepped limiting of % motor current down to 40% of RLA based on closure of up to 3 discrete contacts. When activated and no contact is closed, demand limit = demand limit set point value. If more than one contact is closed, the smallest value programmed for any closed contact will be used as set point.

Contact closure can be provided by any means desired, although clock-operated switches enable the user to take advantage of a "time-of-day" utility power rate structure. This example portrays a desire to limit the electrical demand to 3 different levels with 2 contacts. This could be at 3 different times per day, per week or on another schedule. Two switches have been installed as indicated in ESP Installation Instructions (a total of 3 switches may be used) and in this case are in positions A and B. Switch A is programmed for an 80% demand limit and switch B is programmed for a 60% limit. Accordingly, when no switch is closed, the demand limit is the set point value; when A closes the limit is 80%; and when B closes (with or without A closed) the limit is 60%.

Note that the switch C address must be programmed within the assigned limits of from 40% to 100% RLA even though there is no switch C to close. A demand limit value must be programmed for each switch position before the control can be activated.

This function must be programmed and activated.

**Programming Auto. Power Demand Limit Based on Contact Closure**

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for switch A
24	24	
ENTER	24 00	Address for switch A Present value
SET POINT		Blank display; ready for data†
80	80	80% RLA for switch A demand limit
ENTER	80	Data accepted
RECALL	25 00	Address for switch B Present value
REPEAT ENTRY PROCEDURE FOR SWITCH B		
RECALL	26	Address for switch C
REPEAT ENTRY PROCEDURE FOR SWITCH C		
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.  
 †If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**Activating Auto. Power Demand Limit Based on Contact Closure**

Place P/R Switch on ESP in PANEL Position

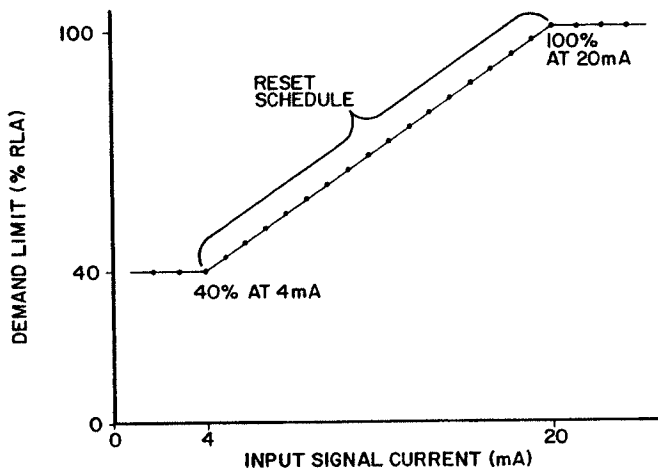
KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	26	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
27	27	
ENTER	27 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	26	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.  
 †If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**AUTO. POWER DEMAND LIMIT BASED ON A 4-20 mA INPUT SIGNAL** — Permits automatic linear limiting of % motor current within a range of 100% down to 40% of RLA based on a 4-20 mA signal.

The signal can come from any 4-20 mA controller including an energy management system. The slope of the demand limiting schedule can be negative or positive with respect to the 4-20 mA signal, i.e., the demand limit can be programmed to increase or decrease with an increased current signal.

Figure 10 shows a positive demand limiting schedule. This function must be programmed and activated.



**Fig. 10 — Demand Limit Schedule Based on 4-20 mA Input**

**Programming Auto. Power Demand Limit Based on a 4-20 mA Input Signal**  
Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
28	28	
ENTER	28 00	Address for demand limit A Present value
SET POINT		Blank display; ready for data†
40	40	40% RLA demand limit A
ENTER	40	Data accepted
RECALL	29	Address for input signal current A Present value
00	00	
SET POINT		Blank display; ready for data†
4	4	4 mA input signal corresponding to demand limit A above
ENTER	04	Data accepted
RECALL	30	Address for demand limit B Present value
00	00	
REPEAT ENTRY PROCEDURE FOR DEMAND LIMIT B		
RECALL	31	Address for input signal B Present value
00	00	
REPEAT ENTRY PROCEDURE FOR INPUT SIGNAL B		
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.  
†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**Activating Auto. Power Demand Limit Based on a 4-20 mA Input Signal**  
Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
32	32	
ENTER	32 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	28	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.  
†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**AUTO. RESTART AFTER POWER FAILURE** — Permits activation of the ESP to automatically restart the machine after a power loss under the following conditions: 1) the machine was operating when the power was interrupted; 2) control voltage has been re-established to within  $\pm 18\%$  of nominal 115 vac and all restart checks have been verified; 3) a shutdown is not requested by the opening of an activated remote start/stop contact or a stop button. No programming is necessary other than to activate this function.

**Activating Auto. Restart After Power Failure**  
Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	26	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
33	33	
ENTER	33 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	26	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.  
†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**RAMP LOADING RATE ADJUSTMENT** — Permits selection of any ramp loading rate that is slower (in degrees/minute) than the value established by the Basic 3200MP Controller DIP switches. Ramp loading rate is selected by programming the code for one of 8 rates listed in the ESP address format (Table 3). When deactivated, the ESP uses the value established by the Basic Controller DIP switches.

This example sets the ramp loading rate at code 6 for 3° F per minute. No additional activation programming is required. To deactivate, enter the deactivation code. The DIP switches must be set for a rate of 3° F per minute or faster (higher).

### Programming Ramp Loading Rate Adjustment

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for ramp loading rate
34	34	
ENTER	34 00	Address for ramp loading rate Present value
SET POINT		Blank display; ready for data†
6	6	New code 6 for 3F ramp loading rate
ENTER	06	Data accepted
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**REMOTE CONTACT START/STOP** — Permits activation of a contact closure from a time clock, EMS system or other device for start-stop control of the machine. When activated, this function establishes the remote contact as being in control of starting the chiller over any other start command and the chiller *cannot* be started unless the remote contacts are closed. The chiller can be stopped at any time from any stop command source, including the regular opening of the remote contacts.

No programming is necessary other than to activate this control.

### Activating Remote Contact Start/Stop

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/ INPUT	DISPLAY/ RESPONSE	COMMENTS
	26	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
35	35	
ENTER	35 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT	26	Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

## Programming ESP with Lead/Lag Option for 2 Single-Compressor Chillers

**GENERAL** — Most of the functions outlined in the previous section are applicable to chillers with the lead/lag option. Following are some exceptions to the operation of these controls in a lead/lag system:

1. The chilled water temperature set point controls the lead chiller only. The lag chiller capacity is controlled through the ESP by matching lag chiller % motor current with the lead chiller % motor current.
2. The demand limit set point controls the whole system when lead/lag is activated. The demand limit is based on the total RLA of the system and may inhibit lag chiller operation.
3. The chilled water temperature reset options and demand limit reset options control capacity of the lead chiller only. The lag chiller capacity is controlled by the lead chiller % motor current.
4. The auto. restart after power failure control will restart the lead chiller only. The lag chiller will restart when the normal conditions for the lag chiller are satisfied.
5. The ramp loading rate adjustment control applies to the lead machine only. The lag chiller is not ramp loaded at start-up, but goes immediately into a temperature control operating mode.
6. The remote start/stop contacts control starts the lead machine only. The lag machine starts when the normal conditions for its start-up have been satisfied. When the remote start/stop control stops the lead machine, the lag machine stops also.

**LEAD/LAG OPERATION** — The lead/lag option permits selection of the lead chiller and the programming of temperature vs time inputs to establish a minimum desired pulldown rate. If the lead machine fails to maintain this minimum pulldown rate, the lag machine will be started when the following conditions have been met:

- Lead/lag is activated
- The lead machine is on
- Ramp loading of the lead machine has been completed for at least 5 minutes
- The chilled water temperature is greater than the control point + deadband
- The chilled water temperature is not decreasing at the desired rate over a continuous 2-minute period
- The system RLA is not at the demand limit set point
- The pulldown time (in minutes) has elapsed since the lead machine started
- A lag machine safety limit is not exceeded
- The lag machine has been off for at least 15 minutes

**NOTE:** These conditions also apply for restart of the lag machine after a normal recycle shutdown.

When all conditions for a lag machine start-up have been satisfied, the lag chiller chilled water pump will be started (parallel system). Two minutes later, the lead chiller's guide vanes will be closed until the lead chiller's motor current is 75% of its RLA. The lead chiller's motor current will be held at or below 75% RLA until the lag machine start-up is aborted or the lag machine starts and has been running for 2 minutes. The lead machine will then return to normal capacity control and the lag machine guide vanes are opened or closed so that lag machine % RLA is within  $\pm 5\%$  of lead machine % RLA. This is the only criterion for control of the lag machine.

Normally the demand limit is simply a percentage of RLA of the single-compressor chiller. When lead/lag is activated, regardless of whether one or both machines are operating, the demand limit is based on a percentage of the total RLA of the lead/lag system. For example, if the RLA of the lead chiller is 250 amps and the RLA of the lag chiller is 150 amps, the total system RLA is 400 amps. If the demand limit is set for 50%, the ESP controls the system operating current to 200 amps. If only the lead chiller is operating it can run up to the 200 amps limit or effectively at 80% of its individual RLA. In that case the lag chiller would not come on.

When the total system load with both chillers running is less than the lead chiller maximum capacity for 15 minutes, the lag chiller's guide vanes will be closed for 2 minutes and then a nonrecycle shutdown of the lag machine will be initiated.

The machines may be operated as basic chillers (with the L/R switches in LOCAL) only if lead/lag is deactivated. If lead/lag is activated while one or both machines are operating, the ESP will initiate a nonrecycle shutdown of the operating machine(s). No diagnostic code will be displayed.

Operation in lead/lag means that lead/lag has been activated and the lead chiller has been started up. To initiate a start-up in lead/lag, L/R switches on Basic 3200MP Controllers of both machines must be in remote. The ESP start button must be depressed or the remote contact must be closed to initiate a lead machine start-up.

A manual override shutdown (code 78) will be initiated by the ESP for any machine switched to local while operating in lead/lag. If both lead and lag machines are operating in lead/lag and the lead machine is switched to local, both machines will shut down. If the lag machine is not operating it can be switched to local without shutting down the lead machine and without the display of a diagnostic code, but it cannot be operated as a basic chiller.

If lead/lag is deactivated while one or both chillers are operating in lead/lag (which means that the L/R switches are in REMOTE), the main chiller will operate and execute control functions and the other chiller will shut down.

**CHILLER IDENTIFICATION NUMBERS** — In addition to programming a chiller identification number at Address #1, the lead/lag option requires programming of the identification number of the other chiller in the lead/lag system at Address #2, and selection of one of these 2 chillers as the lead chiller at Address #3. The ID number of the "other" chiller in the lead/lag system must be different from the ID number of the chiller at Address #1. The lead chiller can be either chiller. In addition, the lag chiller does not have to be selected. The chiller not selected as the lead chiller will automatically be selected by the ESP as the lag chiller.

The method for programming these chiller identification numbers in the ESP lead/lag option address format is the same as that outlined previously in ESP Start-Up, Programming Chiller Identification. The only difference is that a chiller ID number must be programmed at 3 different addresses: first for the chiller at Address #1, then for the other chiller, and then for the lead chiller.

**CHILLED WATER PULLDOWN RATE** — The time and temperature inputs are variables that define a minimum desired leaving chilled water temperature pulldown rate (slope) in degrees/minute. The time variable also controls the minimum time that must elapse between the start of the lead chiller and the start of the lag chiller.

The programming example below shows a desire to have the chilled water temperature pulldown at least 2 degrees F in 10 minutes.

#### Programming Chilled Water Pulldown Rate

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for pulldown rate time
4	4	
ENTER	04 00	Address for pulldown rate time Present value
SET POINT		Blank display; ready for data†
10	10	New time rate of 10 minutes
ENTER	10	Data accepted
RECALL	5 00	Address for pulldown rate temperature Present value
SET POINT		Blank display; ready for data†
2	2	New pulldown rate temperature of 2 degrees
ENTER	02	Data accepted
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**CHILLER AT ADDRESS #1 PERCENTAGE OF TOTAL SYSTEM CAPACITY** — In order for the ESP to determine when the lead chiller can carry the load and shut down the lag chiller, it is necessary to enter the chiller capacity split of the total system. Entry of only the chiller at Address #1 is required; the ESP will automatically assign the remainder of the total to the other machine.

The entry is made as a percentage of the total. If, for example, the capacity of each chiller were the same, the chiller at Address #1 percentage of total capacity would be 50.

The programming example below shows the capacity of the chiller at Address #1 to be two-thirds of the total system capacity.

#### Programming Chiller at Address #1 Percentage of Total System Capacity

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
	28	Chiller present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address for chiller at address #1 percentage of capacity
6	6	
ENTER	06 00	Address for chiller at address #1 percentage of capacity Present value
SET POINT		Blank display; ready for data†
67	67	67% of total system capacity for the chiller at address #1
ENTER	67	Data accepted
EXIT	28	Chiller present status (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

**ACTIVATION OF LEAD/LAG** — Activation of lead/lag requires entry of all lead/lag program parameters shown above and activation of the lead/lag option as shown below.

#### Activating Lead/Lag Option

Place P/R Switch on ESP in PANEL Position

KEYSTROKE/INPUT	DISPLAY/RESPONSE	COMMENTS
		Unit present status*
0000	0000	(A zero appears with each keystroke)
ENTER	+18888	Access open; programming can begin
CHILLED WATER (Address)		Blank display; ready for address
7	7	
ENTER	07 00	Activation/deactivation address Present value
SET POINT		Blank display (ready for data)†
1	1	
ENTER	01	Activation code accepted
EXIT		Chiller present status code (new data registered)*

\*Chiller present status code may be any in the Diagnostic Codes table, or blank when unit is ready to start.

†If the display response to set point input is blinking, press CLEAR; check to be sure P/R switch is in PANEL position; then continue.

NOTE: Activation or deactivation of lead/lag while chillers are operating will cause chillers to shut down.

**Table 3 — ESP Address Format**

*42° SR  
30° RS  
CWR 42-62  
Return Water  
Reset*

ADDRESS	DESCRIPTION		VARIABLE INPUT RANGE		
1	Chiller Identification Number		0-7		
3	Chiller Identification Number Non-lead/lag system: Must be same ID no. as chiller at Address #1. Lead-lag system: Lead chiller (may be same ID no. as either chiller at Address #1 or Address #2).		0-7		
<b>Variables Associated with Chilled Water Reset Based on Cooler Temperature Difference</b>					
8 9	DATA PAIR A	Degrees of reset for the temperature difference at address 9. Temperature difference for the degrees of reset at address 8.	0° to ±30F (0° to ±17C) 2.0 0° to 20F (0° to 11C) 1.0		
10 11	DATA PAIR B	Degrees of reset for the temperature difference at address 11. Temperature difference for the degrees of reset at address 10.	0° to ±30F (0° to ±17C) 0 0° to 20F (0° to 11C) 2.0		
12	Activation/Deactivation		1 — Activate 0 — Deactivate		
<b>Variables Associated with Return Chilled Water Temperature Control</b>					
13	Activation/Deactivation NOTE: When activated, chilled water set point = return water control point		1 — Activate 0 — Deactivate		
<b>Variables Associated with Chilled Water Temperature Reset Based on a 4-20 mA Input Signal</b>					
14 15	DATA PAIR A	Degrees of reset for the amount of current at address 15. Amount of current for degrees of reset at address 14.	0° to ±30F (0° to ±17C) (4-20 mA)		
16 17	DATA PAIR B	Degrees of reset for the amount of current at address 17. Amount of current for degrees of reset at address 16.	0° to ±30F (0° to ±17C) (4-20 mA)		
18	Activation/Deactivation		1 — Activate 0 — Deactivate		
<b>Variables Associated with Chilled Water Temperature Reset Based on a Remote Temperature Sensor Input</b>					
19 20	DATA PAIR A	Degrees of reset for the temperature at address 20. Remote temperature value for degrees of reset at address 19.	0° to ±30F (0° to ±17C) -20 to 240F (-29 to 116C)		
21 22	DATA PAIR B	Degrees of reset for the temperature at address 22. Remote temperature value for degrees of reset at address 21.	0° to ±30F (0° to ±17C) -20 to 240F (-29 to 116C)		
23	Activation/Deactivation		1 — Activate 0 — Deactivate		
<b>Variables Associated with Demand Limit Set Point Based on Contact Closure</b>					
24 25 26 27	Demand limit when contact A is closed. Demand limit when contact B is closed. Demand limit when contact C is closed. Activation/Deactivation		40% to 100% 40% to 100% 40% to 100% 1 — Activate 0 — Deactivate		
<b>Variables Associated with Demand Limit Set Point Based on a 4-20 mA Input Signal</b>					
28 29	DATA PAIR A	Demand limit for the current at address 29. Current for demand limit at address 28.	40% to 100% 4-20 mA		
30 31	DATA PAIR B	Demand limit for the current at address 31. Current for demand limit at address 30.	40% to 100% 4-20 mA		
32	Activation/Deactivation		1 — Activate 0 — Deactivate		
<b>Variables Associated with Self-Start After Power Failure</b>					
33	Activation/Deactivation		1 — Activate 0 — Deactivate		
<b>Variables Associated with Ramp Loading Rate Adjustment</b>					
34	Ramp loading rate code	Code	Loading Rate (Degrees/Minute)		
			F C		
			Deactivate		
			0		
			1	2.25	1.25
			2	.75	0.42
			3	1.13	0.63
			4	1.50	0.83
			5	.38	0.21
6	3.0	1.67			
7	5.25	2.92			
8	10.5	5.38			
<b>Variables Associated with Enabling a Remote Contact</b>					
35	Activation/Deactivation		1 — Activate 0 — Deactivate		

Shaded area indicates addresses that apply only to ESP with lead/lag option.

## CONTROL TROUBLESHOOTING

The ESP has the capability to monitor inputs from control sensors, 4-20 mA output devices and the Basic 3200MP Controller serial communications port. If a problem with one of these inputs is detected, the ESP will display a diagnostic code. The ESP also has the ability to determine if data programmed in its address format is invalid or incomplete. The display will blink while attempting to program invalid data or activate a control option that has not been fully programmed.

If a control problem is suspected, the machine should be operated in local to determine if the problem exists in the Basic 3200MP Controller or the ESP. If a problem with a control is suspected, bear in mind that the ESP program depends on remote inputs. These inputs must be accurate and indicative of the parameters programmed in the ESP address format.

The ESP monitors options inputs for out-of-range conditions. If an out-of-range condition is detected a safety shutdown will be initiated and code 64 (sensor-out-of-range) will be displayed. The acceptable range for temperature inputs is -20 to 240 F (-29 to 116C) and for 4-20 mA inputs is 2 mA (0.5 vdc) to 22 mA (5.5 vdc).

Out-of-range or defective remote sensor inputs can be isolated by performing the controls test for the chiller (Basic Controller L/R switch set to LOCAL). Refer to chiller Start-Up, Operation and Maintenance Instructions for instructions for descriptions of controls test procedure.

**NOTE:** While the chiller controls test is being performed, the ESP K/D panel may not mimic the display on the S/D board.

Additional controls test steps are shown in Table 4. Test steps are automatically added to the steps for the Basic 3200MP Controller when an ESP is connected.

Check the accuracy of temperature sensors as described in the Basic 3200MP Controls section of the chiller Start-Up, Operation and Maintenance Instructions.

## CHILLER TROUBLESHOOTING

The ESP can serve as an aid to diagnosing a problem with the chiller(s). Shutdown codes are captured and stored in permanent memory and will not be lost, even if the ESP loses power. Shutdown codes are listed in the Start-Up, Operation and Maintenance Instructions for the chiller. Additional codes related specifically to problems involving the ESP are shown in Table 5.

The ESP will store the shutdown codes from the last 5 chiller shutdowns in order from most recent to least recent. Displaying stored shutdown status codes is described in ESP Display Functions Operations section.

**Table 4 — Additional Controls Test Steps for ESP**

STEP NUMBER		TEST DESCRIPTION	DISPLAY CODE STATUS
Single-Compressor Chiller	Dual-Compressor Chiller		
34	44	Display Spare #1 Sensor Input Status	1 — OK (Activated) 0 — Faulty 2 — OK (Not Activated)
35	45	Display Spare #2 Sensor Input Status	1 — OK (Activated) 0 — Faulty 2 — OK (Not Activated)
36	46	Display Temperature Reset 4-20 mA Input Status	1 — OK (Activated) 0 — Faulty 2 — OK (Not Activated)
37	47	Display Demand Limit Set Point 4-20 mA Input Status	1 — OK (Activated) 0 — Faulty 2 — OK (Not Activated)
38	48	Cycle Back to First Test (Depress Reset Pushbutton) End Controls Test (Depress POR Pushbutton)	0.1 (Test Step) 03 (Minutes)

**Table 5 — ESP Diagnostic Codes**

<b>CODE NO.</b>	<b>DESCRIPTION/MALFUNCTION</b>	<b>PROBABLE CAUSE/REMEDY</b>
45	Sensor Out-of-Range (Prestart)	Perform controls test to check for defective set point potentiometer(s) or open or shorted sensors; check sensor resistance.
55	Lag Chiller Malfunction (ESP displays 55, lead chiller displays error code, lag chiller displays present status code.) Code 55 will be displayed at ESP only when lead/lag option is active. When lead/lag is not active, ESP will display error code.	Lag chiller shutdown on safety. Lead chiller under ESP control. Check lag chiller status for shutdown code. Correct malfunction and reset lag chiller.
64	Sensor Out-of-Range (Operating)	Temperature sensor or diffuser feedback potentiometer (on DM) open or shorted or 4-20 mA input signal below 2 mA. Perform 38-step Controls Test to isolate defective input; check temperature sensor accuracy. Check connections at Basic Controller processor board.
76	Invalid Configuration	Basic Controller identification number not programmed in the ESP address format. Determine basic chiller identification number and program at address #1 and address #3 in the format.
81	Loss of Communication	Communication between the Basic Controller and the ESP not initialized or lost for more than 15 seconds after being initialized. See Initializing the ESP; check serial communication line for proper connection and contact; check line for shorts or breaks. Check for proper installation of memory expansion module.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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Replaces: 3200MP-ESP-1SSM

For replacement items use Carrier Specified Parts.

