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[1] LON is a U.S. registered trademark of Echelon Corporation.
[2] Echelon is a U.S. registered trademark of Echelon Corporation.

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INTRODUCTION

This manual will explain how to configure the RC-2000 Control Software for refrigeration control. The ECI RC-2000 Refrigeration Controller controls refrigeration groups/circuits and also logs, communicates, alarms, and backs up the data it controls. The software control areas include temperature/defrost, racks, logic statements, and leak detect. They are explained in the sections that follow.

TEMPERATURE/DEFROST CONTROL

CIRCUIT

The temperature/defrost control group controls a maximum of 32 individual circuits that support time or temperature termination, digital termination, demand defrost initiation, and programmable hot-gas relay outputs. Included also are refrigeration and runoff time delays, high and low alarm setpoints, and defrost skipping on dew point. Up to six defrost times are available per day.

Each circuit and sensor can be assigned a name (or description) that is a maximum of 34 alphanumeric characters long. Both the input sensors and output relays are programmable.

Features may be added or substituted with a simple configuration. If certain features are not used, the screens do not contain needless references to them.

Other circuit control features include:

1. Suction and/or liquid line solenoid control by temperature.
2. Industrial hot gas defrost control strategy: pump out phase, defrost phase, equalize phase
3. Individual case defrost control
4. Defrost restart control option
5. Temperature dead band

ELECTRONIC CASE CONTROL

The RC-2000 provides Echelon Network management for a maximum of 59 Electronic Case Control (ECC) Units. The ECI case control provides stand alone refrigeration and defrost control at the case.

NOTE
Electronic Case Controls (ECCs) are stand-alone units that do not depend on the RC-2000 for active control.

The RC-2000 can be used to program setpoints and view status of the ECC's. In addition, all data for the ECC's are stored within the RC-2000 and saved for local or remote viewing.

SUCTION-HEAD PRESSURE CONTROL

RACKS

The RC-2000 controls suction and discharge pressure for a maximum of four groups (racks). The racks may be configured to add control capabilities such as variable speed, floating setpoints, auxiliary setpoints and heat reclaim override. To gain control of a rack, some setpoints need entered for cut in and cut out pressures along with pressure inputs and control relays for compressors and condenser fans. In addition, there are adjusting setpoints such as capacities, gains, and short cycle delays.

RACK CONTROL GENERAL FEATURES

Rack control features on rack and condenser fans are listed below.

1. Temperature compensation of the suction setpoints by automatically referencing the most critical circuits.
2. Digital inputs that activate auxiliary suction and/or head setpoints.
3. Digital inputs for phase loss, liquid level, oil failure, defrost sensing, and run verification.
4. Head pressure control via temperature differential. Condenser fans cycle based on ambient temperature, with upper and lower pressure control limits.
5. Two stage interlocking of racks (i.e., lockout the low temperature rack if the medium temp rack compressors are not running).
6. Additional monitor only points for up to eight temperature sensors, eight pressure sensors, four relays, four digital inputs, and one analog input per rack.
7. Desuperheater control based on manifold temperatures.
8. High head pressure override of compressors.
9. Split condenser operation based on outdoor temperature for 6-12 condenser fans.

Each rack and sensor may have a name. A rack name may be a maximum of sixteen characters long, and each sensor description can be up to twenty-four characters long. Both the input sensors and the output relays are programmable. Add or subtract features in a configuration section. If certain features are not used, the various screens do not refer to them.

LOGIC STATEMENTS

Logic statements base control configuration on 'If…Then' decisions. The RC-2000 Control Software provides a maximum of 32 logic statements. They can be used for Stand-alone System Control or Supplemental Control of existing Circuit or Rack Loads.

NOTE

Loads controlled by a logic statement can be put into a software override condition at any time. When a load is returned to its normal system control, it assumes the state called for by the current logic statement.

REFRIGERANT LEAK MONITORING

The RC-2000 Control Software controls refrigerant leak monitoring groups. The groups include digital input, analog input, and the IRIS leak monitor. Each group monitors either one digital contact; three analog inputs from remotely located ECI leak sensors; or eight inputs from the IRIS Infrared Leak Monitor. The software supports a maximum of four digital input groups via one input, four analog input groups via three inputs, and one leak detect group (through the IRIS Unit) via eight inputs.

NOTE

Each analog input may have a separate alarm setpoint.

Contact ECI for more information about analog and infrared leak sensors.

LOGGING

The RC-2000 Control Software automatically logs all analog and digital inputs, all digital outputs (relay drivers), and all analog outputs that are assigned. In addition, rack run-times, and circuit cycles are logged. This information is accessible on site or remotely for analysis of overall system performance.

NOTE

A logging interval must be used to enable this feature. The RC-2000 Control Software defaults the logging interval to 180 seconds. The logging interval is the period between logged points of data.

You may view the logging information at the unit or from a remote computer via graphs.

SUGGESTION

Use logging information to analyze the overall system performance.

COMMUNICATIONS

Each RC-2000 includes an RJ-11 port for connection to most compatible telephone modems rated for 1200, 2400 or 9600 baud. All RC-2000 units on site can be "daisy-chained" together to create a local network accessible locally with a direct-connected PC or laptop, or remotely via a modem connection.

IMPORTANT

The RC-2000's communicate to each other via an RS-485 loop.

Communication to the input/output modules is through a separate RS232 serial connection.

ALARMING

The RC-2000 Control Software notifies upon alarm conditions in the refrigeration system. It reads an alarm by comparing measured inputs against user defined setpoints. The RC-2000 will also monitor the RAM back up battery and alarm on a low battery condition.

NOTE

All alarms are listed in the alarm log; they can be "sent out" via system relays or dial out capability through the modem. You must identify the relays that will be used for this purpose (by number and name).

Alarms can be sent to:

- a local dumb terminal **AND**
- a maximum of six (6) occupied telephone numbers plus a maximum of six (6) unoccupied telephone numbers.

All major alarm types can be enabled or disabled for dial out activity. Each circuit, rack, refrigerant leak group, and logic statement individually control the dial out parameters.

NOTE

Dial out tests are provided a maximum of two times/day. All dial outs are logged (whether they are successful or not).

An ECI Smart Alarm can be installed within the RC-2000 communications network. The RC-2000 can be configured to transmit alarm conditions to the smart alarm. The smart alarm will display and log all alarm conditions.

SETPOINT AND LOGGING BACKUP

The RC-2000 Control Software saves all setpoint data. It uses non-volatile flash memory to maintain the setpoint data. Data is backed up upon exiting to the "banner screen" or after disconnecting from any communication in which a setpoint change was made.

IMPORTANT

If an RC-2000 loses power and the RAM backup battery is dead, the RC-2000 will recall the setpoints from its flash memory.

Indications of data backup are displayed in the "banner screen" and will be explained there. All logged data is saved in static RAM, which is backed up by the nine-volt battery located on the power supply. This information will be lost should the battery fail during a power outage.

THE RC-2000 CHANNEL NUMBERING SYSTEM

The RC-2000 can read 128 inputs via eight 16 channel universal input boards. These inputs can be any combination of digital and analog types up to a combined total of 128. The RC-2000 will evaluate conditions of these inputs to control up to 64 digital relay outputs and up to 32 analog outputs.

The RC-2000 Inputs/Outputs (I/O) are assigned and addressed via a board number and a channel number. There are five different types of boards that are used for RC-2000 I/O.

1. Digital Input (8 Channel)
2. Analog Input (8 Channel: 1-6V, 0-10V, temperature)
3. Universal 16 Channel Input combination of: DigIn & AnalogIn with total flexibility of input type per channel.
4. Analog Output (4 Channel)
5. Digital Output (Relays) (8 Channel)

The RC-2000 can use up to eight of each of the board types.

NOTE

When using a 16 Channel Universal Input Board (SUI16), you lose the capability to use a digital input AND an analog input board with the same board number. 16 Channel Input replaces two eight channel boards of either digital or analog input type.

The Digital Output Boards can have a ninth board assigned for Echelon Network communications only. The ninth board may be used for ECT's KWIC Module applications.

The RC-2000 addresses the input boards via a three-digit address method in the form of "x-yy." The output boards are addressed in a two-digit address method: x-y. The x represents the board numbers 1-8 and the yy represents the input channel, 1-16. Channels 9-16 are only available on the SUI16. On this SUI16, y represents output channels 1-8.

A channel numbering convention remains consistent throughout the RC-2000 Controller. It includes channel references found on hardware labels, firmware menus, and screens within the remote communications software. The format is explained in Table 1.

NOTE

Prior to assigning input board/channel values ensure that the board type is set for application. All input boards are configured as sixteen channel input by default within the Board/Channel Setup Screen. See the Board/Channel Setup Screen explanation and example later in this manual.

IMPORTANT

RC-2000 Control Software, Version 4.40 and higher, supports a Board 9 Network.

Table 1, below defines the input and output channel assignment and lists assignment values.

TABLE 1 – RC-2000 INPUT/OUTPUT BOARD CHANNEL ASSIGNMENTS

Inputs	**Input Channel Assignment Definition**	**Board/Channel Ranges**
x-yy	***x*** = Module or Board Number ***yy*** = Channel Number	***x*** = 1-8 ***yy*** = 1-16* *9-16 only available on SUI16 boards.
Outputs	**Output Channel Assignment Definition**	**Board/Channel Ranges**
x –y	***x*** = Board Number ***y*** = Channel Number	***x*** = 1-8 (Brd 9 DigOut Net only) ***y*** = 1-8 (digital output) or 1-4 (analog output)

THE WINDOW/PAGE USER INTERFACE

The RC-2000 has a 20 x 40 character LCD, and a numeric keypad for programming and interrogating the RC-2000 Control Software. Information is stored and organized in hierarchical form. The hierarchy runs from lowest to highest, as follows:

1. **The Data Field**. A single user accessible data item, such as a setpoint.
2. **The Screen**. A display point for specific setpoint information.
3. **The Menu**. Related screen groupings displayed on the screen.
4. **The RC-2000 Main Menu**. The Main Screen from which to navigate through the data levels.

The RC-2000's LCD displays up to twenty-lines of information. The related data fields in the software are displayed on the LCD screens. If a screen contains information covering multiple circuits or racks, the screen will be subdivided into pages. Press [↑, or ↓] to scroll through information on the page. Press [←, →] to move to another page. To jump to a specific page, press [THE PAGE NUMBER] (for example, press [0] and [8] to display page eight).

SUGGESTION

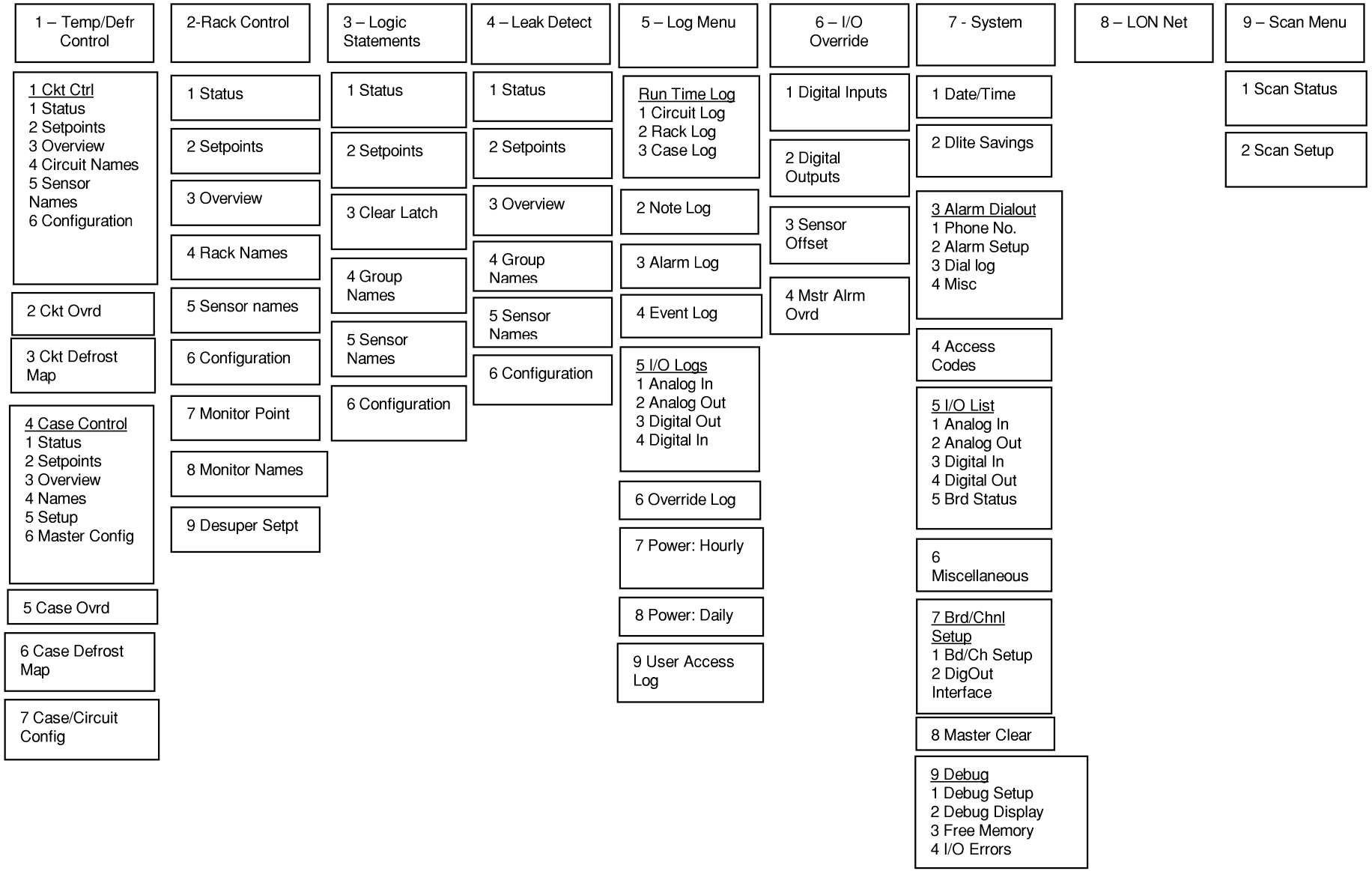
To move through menus, screens, pages, and data fields faster: Press [THE DESIRED ARROW KEY] and hold it down to repeat the action. It will stop when the key is released.

NOTE

When moving from page to page (column to column), the window remains in the same relative position. For example, on the Rack Setpoint Screen, scroll down the page to the area showing relay assignments and view the relay assignment for each configured rack by changing pages.

RC-2000 CONTROL SOFTWARE PROGRAMMING

RC-2000 CONTROL SOFTWARE MENU FLOW CHART, VERSION 4.40



INTRODUCTION

The RC-2000 Control Software is initially programmed during installation. For best results, ECI recommends that you follow this programming sequence:

1. Board Channel Set-Up
2. Configuration Screens
3. Setpoint Screens
4. Names Screens

Each menu or screen consists of a (title line) plus (one or more lines of text and data). The title line consists of a (page number) plus either (a screen title) or (a user-defined identifier). If the screen consists of more than twenty data lines, press [↑] or [↓] on the keypad to scroll through the entire selection. (Any screen that can be scrolled through is terminated by two rows of double asterisks to separate the first and last data lines.)

An arrow (>) denotes cursor position. Cursor position in the software will indicate: the current page, menu selection, or data field.

NOTE

If more than one page of information is available for a given screen, the cursor appears to the left of the page number when the screen or a new page is installed.

RC-2000 DATA NAVIGATION GUIDE

Refer to the following list for RC-2000 programming basics:

1. **To change menu selections or data fields:** press [←, ↑, →, ↓];
   To move the cursor around the menu or screen: press [**ENTER**].
2. **To change menus:**
   press [**THE MENU NUMBER**] that corresponds to the number of the desired menu selection;
3. **To change pages** (e.g., from CIRCUIT A01 to CIRCUIT A02): press [→ **or** ←] when the cursor is to the left of the page number.
4. **To enter the data portion of a programmable screen from the title line:** press [**ENTER**]; the cursor will appear to the left of the first programmable data field on the screen.
5. **To begin data entry for any selected field:** press [**ENTER**]; the arrow cursor will change to an underline, this shows that new data will be accepted.
6. **To enter data for numeric fields:** press the [**APPROPRIATE NUMBER**] or [↑ **and** ↓] to advance each digit in the field to the desired value.
7. **To change position:** press [← **or** →].
   To enter data for alphanumeric fields: press the [**APPROPRIATE NUMBER**] or [↑ **and** ↓] to advance each character in the field to one of the following:

0 1 2 3 4 5 6 7 8 9
A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z .
a b c d e f g h i j k l m
n o p q r s t u v w x y z
, : # * ! / &

8. **To enter data for a multiple-choice field:** press [↑ **or** ↓] to cycle through the available choices.
9. **To complete your data entry for any field:** press [**ENTER**]; the cursor will reappear either at the next field or to the left of the current field.
10. **To leave a field without changing its value:** press [**EXIT**].
    - If more than one page of information is available for a particular screen, press [**EXIT**] to return the cursor to the page number of the screen.
    - To cause a feature or setpoint to be unused on a Rack or Circuit, set the input or output designation to channel number 0-00 or 0-0.

RC-2000 START UP SCREENS AND MENUS

RC-2000 Menu

1 – Temp/Defrost Control	5 – Log Menu
2 – Rack Control	6 – I/O Override
3 – Logic Statements	7 – System
4 – Leak Detect	8 – LON Network
9 – Scan Menu (Unit 1 Only)	

SUGGESTION
Before programming the Control Software, become familiar with the menus, screens, and data fields.

RC-2000 BANNER SCREEN

The RC-2000 Banner Screen appears at these times:

1. Upon initial power up
2. After a power failure
3. After a timeout period minute with no keypad action. (The back light will also go out after this timeout period, however, after any key is pressed, the back light will re-energize. If the unit has no new alarms, the top status line will be blank.)

The Banner Screen displays the status of flash memory backup. Flash memory backup states are displayed after the actions listed below:

1. When a setpoint is changed and you exit to the 'Banner Screen.'
2. When on line with the unit while using terminal software, you make a setpoint change, and then disconnect.

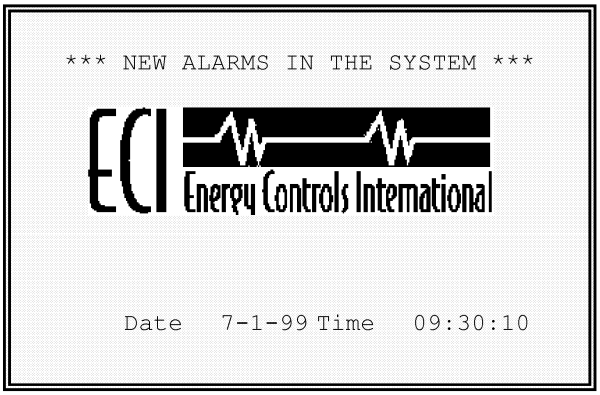
The flash memory backup statements that are displayed on the Banner Screen include:

1. **Saving changes to flash. . . .pend**
   This indicates that flash changes need to be performed, but the RC-2000 is waiting for communication to be disconnected.
   A disconnect must be performed in the terminal software to ensure that the RC-2000 registers communication termination. If a disconnect at the RC-2000 is not performed, the RC-2000 must wait fifteen minutes for the communication time out period.
2. **Saving changes to flash . . . .busy**

   A flash save is in progress.

3. **Saving changes to flash . . .done**

   A flash save is complete. This message will only be displayed for a few seconds.



RC-2000 BANNER SCREEN

RC-2000 USER INTERROGATION MENU

From the Banner Screen, press [0] to activate the User Interrogation Menu Screen. At the User Interrogation Menu Screen, you may access circuit; rack and case status; alarm log; I/O graphics; and emergency defrost settings. The emergency defrost settings provide for defrost overrides. Temperature control override time intervals can also be set in the emergency defrost settings. The maximum temperature control override interval is 998 minutes. You may also set an alarm override time of 9998 minutes here.

```
        User Interrogation Menu
 1 - Circuit Status   4 - Emergency Defrost
 2 - Rack Status      5 - I/O Graphics
 3 - Alarm Log        6 - Case Status
                      7 - Case Ovrd
```

RC-2000 TITLE SCREEN

The RC-2000 Title Screen shows the RC-2000 Control Software version number and the baud rate setting for the unit.

IMPORTANT

Record the version number of the installed firmware and be sure to reference it when discussing your RC-2000 with an ECI sales representative or engineer.

It also displays warning messages. For example, the message 'NEW ALARMS IN THE SYSTEM' will remain displayed until the alarm log is viewed either at the unit or remotely. The message 'RAM Backup Battery is Low' will display if the voltage of the 9-Volt RAM back-up battery falls below 6 Volts.

The Title Screen asks you for your user access number. You must enter [AN ACCESS CODE] or press [ENTER] to access the RC-2000 Main Menu. If you enter the RC-2000 Main Menu by pressing enter, you have view-only system access. If you want to interrogate the software for setpoint changes, you MUST ENTER a VALID ACCESS CODE. Access codes are administered by the Super User. If during maintenance or repair, you need access to certain programmable data fields, enter the access code that is appropriate for your programming needs. For more complete information on RC-2000 Control Software (Version 4.30 or higher) footprinting security features, see the next section.

```
ECI RC-2000 SOFTWARE VERSION 4.00

     Enter Access Code:  XXXX_
      Unit ID #1   Baud 9600
```

ACCESS CODES

ECI has implemented footprinting capability in software version 4.30 and higher. The access codes are entered at the Title Screen.

THEORY AND OPERATION

FOOTPRINTING FEATURE

The software footprinting feature improves program security. It also allows you to monitor all user-programmed changes to a unit. It works through user access level assignments by starting with a high-level system administrator called the "Superuser." The "Superuser" creates a list of users with programming access to the RC-2000.

This new security approach has three access levels: read, write, and "Superuser." ECI also provides a backdoor access in the case of a system lockout. The ECI backdoor access is at the "Superuser" level. With this security approach, the "Superuser" can control and monitor all system changes.

NOTE

A default "Superuser" password will be programmed into your software. It is 9876.
ECI recommends that you change it immediately.

IMPORTANT

The system will support a **MAXIMUM** of **twenty** (20) users.

ECI BACKDOOR SECURITY ACCESS

ECI provides backdoor security access into the system to protect against a system lockout. Backdoor access provides emergency access when system operation must be maintained. Each RC-2000 is equipped with an algorithm that enables backdoor access. The backdoor access code changes on a daily basis.

SECURITY ACCESS LIST

The access level is for user change tracking. It lists a user name and a specific password for each user. For example, whenever the user accesses the RC-2000 unit and makes a programming change, a log will update. Table 2 contains a complete list of footprinting security features.

ACCESS LEVEL EXPLANATIONS

The definitions below explain the different user access levels available with the footprinting feature:

Read Only Access: The right to view system setpoints and status, and initiate emergency defrost.

Write Access: The right to change system setpoints or status with the exception of the access codes.

Superuser Access: The right to change system setpoints or status. Can also view access code screens and assign an access code to a maximum of twenty (20) write level users. *Note:* "Superuser Access" also applies to the ECI backdoor user.

TABLE 2 – SECURITY ACCESS FEATURES

PASSWORD:	LOGGED NAME:	ACCESS LEVEL:
None	None	Read Only & Emergency Defrost
Any four (4) digit number **EXCEPT 9876**, assigned by "Superuser"	Assigned by "Superuser" (8 character alphanumeric maximum)	Write/no access to user access screens
9876 default, **should be modified** to another four (4) digit number	"Superuser"	Write, including user access screens
ECI backdoor, daily revolving security code	ECI BckDr	Write, including user access screens

"SUPERUSER" AND ECI BACKDOOR ACCESS

The "Superuser" and ECI backdoor access will allow the user to view two new screens. These screens support the new footprinting capabilities.

ACCESS CODE SCREEN

The first screen is a new access code screen. The access code screen consists of the following:

1. A single line for "Superuser" access.
2. Multiple lines for additional users.

To access the screen, follow this path from the main menu:

1. Press [7], System
2. Press [4], Access Codes

The access code screen will appear, and you will be able to view system users by name and password.

IMPORTANT

This screen can only be viewed and cleared by the "Superuser" or through the ECI backdoor. The User Access screen will record an entry for the user who cleared the log.

USER ACCESS LOG

The second screen addition is a User Access Log. To access the User Access Log, follow this path from the main menu:

1. Press [5], Log Menu
2. Press [9], User Access Log

This log maintains a chronological list of user access, and each line shows the user name, the functional group accessed (i.e., rack setpoints, sensor offset, emergency circuit defrost, etc.) as well as the date and time.

NOTE

This screen is accessible only to the "Superuser" or through the ECI backdoor.

ACCESS CODE NAME	PASSWORD
SuperUsr	5678
Manager	6789
StorSer	7890
ECIServ	1111

Access Code Screen Example

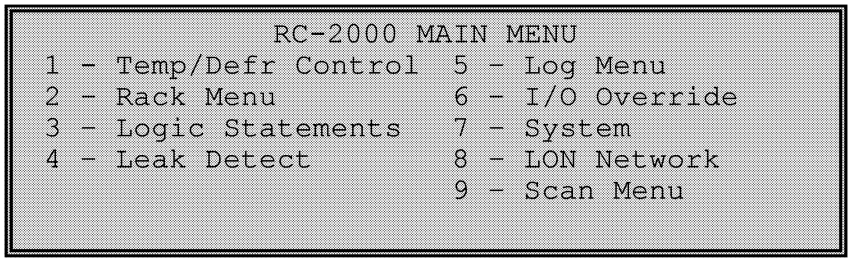
DATE	TIME	USER NAME	USAGE RECORD
04-01	21:55	StorServ	Case Install
04-01	13:59	SuperUsr	System Dial
04-01	10:01	SuperUsr	^Case Install (*see below)
04-01	09:55	ECIBkDr	^Data Download (*see below)

User Access Log Example

***NOTE:** ^ represents a user change made by remote access (i.e., away from the unit).

RC-2000 MAIN MENU

The RC-2000 Main Menu appears after you enter an access code and/or press [ENTER] at the RC-2000 Title Screen. It is a Table of Contents to the system configuration and control functions. The Scan Menu choice (number 9) will only be available for the unit that is IDed as "Unit ID #1."



Required Access Level: None

TEMPERATURE/DEFROST CONTROL

TEMPERATURE/DEFROST CONTROL MENU

The Temperature/Defrost Menu is selection number one from the RC-2000 Main Menu. It is a Table of Contents to the RC-2000s circuit and case configuration and control functions. To make any programming changes at this menu, you **MUST HAVE** user access clearance (refer to the *Access Codes* section of this manual for more information).

```
              Temp/Defr Control
 1 - Ckt Control        4 - Case Control
 2 - Ckt Ovrd           5 - Case Ovrd
 3 - Ckt Defrost Map    6 - Case Defrost Map
         7 - Case and Circuit Config.
```

CASE & CIRCUIT CONFIGURATION SCREEN

The Case & Circuit Configuration screen is choice [7] on the Temperature/Defrost Control Menu. This screen will set up the ratio of circuits and cases that will be programmed.

NOTE
This field should be set prior to programming circuits and cases.

The configuration options are:

Circuits	Case
32 (default)	10
26	20
20	30
14	40
8	50
2	59

CIRCUIT CONTROL MENU

The Circuit Menu is selected from the Temperature/Defrost Control Menu. It is a Table of Contents to the RC-2000s circuit configurations and control functions. To make any programming changes at this menu, you **MUST HAVE** user access clearance (refer to the *Access Codes* section of this manual for more information).

```
              Ckt Control
 1 - Status           4 - Circuit Names
 2 - Setpoints        5 - Sensor Names
 3 - Overview         6 - Configuration
```

CIRCUIT STATUS SCREEN

The Circuit Status Screen displays the status of each circuit configured for temperature/defrost control. The screen title line lists (the circuit number) plus (the user defined name of the circuit).

Line 2 displays (a status field) plus (several headings). The headings serve as status field descriptors. Some heading examples for Line 2 include Refrig ON, Refrig OFF, and Refrig OVR. A complete list of headings and their descriptors is compiled in Table 3, below.

The headings in the screen example presented for the Circuit Status Screen represent the circuit setpoint and the actual sensor fields that follow on Lines 3 & 4.

NOTE

On the Circuit Status Screen Example:
Temperature setpoints and actual sensor readings are displayed in degrees Fahrenheit (Celsius is available as an option, see the Miscellaneous Screen under the System Menu).

Temperatures read from, or programmed for a standard temperature card (-30° to 97°) have 'f' as units.

Temperatures read from, or programmed for the high temperature card (0 to 255°) have 'F' as units.

If there are no sensors assigned for a given category, (i.e., termination, alarm) the status will show "n/a."

TABLE 3 – STATUS FIELD DESCRIPTIONS

STATUS FIELD DESIGNATOR	STATUS FIELD DESIGNATOR DESCRIPTION
Refrig ON	Refrigeration Phase ON
Refrig OFF	Refrigeration Phase OFF
Refrig OVR	Refrigeration Relay Override
Relay ON	Refrigeration is on due to another circuit's action using the same relay
Defr OVR	Master defrost relay override
DEF XXXm	Normal defrost, master relay on, XXX minutes left
DEF on XXXm	Normal defrost, master relay off, XXX minutes left
EMG XXXm	Emergency defrost, master relay off, XXX min. left
EMG on XXXm	Emergency defrost, master relay on, XXX min. left
Ecase XXXm	Case emergency defrost, XXX minutes left
Case XXXm	Case normal defrost, XXX min. left
Rn OFF XXXm	Runoff phase, XXX minutes left
PumpO XXXm	Pumpout phase, XXX minutes left
EqualXXXm	Equalize phase, XXX minutes left
EvpFn XXXm	Evaporator fan delay, XXX minutes left
T ovr XXXm	Temperature override, XXX minutes left
-Ph Loss	Phase loss of the assigned rack, refrigeration off
Note: The (XXX) value in the table above represents a timer value in minutes	

Certain symbols on this screen show specific alarm conditions. They are defined in the table listed below.

TABLE 4 – ALARM CONDITION SYMBOLS WITH EXPLANATIONS

SYMBOL	EXPLANATION
L (reverse video)	Low temperature
H (reverse video)	High temperature
O (reverse video)	Alarm override
B (reverse video)	Sensor fault
Reverse Video – Symbol appears white on a black background, (in reverse of the norm, which is black on a white background.)	

When multi-case defrost termination is selected, each case status is displayed. The actual 'Term' status above is displayed as 'CASE.' This indicates to look further below for actual case status. The individual case status display is shown in Table 5 below.

The **'ACT' row** on the case status display indicates the current case temperatures. If termination sensors were not assigned to a particular case, the actual value shows as 'n/a.'

The **'Defr' row** on the case status display shows the state of the case defrost relays. If a defrost relay was not assigned to a case, the field shows 'n/a.'

If **TIME/DIG defrost initiation** is configured, a line will be displayed indicating when the last defrost cycle ended.

Under the heading **'Sensors,'** the analog input type, I/O board channel number, status, and user-defined name are displayed for each assigned temperature, alarm, and defrost termination sensor. The digital input type, I/O board-channel number, and status are displayed for the assigned digital defrost termination and initiation inputs.

NOTE

Only the sensors being used will have data displayed.

The types of sensors and inputs associated with the temperature/defrost control circuits are determined by the options selected on the Circuit Configuration Screen.

If 'View Rack Status' is configured, and a rack number is assigned in the setpoints screen, rack status will display below the circuit status.

TABLE 5 – INDIVIDUAL CASE STATUS DISPLAY

CASE	1	2	3	4	5	6
Act	22F	25F	29F	25F	23F	N/A
Defr	ON	ON	OFF	OFF	OVR	N/A

CIRCUIT SETPOINTS SCREEN

INTRODUCTION

All programmable parameters that affect the temperature/defrost control circuits of the RC-2000 can be found on the Circuit Setpoints Screen. The title line consists of the circuit number and user-defined circuit name.

NOTE

The circuit setpoint screen example displayed with this text has all possible options configured.

In most cases, the circuit setpoints screen will only have a portion of total options displayed.

The RC-2000 will reference the Fahrenheit or the Celsius temperature scale. (This option may be modified in the System/Miscellaneous screen.)

The RC-2000 controls refrigeration by using a low temperature or a high temperature sensor. The default setpoints for low temperature sensors range from (-30°F to 97°F). The default setpoints for high temperature sensors range from (0°F to 255°F). If configured for a high temperature, the sensor should be assigned prior to assigning setpoints.

CIRCUIT SETPOINT FIELDS

The **Temp Setpoint** is a single setpoint that represents the cut out temperature of the circuit.

NOTE

When temperature deadband control is selected in circuit configuration, the **Temp Setpoint** will be replaced by **Cut in** and **Cut out Setpoints**.

The **High And Low Alarms** are temperature alarms for the circuit. If their value is exceeded in either direction (greater than high or less than low) for the time assigned to the alarm delay, an alarm will be generated. These setpoints will only be activated when an alarm sensor is assigned to the circuit. If more than one is assigned, the lowest temperature will be used for the low alarm, and the highest temperature will be used for the high alarm.

The **Alt High** and **Alt Low Alarms** will be available when the system is configured for alternate alarms. The Alt Alarm setpoints provide an additional alarm setpoint for dual temp applications that are in the same column as an assigned Alt Alrm Dig Input that is in closed position.

The **Defrost Term Setpoint** is a temperature setting. If all Term Sensors are greater than this setpoint, refrigeration defrost will terminate BEFORE timing out. For the defrost term setpoint to be active, the system must be configured for temperature, a Term sensor must be assigned and this setpoint (defrost term) must be assigned.

The **Defrost Restart** setpoint is a temperature setting. If the temperature of all assigned termination sensors fall below this setpoint during the current defrost period, a defrost restart will occur. For example, defrost restart will restart defrost if there is an icing problem with a case.

The **Evap Fan Start** setpoint is a temperature setting. It will hold the evaporator fan off after defrost until the termination sensors fall at or below this temperature. If this temperature setpoint is not reached, the fan will start after the evaporator fan delay time has expired as a fail-safe to ensure a fan restart.

The **Dew point Controlled Skip** setpoint is a dew point temperature. It is selected on the Circuit Configuration Screen. When it is selected, the data fields **Skip defr @dp** and **Max dp skips** are added to the Circuit Setpoint Screen. The **Skip defr @dp** field is a setting that will allow the system to inhibit or skip the next defrost cycle if the dew point temperature has been below it for the interval between a complete defrost cycle. The **Max dp skips** field sets the maximum number of times that the dew point will be permitted to skip the defrost cycle before the system goes into mandatory defrost.

NOTE

The **dew point controlled defrost skip** and the **digitally initiated defrost** are mutually exclusive. They cannot be enabled at the same time.

The **Refrig Delay** setpoint is the minimum off time between refrigeration relay cycles.

SUGGESTION

Use the **Refrig Delay** setpoint to prevent short cycling of the refrigeration system.

The **Alarm delay** setpoint is the period that an alarm condition must be active before an alarm is logged.

NOTE

The alarm is inactive:

- DURING defrost
- 15 minutes plus the alarm delay AFTER defrost

The **Pumpout Time** setpoint is the time allowed for pumpout when the pumpout phase is configured. When a defrost is initiated, the liquid relay will turn off for the programmed time to allow the circuit to pumpout. Afterwards, normal defrost will occur.

The **Runoff Time** is the period after defrost that the refrigeration relay will be off. Afterwards, normal circuit refrigeration will begin. Runoff time allows evaporator coils to drip off completely before refrigeration begins again.

NOTE

When Pumpout Phase is configured, the Runoff Time setpoint will not be shown.

The **Defrost Time** setpoint is the maximum time a *normal-time initiated defrost* will last UNLESS it is terminated by temperature or digital input.

The **Equalize Time** setpoint is the time allowed for equalizing pressures when the Equalize Phase option is configured. Following a defrost cycle, the equalize relay will be energized for this period before normal refrigeration control is resumed.

The **Evp Fan Dly** setpoint is the maximum time after a defrost that the evaporator fan will stay off (see 'Evap fan start').

The **Defrost Start Times** setpoints are six separate time fields. They are set as **HOURS: MINUTES** (military time).

IMPORTANT

[00:00] is not a valid field!
To set defrost at midnight enter [24:00].

The **Alternate Alarm Digital Inputs** are available when the RC-2000 is configured for Alternate Alarms. When the Alternate Alarm Input is CLOSED, the RC-2000 will compare the associated alarm sensor with the Alternate Alarm setpoints and will allow temperature setting changes to the dual temperature cases without changing setpoints. The system will provide six or twelve Alt Alrm Inputs, depending on the number of sensors configured per circuit. Each Alt Alrm Input is associated with one alarm sensor in that circuit. For example, the first input in the first row is associated with the first alarm sensor in the first row; the second input in the first row is associated with the second alarm sensor in the first row.

The **Dew point Sensor** input is only available when configured for dew point controlled skip. This input value will be referenced by the RC-2000 to determine if defrost should be skipped based on current store dew point temperature.

The **Temperature Sensor** inputs are used to compare against the circuit temp setpoint to cycle refrigeration. The RC-2000 can be configured for six or twelve input sensors. One to twelve temperature sensor inputs can be assigned to be used for each circuit. The RC-2000 will average the values of all assigned temperature sensors.

The **Alarm Sensor** input is an assignment for an alarm sensor. Up to six or twelve alarm sensors can be assigned, depending on the number of sensors configured. The alarm sensor inputs are used for circuit alarm reference. The lowest value is compared against the low alarm setpoint; the highest value is compared against the high alarm setpoint.

The **Term Sensor** input is a temperature assignment for a defrost term sensor. Up to six or twelve term sensors can be assigned, depending on the number of sensors configured. The termination sensors are used to terminate the defrost cycle by temperature, restart the evaporator fan, and restart defrost depending on circuit configurations. For defrost termination to occur, all term sensors must exceed the term setpoint. For evap fan start to occur, all term sensors must fall below the Evap Fan Start Temperature. For Defrost Restart to occur, all term sensors must fall below the defrost restart temperature in the defrost period.

The **Individual Case Defrost Relays** are only available when configured for Multi-Case Defrost. All of these defrost relays will initiate defrost from a single defrost schedule for the circuit. Each defrost relay references an individual termination sensor thus terminating defrost from that valve. The defrost relay is paired with the term sensor input that is in the same row on the setpoint screen. For example, the first relay in the first row is associated with the first termination sensor in the first row. The second relay in the first row is associated with the second termination sensor in the first row.

The **Suction Relay** is used for controlling the suction line solenoid on the circuit (use with N/C contacts). This relay is available with circuit default configuration.

The **Liquid Relay** is used for controlling the liquid line solenoid on a circuit (use with N/C contacts). The RC-2000 can be configured to use only a liquid relay or both suction and a liquid relay.

The **Defrost Relay** is used for a defrost load (use with N/O contacts).

The **Mstr Hgas rly** (Master Hot Gas Relay) controls the hot gas defrost valve (use with N/O contacts). The circuits must be configured for the Hot Gas option for this relay to be available.

The **Evap fan rly** (Evaporator Fan Relay) controls the evaporator fan (use with N/C contacts). The circuits must be configured for EVAP FAN control for this relay to be available.

The **Equalize Relay** controls the equalize valve (use with N/O contacts). The circuit must be configured for Equalize Phase for this relay to be available.

The **Alarm Relay** is the relay used for all alarm functions on a circuit. It is energized if nothing is in alarm (use with N/C contacts).

The **Def vrfy inpt** (Defrost Verify Input), **Suct vrfy inpt** (Suction Verify Input) and **Liq vrfy inpt** (Liquid Verify Input) are digital inputs used for proof of run verification. If a system is in defrost or refrigeration, the corresponding digital contact should be closed.

The **Defrost Initiates on OPEN/CLOSE** field is a polarity setting. If defrost initiation is set for time/digital, then this field will be available to select the polarity of the defrost sense input. When defrost is scheduled to begin, the RC-2000 will check the defrost sense inputs to ensure that at least one of the inputs matches this setting. If there is not a match, defrost will be skipped for that cycle.

The **Defrost Off** setpoint is a time setting. When defrost initiation is set for time/digital, this field selection is available. It is the maximum time that defrost can elapse when the defrost init input setting(s) do not match the defrost initiates on setting(s) during a call for defrost.

The **Defrost Term Input** is available when configured for time/digital defrost termination. If this input is assigned, defrost will terminate when it is closed. This input must be open at the Defrost initiation time for defrost to occur.

The **Alarm Override Input** is available when the system is configured for digital alarm override. When this input is CLOSED, all alarms from that circuit will be overridden. For the override condition to clear, the input must be OPEN.

The **Temp Compensation Priority** setpoint assigns priorities to each circuit when using floating setpoints on the rack. To enable the Temp Compensation Priority, the Rack Configuration Screen under Temp Controlled Setpoints must be set to [SELECT] or [DEFAULT]. When [SELECT] is chosen, priorities may be assigned to the circuit(s) that will be referenced to float rack suction pressure setpoints. When [DEFAULT] is chosen, the circuit with the lowest setpoint will be referenced to float rack suction pressure setpoints.

The rack setpoints will float (up to the **Max Cut In** setpoint on the Rack Setpoint Screen) only if the priority 1 circuit is satisfied. If the priority 1 circuit is in defrost, the rack setpoints will float only if the priority 2 circuit is satisfied, and so on. The rack setpoints will float down to normal when the circuit with priority 1 refrigeration comes on.

When default is selected on the Rack Configuration Screen for Temp Controlled Setpoints, the circuit with the lowest setpoint must be satisfied for the rack setpoints to float. When the circuit with the lowest setpoint goes above that point, the rack setpoints will float back down, but will not go below the standard cut in and cut out values.

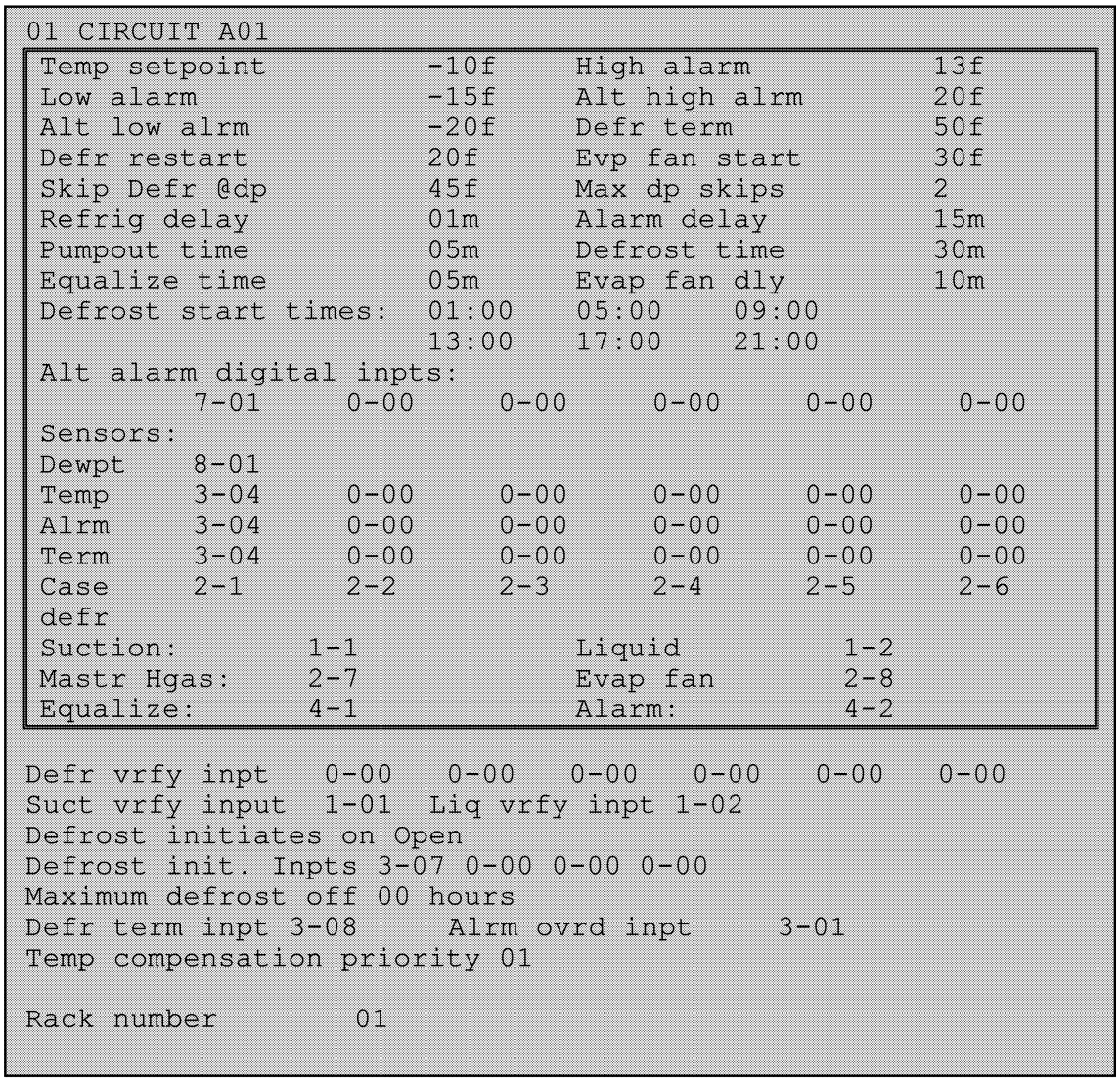
The **Rack Number** setpoint is a rack number. The setpoint specifies the rack that a circuit uses. The number should correspond to an actual RC-2000 rack number.

IMPORTANT

The **Rack Number** setpoint is used by the software as a key when using the **Defrost Sense** and **Temperature Controlled** setpoints; both are affected by this parameter.

NOTE

When **Floating** setpoints are used, all associated circuits will have the setpoints adjusted to 2°F below the programmed value. The **Rack Cut in** and **Rack Cut out** setpoints will float up to but not exceed the **Max Cut in** value.



Circuit Setpoint Screen Example

CIRCUIT OVERVIEW SCREEN

The Circuit Overview Screen shows the status of all circuits configured for temperature/defrost control in a condensed format. Each data line displays temperature readings and pairs of status indicators for up to four circuits. One status indicator for defrost and one for refrigeration combine to show the current state of ***each*** circuit. Table 6 lists the status indicators that will display on this screen.

NOTE

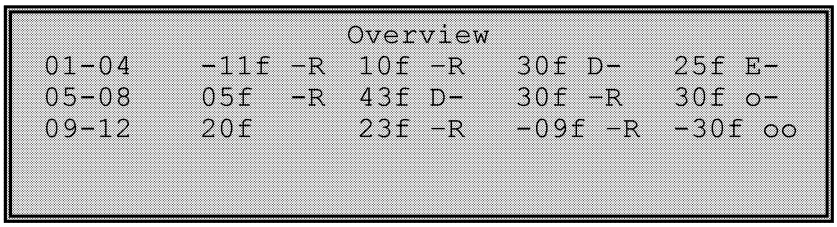
In the Circuit Overview Screen, the state of the defrost and refrigeration load are represented by a [-].

The Left position dash indicates the state of the defrost load.

The Right position dash indicates the state of the refrigeration load.

TABLE 6 – STATUS INDICATOR SYMBOL AND DEFINITION

STATUS SYMBOL	SYMBOL DEFINITION
(-) /minus sign	System off
o	System in override
E	Emergency defrost on, Master case relay on
e	Emergency defrost on, Master case relay off
D	Normal defrost on, Master case relay on
d	Normal defrost on, Master case relay off
R	Refrigeration phase, relay on
r	Run off
H (reverse video)	High temperature alarm
L (reverse video)	Low temperature alarm
P	Pumpout cycle
Q	Equalize Cycle



Circuit Overview Screen Example

CIRCUIT NAME SCREEN

At the circuit name screen, enter descriptive names for each circuit configured for temperature/ defrost control.

NOTE

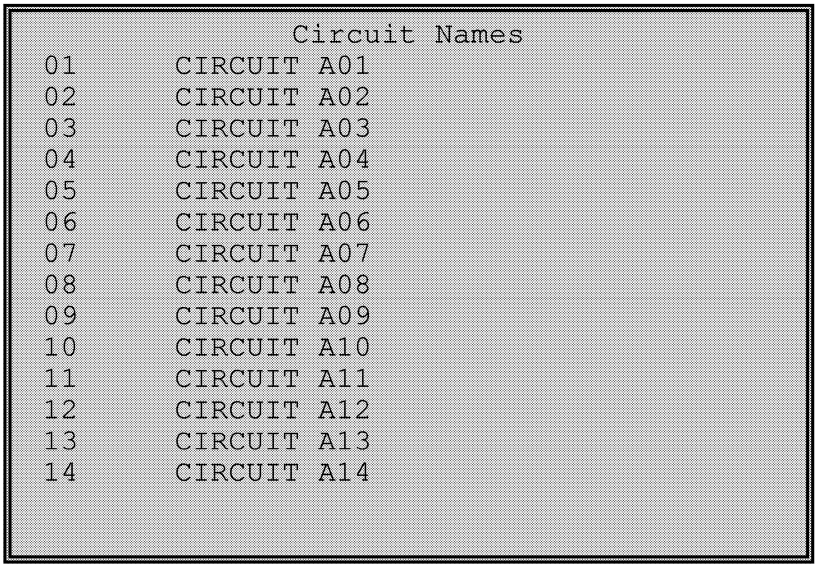
Each circuit name can be a maximum of 34 alphanumeric characters.

SUGGESTION

During alarm dial out only, the first sixteen characters dial out. Care should be taken when naming the circuit to put critical information first so that it can easily be identified.

Follow the steps listed below to change the description for this screen:

1. Press [ENTER]. An arrow will appear with this descriptor beside it: '▸ CIRCUIT A01.'
2. Press [↑ and/or ↓] to select the circuit that you want to change. When you reach the circuit you want to change, press [ENTER].
3. The cursor now appears under the first character of the description [CIRCUIT A01].
4. Press [↑ and/or ↓] to scroll through the alphabet. When the desired character appears, press the [→] to move the cursor to the next character.
5. If a space is required, it is located after the [9] and before the [A].



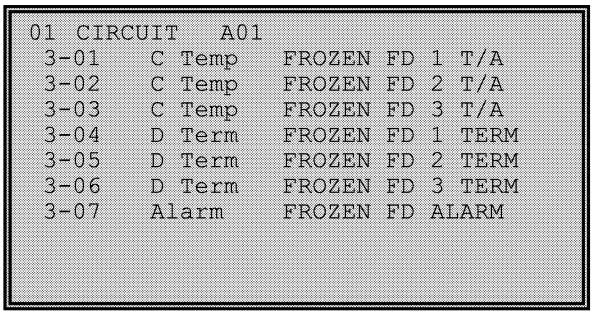
Circuit Name Screen Example

CIRCUIT SENSOR NAME SCREEN

At the Circuit Sensor Name Screen, enter descriptive names for each sensor assigned. Each name may have up to 24 alphanumeric characters. Place the sensor name descriptions **AFTER** the sensor assignment in the Circuit Setpoint Screen.

IMPORTANT

The sensor must be assigned in the Circuit Setpoint Screen **BEFORE** it will be present in the Circuit Sensor Name Screen.



CIRCUIT CONFIGURATION SCREEN

At the Circuit Configuration Screen, you may select the circuit configuration options that apply to your particular refrigeration control system.

NOTE

Circuit configuration options on the Circuit Configuration Screen have data fields that correspond with the ones on the Circuit Status Screen and the Circuit Setpoint Screen.

The first circuit configuration field specifies the numbers of circuits that the RC-2000 will control; therefore it is the most critical. You will be unable to view the other screens listed on the Circuit Menu until an assignment is made here.

CIRCUIT CONFIGURATION FIELDS

The first line of this screen allows you to choose the **amount of circuits** the software controls. It is a user-selectable numeric value. Available values include 2, 8, 14, 20, 26, and 32. The amount you choose will directly correlate to the physical case and circuit configuration of the building.

The **Number of temperature sensors per circuit** line contains two choices, six or twelve. Sensor types available include temperature, termination, and alarm. The default value is six sensors of each type per circuit.

NOTE

A maximum of twelve sensor types per circuit can be configured with the control software.

The **Refrig relay control** line contains three choices: suction, liquid, and suction/liquid. Suction control, the default choice, allows one relay to be assigned for control of the suction solenoid valve. Liquid control allows a relay to be assigned for liquid line solenoid control. The final choice is 'Suc/Liq' control. This allows one relay to be assigned for the suction valve and one relay to be assigned for a liquid line solenoid.

The **Temperature dead band** line activates the temperature dead band for control of the circuit based on cut in and cut out setpoints. The cut in and cut out temperature setpoints are provided on the setpoint screen.

NOTE

To activate the temperature dead band, select yes.

Defrost initiation can be initiated by an input setting or by a time setting. Select one upon control software configuration.

The TIME/DIGITAL selection is the input setting. Choosing it adds a *Def init* input field to the Circuit Setpoint Screen and an *Init input* field to the Circuit Status Screen under *Inputs: heading*.

Two conditions must be satisfied to initiate defrost:

1. The contacts must be closed to the assigned digital input.
2. The time scheduled for defrost must be active.

NOTE

If the time of defrost is not entered, then defrost is initiated only by the digital input closure.

Digital Defrost Initiation and the **Dew point Option** cannot both be active at the same time. When **Digital Defrost** is selected, the **Dew point** option is automatically disabled.

When TIME is selected for initiation of defrost, defrost is initiated only by the scheduled time.

Defrost Termination: Refrigeration defrost can be terminated by a time setting or an input setting. The setting that terminates defrost is called the **Defrost Termination** field. Select your choice upon control software configuration. The available **choices** are **Time/Temp** or **Time/Digital**.

When **Time/Temp** is chosen, defrost continues the entire time as long as the termination temperature is below the termination setpoint. If the termination exceeds the termination setpoint, defrost will terminate.

When **Time/Digital** is selected, a Def term input field is added to the Circuit Setpoint Screen and a Term input field is added to the Circuit Status Screen under the Inputs heading. To terminate defrost, the programmed digital input must see a contact closure (Klixon or case thermostat), otherwise defrost will end when the duration has expired.

Actual implementation of the digital defrost options is on a per-circuit basis and is dependent upon input assignment, sensor assignments, and defrost times.

An explanation of the **Defrost Restart** provision in the control software follows.

The phase of defrost will be active for the entire defrost time programmed. *Within* defrost duration, any defrost relay (master or case), **will turn OFF** when that circuit/case termination condition is satisfied. **IF** temperature termination of defrost is specified, any defrost relay **will turn back ON IF** the associated temperature meets a specified **defrost restart setpoint AND** the **defrost time duration has not expired**.

IF **digital termination** of defrost is configured, **all assigned relays will turn back on** if the **termination input has been active for two minutes**. Defrost relay cycling, based on the above description will continue for the full defrost duration.

When **Multi-Case Defrost Term** is configured, each individual case defrost relay is associated with a defrost termination sensor that is displayed vertically above the relay assignment on the setpoints screen.

If twelve sensors per circuit is configured, each case defrost relay will have two termination sensors associated to it.

If temperature termination of defrost is configured, each case turns off its individual defrost relay. Once all the cases have terminated (or the defrost duration has expired), the circuits defrost phase is complete and normal refrigeration control resumes.

If defrost is configured to terminate by digital signal, all case relays are switched simultaneously (only one digital termination input is provided).

When **Hot Gas Defrost** is selected, the **Hot Gas Relay** field is added to the Circuit Setpoint Screen. The **Hot Gas Relay** should be wired to the main liquid solenoid or head pressure modulating valve. The **Hot Gas Defrost** option should be programmed on only those circuits that use hot gas for defrost.

The **Pumpout Phase** is the time before defrost that the **liquid relay** is **off** and the **suction relay** is **on**. During the pump out phase, the evaporator coil is pumped out. After pump out, normal defrost occurs.

The **Equalize Phase** equalizes the pressure across the evaporator coil after a defrost cycle. If this option is configured, the **Run Off Time** field will be **replaced** with the **Equalize Time** field **AND** a **corresponding Equalize Relay Assignment** field. After the normal defrost cycle, the equalize time will energize for the equalize period before normal refrigeration control is allowed.

The **Evaporator Fan Control** option has three entry fields. They are for the evaporator fan temperature setpoint, the evaporator fan delay, and the evaporator fan relay assignment. Upon refrigeration control after defrost, the evaporator time delay period begins. Depending on which one comes first, the evaporator fan restarts when the evaporator coil temperature drops below the **evap fan setpoint** or the **evap fan delay** period expires. This option requires that at least one defrost termination sensor be assigned. If more than one sensor is assigned, the maximum of all the sensors controls the evaporator fan restart.

When the **Dew point Controlled Skip** option is selected, the fields **Skip defr @ dp** and **Max skips** are added to the Circuit Setpoint Screen. If this option is selected, the defrost cycle will be skipped (up to the maximum number of skips) when the dew point is below the dew point skip setpoint. If this option is configured, a dew point sensor will need to be installed. This feature cannot be configured at the same time as a digital initiated defrost.

The **Digital Alarm Override** uses a digital input to override alarms for a circuit. If the contacts are closed, the circuit will not alarm on high or low temperature conditions. Normal operation is resumed when the contacts are opened. This may be useful when servicing a circuit or when stocking a case.

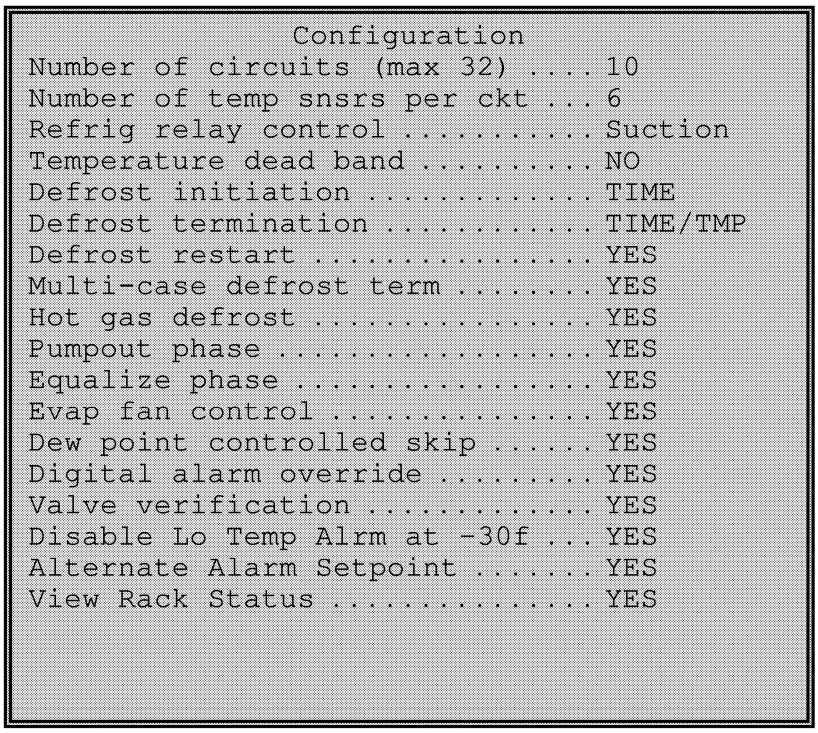
The **Valve Verification** feature uses a digital input to remotely monitor the actual refrigeration valve or defrost valve, on a per-circuit basis. If the RC-2000 calls for refrigeration and the **Ref Valve** is not energized, the alarm log will show date/time and circuit description; further, it will activate the remote alarm. Defrost valve verification works in a similar manner.

Disable Lo Temp Alrm at –30°F disables all circuit low temperature alarms at (-30°F); it accommodates freezer cases set at (-30°F) or lower. This feature also disables the **Shorted Sensor Fault Alarm**.

The **Alternate Alarms** field provides for an alternate alarm input associated with each alarm sensor available (six or twelve dependent on the configuration). There is also an alternate high and low alarm setpoint for each circuit. This feature allows dual temp cases to be changed to alternate modes without making adjustments to the program setpoints.

If the alarms sensor's corresponding alternate alarm input is closed, then that alarm sensor is in alternate mode. The list of sensors designates an alternate alarm by displaying an **A Alrm** prior to the sensor data.

When **View Rack Status** is selected and a rack number is assigned, the circuit status screen will display the actual pressure, cut in and cut in setpoints, and the calculated refrigerant temperature for the suction discharge of the assigned rack number.

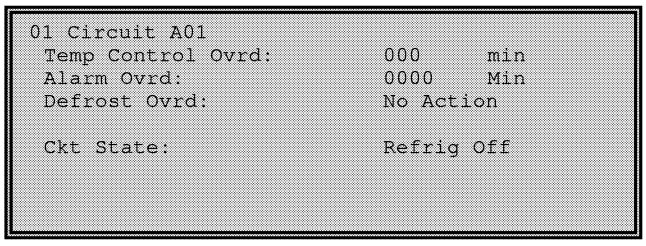


Circuit Configuration Screen Example

CIRCUIT OVERRIDE SCREEN

You may set temporary overrides of circuit controls on the Circuit Override Screen. The Temp Control and Alarm Override are set in minutes. The Defrost Overrides are setpoint fields that include the following:

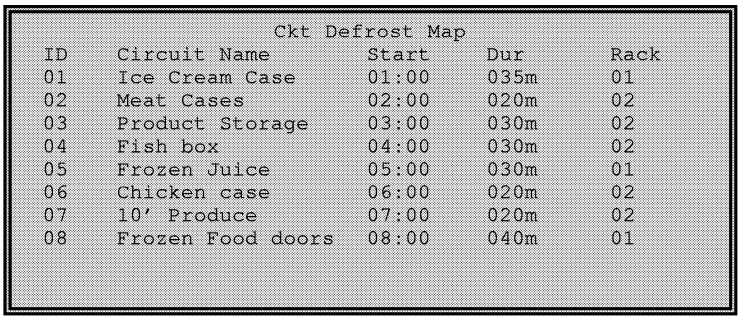
- **Normal term:** Initiates a normal defrost cycle which would be time or temperature terminated.
- **Time term:** Terminates only after the defrost time has expired.
- **End Defrost:** Ends a normal or overridden defrost cycle.
- **No Action:** The default for no changes to occur.



Circuit Override Screen

DEFROST MAP SCREEN

The Defrost Map screen display shows all configured circuits and their defrost schedules on a time-based sorted list. Use it to determine the efficient operation of defrost schedules and to quickly reference defrost times. The circuit number, name, defrost start time, defrost duration, and associated rack are displayed. This information can be used to check for overlapping defrost times, which might affect overall refrigeration system operation.



Ckt Defrost Map

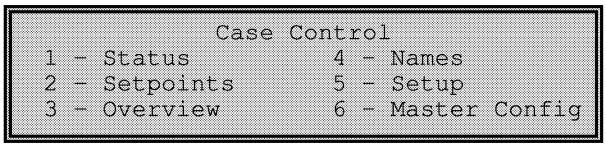
ID	Circuit Name	Start	Dur	Rack
01	Ice Cream Case	01:00	035m	01
02	Meat Cases	02:00	020m	02
03	Product Storage	03:00	030m	02
04	Fish box	04:00	030m	02
05	Frozen Juice	05:00	030m	01
06	Chicken case	06:00	020m	02
07	10' Produce	07:00	020m	02
08	Frozen Food doors	08:00	040m	01

Defrost Map Screen

CASE CONTROL MENU

The RC-2000 Control Software controls Distributed Case Control (DCU) units. To access case control options in the software, follow this path:

1. At the Main Menu, choose [1] – Temperature/Defrost Control.
2. At the Temperature/Defrost Control Menu, choose [4] – Case Control.
3. The Case Control Menu appears. The Case Control Screens are discussed in the section that follows. An example of the Case Control Screen appears below.



Case Control Menu Screen Example

CASE CONTROL STATUS SCREEN

On the Case Status Screen, the **first line displays** the **state of the case**. The following table catalogs the different case states that you may see on this line.

TABLE 7 – CASE STATE ABBREVIATIONS & DEFINITIONS

Status Abbreviation	Definition
Refr On	**Refrigeration on**
Refr Off	**Refrigeration off**
Refr On FS	**Refrigeration on fail safe,** means a sensor has gone bad.
Refr Off-Phs	**Refrigeration is off** because of a phase loss.
Refr Off-HiP	**Refrigeration off,** on high pressure; this takes place when the Refr In sensor and the Suction Temp are both seven degrees above the case setpoint.
Defr XXXm	**Normal defrost,** xxx minutes remaining
Emg Defr XXXm	**Emergency defrost,** xxx minutes remaining
RunOff XXXm	**Run off after defrost,** xxx minutes remaining
FanDly XXXm	**Evaporator fan delay after defrost,** xxx minutes remaining
CaseOff	**Case** has been **turned off** in **software** or has gone **offline with RC-2000**.
Sw Refr On	**Interlock switch** has **Refrigeration on**.
Sw Refr Off	**Interlock switch** has **Refrigeration off**.

The **second line reflects** the **setpoints** entered in the setpoint screen. Refer to Table 8 for a list of them.

TABLE 8 – CASE SETTING CATEGORIES

Case Setting	Setpoint Field
Temp	Control Setpoint
Term	Defrost Termination
HiAlm	High Alarm Setpoint
LoAlm	Low Alarm Setpoint
TD1	Evaporator #1: Temperature Difference
TD2	Evaporator #2: Temperature Difference

The **third line** on the **case status** screen reflects the actual case readings for the setpoints that are available on Line 2. In addition, it posts any system malfunctions through alarm or warning icons. The following table describes the entries on this line.

TABLE 9 – CASE STATUS READINGS

Temp: AVERAGE of all Ctrl sensors
Term: displays the **LOWEST** Defr Term Sensor reading
HiAlm: displays the **HIGHEST** Alarm Sensor Reading
LoAlm: displays the **LOWEST** Alarm Sensor Reading
TD = (RefrIn or Suct Temp – RefrOut) **TD1** = RefrIn1, Suct Temp, or RefOut1 **TD2** = RefrIn2, Suct Temp, or RefOut2 **NOTE:** • The control reads the **RefrIn Sensor** and the **Suction Temp**; it then uses the **coldest** reading in the **TD calculation**. • If the control is using the **Suction Temp** for the calculation it will display a **[#]** symbol next to the actual TD reading. • **TD = Temperature Difference**
ALARM/WARNING ICONS DISPLAYED: • **Reverse Video L:** Low Temperature Alarm • **Reverse Video H:** High Temperature Alarm • **Reverse Video S:** Sensor Fault • **Reverse Video I:** Interlock Action Time Delay Expired • **Reverse Video O:** Alarm Override

The fourth line displays the actual status of the case outputs.

The fifth line reflects the override status for the case control outputs.

NOTE
The Case Control Status Screen is able to override outputs from the status screen.

The rest of the Case Control Status Screen reflects

1. The **ACTUAL** reading for each sensor assigned, and
2. The calculated suction temperature sent down from the RC-2000, **IF CONFIGURED for EEV**.

NOTE
The Case Control Status Screen is able to offset the sensors from the status screen.

```
CaseOff
        Temp   Term   HiAlm   LoAlm   TD1     TD2
 Spt:   -15f    58f    20f    -30f     9f      9f
 Act:     0f     0f     0f H    0f L   0f      0f

 Out:  Fan   Lite  Defr  ASH   Aux   EEV1  EEV2
 Act:  Off   Off   Off   000%  --    000%  000%
 Ovr:  n/a   n/a   --    n/a   --    000%  000%

 Inputs          Offset          Actual
 Refr In1          0f              0f
 Refr Out1         0f              0f
 DchCtl1           0f              0f
 RtnMon2           0f              0f
 Alarm1            0f              0f
 Defr Term1        0f              0f
 Suct Temp         10f             0f
```

CASE STATUS SCREEN EXAMPLE

CASE SETPOINTS SCREEN

All programmable parameters that affect case control of the RC-2000 can be found on the Case Setpoints Screen.

NOTE

The case setpoint screen example displayed with this text has all possible options configured.

In most cases, the case setpoints screen will only have a portion of total options displayed.

The RC-2000 will reference the Fahrenheit or the Celsius temperature scale. (This option may be modified in the System/Miscellaneous screen.)

The RC-2000 controls case level refrigeration by using a low temperature or a high temperature sensor.

NOTE

The **DEFAULT SETPOINTS** for **low temperature** sensors **range** from (-40°F to 97°F).

The **DEFAULT SETPOINTS** for **high temperature** sensors range from (0°F to 255°F).

If configured for a **high temperature**, the **sensor should be assigned prior** to assigning setpoints.

CASE SETPOINTS

A complete listing of case setpoints and their functions follow.

The **Cut in** setpoint assigns the temperature on which refrigeration will cycle on. It is always available.

The **Cut out** setpoint assigns the temperature on which refrigeration will cycle off. It is always available.

The **High and Low Alarms** are temperature alarms for the case. If their value is exceeded in either direction (greater than high or less than low) for the time assigned to the alarm delay, an alarm will be generated. These setpoints will only be activated when an alarm sensor is assigned to the case. If more than one is assigned, the lowest temperature will be used for the low alarm, and the highest temperature will be used for the high alarm.

The **Evap TD** setpoint is **ONLY AVAILABLE** when selected for the **EEV (pulse type expansion valve)** or **SEEV (stepper drive expansion valve)**.

NOTE

The Evap TD setpoint is the target for the electronic expansion valve algorithm. The Case control will take the difference of the Refr In-Refr Out sensors and cycle the valve to target the TD setpoint.

The **Defrost Term Setpoint** is a temperature setting. If all **TERM SENSORS are greater than this setpoint**, refrigeration defrost will terminate **BEFORE** timing out. **For the defrost term setpoint to be active,** the system must be configured for temperature, a Term sensor must be assigned and the defrost term setpoint must be assigned.

The **ASH Hi Setpoint** is a temperature setting always available for programming. The anti-sweat heaters will be on for the entire ASH duty cycle when the dew point temperature falls below this setpoint value.

The **ASH Lo Setpoint** is a temperature setting always available for programming. The anti sweat heaters will be off for the entire ASH duty cycle when the dew point temperature falls below this setpoint value.

The **Offsets for Second Evap** setpoint **IS AVAILABLE** when **Aux Refrig Control** is set for **Dual Evap**. The range of this setpoint is [(-40° to 97°F)]; the default setting is [00].

NOTE

If the default setting is active, both evaporators will function from the same setpoint values.

The value of this setpoint will offset the entered setpoints for Cut in/Cut out and High Alarm and Low Alarm for operation of the second evaporator. The Control Alarm and Defrost Term sensors are grouped by evaporator, which allows each evaporator's sensors to reference the appropriate setpoints. (The value driven by the second solid state output on the 3 Chan SSR daughter board, ECI Part # 5120045404 is for Evap 2.)

The **Offsets for Low Temp** setpoint is available when Aux Refrig Control is selected for Medium Temp. The setpoint for Cut in and Cut out and High and Low Alarm will be offset by this setpoint and used for control and alarming when in the low temperature mode of operation.

NOTE

[Medium Temp] is a dual temperature control mode.

The case will operate in low temperature mode when the dual temperature switch is closed.

Only **NEGATIVE offset values** can be **entered** for this setpoint.

The **Offsets for Medium Temp Setpoint** is available when Aux Refrig control is selected for low temperature. The setpoints for Cut in/Cut out and High and Low Alarm will be offset by the value of this setpoint and used for control and alarming when in the medium temp mode of operation.

NOTE

Low temperature is a dual temp control mode.

The case will operate in medium temp mode when the dual temp switch is closed.

Only **POSITIVE offset values** can be **entered** for this setpoint.

The **Refrig Off Time** field is always available in all modes of operation. It is the minimum time in seconds that the refrigeration will remain off after the case satisfies on the temperature setpoint.

The **Defrost Duration** field is always available in all modes of operation. It is the maximum time in minutes that a defrost cycle will occur. If the defrost doesn't terminate on temperature or input, this is the final and highest level condition that will terminate the cycle.

The **Defrost Min On Time** field is always available in all modes of operation. It is the minimum period in minutes that a defrost cycle will occur even if the temperature of defrost termination input calls for the defrost cycle to terminate. The defrost cycle will have to meet this minimum time requirement prior to terminating.

The **Runoff Time** is the period after defrost that the refrigeration relay will be off. Afterwards, normal case refrigeration will begin. Runoff time allows evaporator coils to drip off completely before refrigeration begins again.

The **Intlk On Time** field is only available when the Intlk Switch Action is set for [TIME]. It is the time in minutes that the interlock action (i.e., refrigeration off, case off) will remain active after the case control senses a momentary closure of the door interlock switch.

The **Alarm Delay** field is always available in all modes of operation. It is the time in minutes that an alarm condition will have to be active at the case prior to becoming an active alarm.

The **ASH Period** field is always available in all modes of operation. This is the time in minutes that the ASH algorithm will use to cycle the case anti-sweat heaters. The ASH cycle is determined using the following formula:

ASH Cycle Formula to determine ASH cycle time:

ASH ON TIME:

$$\frac{[(\text{Actual Dew point Temp}) - (\text{ASH Lo Setpoint})]}{[(\text{ASH High Setpoint}) - (\text{ASH Lo Setpoint})]}$$

multiplied by

ASH Period Setpoint

= # OF MINUTES OF ASH ON TIME.

NOTE

ASH OFF TIME = (ASH period – ASH on time).

The **Defrost Start Times** setpoints are six separate time fields. They are set as **HOURS: MINUTES** (military time).

IMPORTANT

[00:00] is not a valid field.
To set defrost at midnight enter [24:00].

The **Copy Master Schedule Now?** field enables you to copy the schedule entered in to the master config screen if you enter [YES]. Leave this field [NO] to customize the time schedule.

The **Light ON Times** are separate time fields in which the case lights are on. They are programmed in military time.

Sensor and Digital Input Section/ Description of the Case Setup Screen

The **Refr In1** field enables you to assign the channel for the number one evaporator coil inlet sensor. The sensor is used only to calculate the evaporator coil TD.

NOTE

The Refr In1 field must be used with EEV or SEEV control.

The **Refr Out1** field enables you to assign the channel for the number one coil outlet sensor. The sensor is used only to calculate the evaporator coil TD.

NOTE

The Refr Out1 field must be used with valid with EEV or SEEV control.

The **Refr In2** field enables you to assign the channel for the number two evaporator coil TD.

NOTE

This field must be used with Dual EEV or Dual SEEV control.

Case Sensor Setpoints:

IMPORTANT

The next four sensors OR eight sensors if the cases are configured for Lineup Control are configurable to several different types that allow great flexibility when programming a case.

To change the type move the cursor under the default name, [**DchCtrl**] and use the up arrow to scroll through available options, which are discussed below.

The **DchCtrl** is the Discharge Sensor that will be averaged with other Control Sensors to cycle the case based on the control setpoint.

The **RtnCtrl** is the Return Sensor that will be averaged with other Control Sensors to cycle the case based on the control setpoint.

The **SpcCtrl** is the Space Sensor that will be averaged with other Control Sensors to cycle the case based on the control setpoint.

NOTE

At least one Ctrl (control) of any type is needed for all case applications.

The **DchMon** is the Discharge Sensor that is assigned as a monitoring point only.

NOTE
The **DchMon** setpoint will have no effect on the control of the case.

The **RtnMon** is the Return Sensor that is assigned as a monitoring point only.

NOTE
The **RtnMon** setpoint will have no effect on the control of the case.

The **SpcMon** is the Space Sensor that is assigned as a monitoring point only.

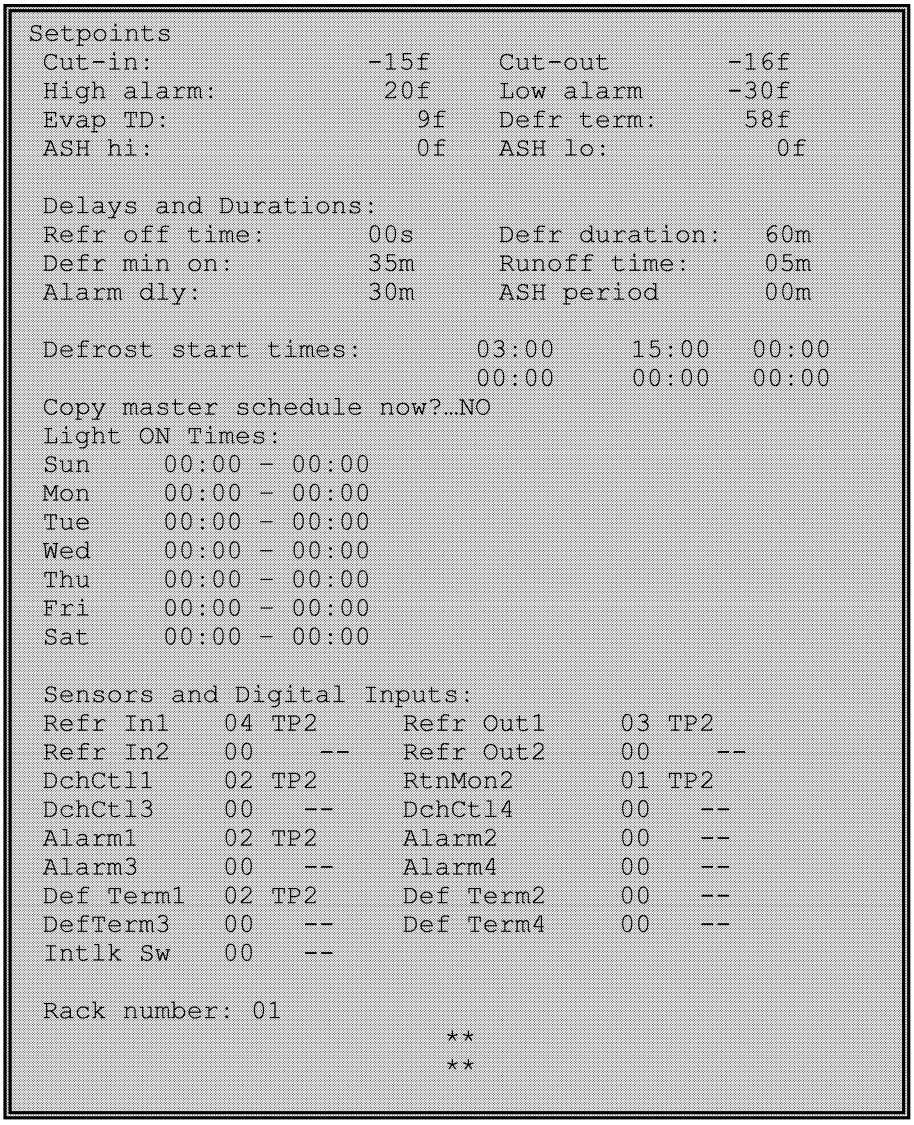
NOTE
The **SpcMon** setpoint will have no effect on the control of the case.

The **Alarm1-4** setpoint enables you to assign channel numbers for up to four alarm sensors. The alarm sensor channel numbers will be used for comparison to the Hi and Lo alarm setpoints.

The **DefTerm1-4** setpoint enables you to assign channel numbers for up to four defrost termination sensors. The defrost termination sensor channel numbers will be used for comparison to the termination setpoints.

The **Intlk Sw** setpoint assigns the channel number for the digital input connected to the door switch or case cleaning switch.

The **Rack Number** is the suction group associated with the case. This setpoint allows the RC-2000 to send the calculated suction temperature to the case and any phase loss conditions.



CASE SETPOINT SCREEN EXAMPLE

CASE CONTROL SETUP SCREEN

ECI Case Controls are stand alone controllers; hence, the setup performed via the Case Control Setup Screen is an independent configuration for each case control.

IMPORTANT

The ECI Electronic Case Controls operate under independent processing control: a software application is installed in each case control. When installing, you must ensure that the software version in the case controls matches the software version that resides in the RC-2000 firmware.

About the case control software:

- The case control application code is downloadable; it does not require a hardware chip change.
- The RC-2000 case code may be upgraded via remote download in many instances.

Contact your ECI representative for more information about ECC/RC-2000 software code compatibility.

CASE SETUP SCREEN SELECTIONS

The **Refrigeration Control** field allows the user to select the valve type being cycled by the case controller.

NOTE

The Refrigeration Control setting has the largest impact on the layout and the selections that will be available in the case setpoint screen.

ECI recommends that this field ALWAYS be selected first when doing setup for a case. The options are listed in Table 10.

TABLE 10 – REFRIGERATION CONTROL SELECTIONS

Selection Description	Valve Type
EEV	Pulse type drive electronic expansion valve.
SEEV	Sporlan SEI stepper motor drive electronic expansion valve
ESR	Alco ESR-12 stepper motor drive suction control valve
EEPR	Sporlan CDS-8 stepper Motor drive suction control valve
Refv	On/Off standard solenoid drive liquid or suction valve

The **Aux Refrig Ctrl** field is the second field that should be assigned in case controller setup. Available selections in this field depend on the valve type selected in the Refrigeration Control field. Aux Refrig selections are listed in Table 11.

TABLE 11 – AUX REFRIG CONTROL SELECTIONS AVAILABLE FOR CASE SETUP

Selection	Description
n/a	Default setting; used for most standard control methods
Dual Evap	Available only with EEV, SEEV and Refv Refrigeration Control selections. Dual Evap enables the case to use one valve to cycle refrigeration on a lineup of up to four cases. Eight temperature inputs are available for averaging; they will be used to reference for case setpoint. All cases will defrost on one common defrost schedule.
Med Temp	Available for EEV, SEEV, ESR, EEPR, and Refv Refrigeration Control selections. Medium Temp (Med Temp) enables the case to operate via a second set of case and alarm setpoints by changing the state of a digital input to **CLOSED** for low temp and **OPEN** for medium temp. When Med Temp is selected, the medium temp setpoints will be directly programmable and the low temp setpoints will be programmable proportionally via an offset setpoint.
Low Temp	Available for EEV, SEEV, ESR, EEPR, and Refv Refrigeration Control selections. Low Temperature (Low Temp) enables the case to operate via a second set of case and alarm setpoints by changing the state of a digital input to **OPEN** for low temp and **CLOSED** for medium temp. When Low Temp is selected, the Low Temp setpoints will be directly programmable and the Med Temp setpoints will be programmable proportionally via an offset setpoint.
Line Up	Available for ESR, EEPR, and Refv valve control. Line up control allows multiple cases to be controlled via one DCU and up to four CPMs. When this mode is selected, the sensor input assignments in the setpoint screen will give the option to program a maximum of eight control sensors. If these sensors are defined as control sensors in the setpoint screen, they will be averaged to calculate case temperature. This allows up to four cases to be cycled with one refrigeration valve for the loop. They will operate from common defrost initiation and termination setpoints. This mode may also be used if the application requires more than four standard control sensors.

STEP RATE

The Step Rate selection is available for EEPR and ESR Valve Refrigeration Control. The Step Rate selection determines how many steps per second that the stepper motor will be driven during valve operation. Step rate options are discussed in the table below.

TABLE 12 – STEP RATE DESCRIPTION

STEP RATE	DESCRIPTION
60	This is the default setting when one of the stepper drive valves is selected. This setpoint should remain at [60] when using the **ESR Valve**.
120	This is the other option when one of the stepper drive valves is selected. This setpoint should be set at [120] when using the **EEPR Valve** selection.
NOTE The **SEEV Valve** currently requires a special release of DCU code to be merged with the RC-2000 for operation of the valve. The SEEV Valve has a 200 step per second setting that is hard coded in the DCU code. **Therefore, you will not have to select a step rate for the SEEV Valve.**	

CASE SETUP HARDWARE CONSIDERATIONS

⇒ On the Stepper Drive Daughter Board, ECI Part # 5120045401, the JP-1 jumper will require certain settings:

For the **60 step rate**, the **JP-1 jumper** should be **REMOVED.**

For the **120 step rate**, the **JP-1 jumper** should be **INSTALLED**.

⇒ If you need to use an SEEV Daughter Board, ECI recommends using Dual Stepper Daughter Board, Part # 5120045403 for optimum control. Dual Stepper Daughter Board, Part # 5120045403 does not require a jumper setting.

⇒ The Single Stepper Daughter Board, Part # 5120045401, may also be used for SEEV Valve control, however, the JP-1 jumper must be installed.

CASE SETUP SELECTIONS (CONTINUED)

The **Defrost Termination** field is used to select the type of defrost termination. Defrost termination options include:

1. Time/Temp (default) and
2. Time/Digital.

When Time/Temp is selected for Defrost Termination, four defrost termination sensors will be available in the case setpoint screen. If all assigned sensors exceed the assigned term setpoint, the defrost cycle will terminate on temperature.

If Time/Digital is selected for Defrost Termination, a digital input will be available for case defrost termination. If digital is assigned and there is a dry contact closure across the input, the defrost will terminate.

The **Defrost Schedule Type** field is not user selectable at this time. All defrost cycles will initiate on a programmed time schedule.

The **Evp Fan Dly** setpoint is the maximum time after a defrost that the evaporator fan will stay off (see 'Evap fan start').

The **Aux Relay** Function is a selection that can be made to select how the third solid state relay will be controlled on the three channel SSR daughter board (ECI part #: 5120045404). This solid state relay can be selected to do different types of control. They are listed and defined in Table 13.

TABLE 13 – AUX RELAY CONTROL SELECTIONS

Aux Relay Selection	Control Function
ASH	Anti Sweat Heaters
Refrig	Cycle on/off refrigeration valve coil
Defrost	Cycle defrost
Light	Cycle case lights
Fan	Cycle evaporator fan
Dual temp	Will energize while in the dual temperature mode of operation to energize evaporator bypass valve

The **Fan during Defrost** selection enables you to turn the fan on or off during defrost. When [off] is selected, the evaporator fan will be cycled off during a defrost cycle.

NOTE
Normally the **Fan during Defrost** selection is [ON] during defrost.

The **Light during Defrost** selection enables you to turn the lights [ON] or [OFF] during defrost. When [OFF] is selected, the case lights will be cycled off during a defrost cycle.

NOTE
Normally the **Light during Defrost** selection is [ON] during defrost.

The **Anti Sweats during Defrost** selection enables you to turn the case Anti Sweat Heaters [ON] or [OFF] during a defrost cycle.

NOTE
Normally the **Anti Sweats during Defrost** selection is [ON] during defrost.

The **Lights in High Temp Alarm** selection enables you to select [ON] or [OFF] for the case light cycling during a high temperature alarm condition at the case.

NOTE
Normally, the lights will stay [on] during a high temperature alarm condition at the case.

The **ASH in High Temp Alarm** selection enables you to choose if the case anti-sweat heaters will be cycled off during a high temperature alarm at the case.

NOTE
Normally the ASH in High Temp Alarm will cycle normally during a high temperature alarm at the case.

The **Intlk Switch** may be selected for [NORMAL] or [TIME]. When [NORMAL] is selected, the interlock action will be in effect whenever there is an open contact across the interlock switch digital input. When [TIME] is selected there is an additional setpoint for Interlock ON Time made available. When the interlock switch receives a momentary closure then reopens, the switch will be in effect for the interval assigned to the time setpoint.

NOTE
The **Interlock Switch** is typically a door switch or case cleaning switch that the control monitors. It is activated on an open condition.

The **Case with Interlock Open** field can be selected for [NORM] or [OFF]. When [OFF] is selected and the interlock action is active (open), the refrigeration will be in the off state until the interlock action clears either by timing out or by the door switch state changing. The way the interlock action clears is dependent on how the Intlk Switch Action is set.

The **Refrig with Interlock Open** field can be selected for [NORM] or [OFF]. When off is selected and the interlock action is active (open) the refrigeration will be in the off state until the interlock action clears either by timing out or by the door switch state changing. The way the interlock action clears is dependent on how the Intlk Switch Action is set.

The **Fans with Interlock Open** field can be selected for [NORM] or [OFF]. When [OFF] is selected, and the interlock action is active (open), the evaporator fans will be in the off state until the interlock action clears either by timing out or by the door switch state changing. The manner in which the Interlock Action clears is dependent on how the Intlk Switch Action is set.

WARNING

When using electronic valve control, do not set the **Fans with Interlock Open** to off without setting the refrigeration to off or a liquid floodback condition may occur.

The **Lights with Interlock Open** field can be selected for [NORM] or [OFF]. When off is selected and the interlock action is active (open), the case lights will be in the off state until the interlock action clears either by timing out or be the door switch state changing dependent on how the Intlk Switch Action is set.

The **Interlock Open Alarm** field can be selected for [NO] or [YES]. When [YES] is selected, the case control will send an alarm to the RC-2000 if the interlock action is active (open) longer than the case alarm delay.

```
Refrigeration control..... EEV
Aux Refrigeration control. N/A
Step rate................. N/A
Defrost termination....... Time/Tmp
Defrost schedule type..... Schedule
Evap fan delay............ NO
AUX relay function........ n/a
Fans during defrost....... Norm
Lights during defrost..... Norm
Anti-sweats during defrost Norm
Lights in HiTemp alarm.... Norm
ASH in HiTemp alarm....... Norm
Intlk Switch Action....... Norm
Case with intlk open...... Norm
Refrig with intlk open.... Norm
Lights with intlk open.... Norm
Intlk open alarm.......... NO
                **
                **
```

CASE CONTROL SETUP SCREEN EXAMPLE

CASE CONTROL MASTER CONFIG SCREEN

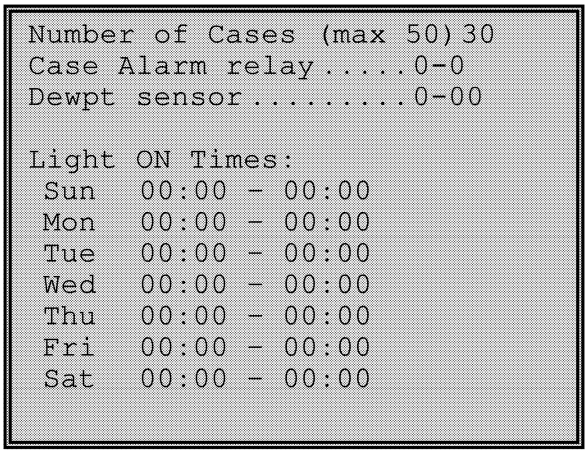
The Case Control Master Config screen is used for high level configuration within the RC-2000 to support the case controls. The selections found on this screen are discussed below.

The **Number of Cases** field is the number of cases that can be selected. The maximum number that can be selected will depend on the ratio of circuits to cases selected in the Case Circuit Config screen.

The **Case Alarm Relay** field is a global alarm relay assigned to the RC-2000 that will be de-energized when a case control is in an alarm condition and reports that condition back to the RC-2000 via the Echelon Network. The alarm relay will remain energized when not in alarm condition.

The **Dew Point Sensor** is a global dew point sensor that can be assigned to the RC-2000. The RC-2000 will take the dew point reading and transmit it to each case control via the Echelon Network. (The dew point reading is used to cycle the anti-sweat heaters when applicable.)

The **Light On Times** is a master copy of the case light on and light off times for each day of the week. These settings may be copied to each case control individually as selected in the case setpoint screen for each case. If these settings are left in the default mode, the lights will be on at all times.



Case Control Master Config Screen Example

EEV VALVE OPERATION AND SAFETIES

In an attempt to achieve a constant temperature differential across the evaporator coil, the Case Controller monitors four temperature parameters:

- Coil Inlet Temperature
- Coil Outlet Temperature
- Case Temperature
- Saturated Suction Temperature

They are explained below.

Coil inlet and Coil outlet temperature readings are read directly from the sensors mounted on the coil.

Case temperature is derived from the sensors assigned as [CONTROL SENSORS] in the Case Setpoint Screen.

NOTE

For the case temperature reading, the Case Controller will average the sensors if more than one has been designated as a [CONTROL SENSOR].

Sensors designated as [MONITOR SENSORS] will not be included in the temperature calculation.

Saturated suction temperature is sent via the communication connection between the RC-2000 and the Case Controller.

IMPORTANT

In order for the suction temperature to be sent, the rack number must be assigned in the Case Setpoint Screen.

Be sure to select the proper refrigerant in the Rack Setpoint Screen in the RC-2000.

SEQUENCE OF CASE CONTROLLER VALVE OPERATION

1. **Case Temperature Check:** The Case Controller first checks the case temperature.

   If the **case temperature** is **HIGHER** than the **temperature setpoint**, the **valve** is allowed to **pulse** (cycle).

   If the **temperature** is **BELOW** the case setpoint, the **valve** will **close** (go to 0%).

2. **If the valve is allowed to cycle,** the **Case Controller** will **determine** the **temperature differential (TD)** of the **coil**.

   To determine the temperature differential, the Case Controller looks at the coil in and saturated suction temperature (with offset); it selects the colder one.

NOTE

It is customary to offset the suction temperature at the Case Controller at least (+10°). This will cause the [COIL IN] to be the primary value for determining TD.

Once the colder temperature has been established, it is subtracted from the [COIL OUT] to determine TD.

IMPORTANT

When the **saturated suction temperature is used to determine the TD**, a [#] sign is displayed next to the TD reading on the RC-2000. **The saturated suction temperature** should **ALWAYS** have a **+10° offset** to **prevent it from being primary control**.

Saturated suction temperature is used as an indication of a rack fault. If **BOTH** the **suction temperature** and **coil in temperature** are **5° higher** than the case setpoint, the **Case Controller** will turn the valve off and indicate a [Refr Off-HiP] in the Case Status Screen.

3. After the TD is determined, the valve begins to pulse to achieve the desired TD. A solid state output on the DCU pulses an Electronic Expansion Valve (EEV).

> **NOTE**
> The valve is cycled in a six second window; this is, if the valve is set to 50%, the valve will be on for three seconds and off for three seconds.

4. The DCU uses an algorithm to determine the best percentage to maintain steady coil TD. If the TD is at or below that setpoint, there is a fixed percentage determined from the natural fill/boil cycle of the evaporator. When the TD begins to rise, a variable percentage is used that is also determined from the evaporator cycle.

> **NOTE**
> In the event of a low TD (TD two degrees lower than the TD setpoint) for longer than a minute, the Case Controller will drop the valve percentage by 1/3 of the fixed valve percentage.

5. After a defrost, the valve will be restricted to 50% through the first minute. At that point, the valve will be allowed to open 100% as long as the evaporator is in a [PULL DOWN] mode.

   Pull Down Mode: A case temperature six degrees above setpoint.

> **NOTE**
> Once the case is below [PULL DOWN], it will be restricted to 90%.

OVERRIDE PULL DOWN FEATURE

The Case Control Override Pull Down Feature will cap the maximum EEV percentage at 50% until a predetermined time has expired.

An override pull down will occur after defrost, a hardware or software reset, a phase loss clear, or a high pressure clear. The following table lists the override pull down occurrences along with their duration:

TABLE 14 – CASE CONTROL OVERRIDE PULL DOWN OCCURRENCES & DURATION

Override Pull Down	Duration
After Defrost	1 minute
After hardware or software reset	10 minutes
After phase loss condition clears	10 minutes
After high pressure condition clears	10 minutes

NOTE

- A **high pressure safety shut down WILL NOT OCCUR during** an **override pull down** condition.
- A **phase loss shut down WILL OCCUR during** an **override pull down condition**.

FAULT CONDITIONS/SAFETIES

SENSOR FAULT CONDITION

The DCU will recognize a sensor fault condition with an evaporator sensor.

NOTE

- An evaporator sensor is considered bad if it reads (+97°F) or (-40°F).
- **IF** the evaporator sensor reading is at (+97°) or (-40°), **the saturated suction temperature** will be used to determine evaporator TD.
  IF there is not a valid suction temperature (reading 97°), the valve will be set to a failsafe percentage determined by the valve algorithm.
- **If either of these conditions is present on the evaporator out,** the valve will be set to a failsafe percentage determined by the valve algorithm.

PHASE LOSS SAFETY

The DCU will turn refrigeration off to an EEV case **IF** a rack number is assigned to the DCU in the Case Setpoint Screen, **AND** that particular rack has logged a phase loss condition. This will be displayed in the status screen as [Refr Off Phs].

NOTE

A Phase Loss condition will clear as soon as the phase condition clears at the rack. After a phase loss, the control will cup the valve at 50% for ten minutes as a flood back safety.

HIGH PRESSURE SAFETY

The RC-2000 uses a pressure to temperature conversion, which depends on the refrigerant type of the suction group for the EEV cases. The conversion is accumulated as a rolling average (based on the latest ten readings) by the RC-2000; it is sent to each case control that has the rack number assigned for the corresponding rack (1-4).

IF the coil-inlet temperature **AND** the suction temperature are both five degrees greater than the case setpoint, the case will turn the refrigeration off and the status will read [Refr Off-HiP]. This condition will clear as soon as the suction temperature **OR** the coil-inlet temperature pull back within five degrees of the case setpoint. After a high pressure fault, the control will cap the valve at 50% for ten minutes as a flood back safety.

The case control will deactivate the high pressure safety feature if the following conditions occur;

1. A rack number is not assigned to the case setpoint screen.
2. The RC-2000 loses communication with the case control (after three minutes the high pressure will clear).
3. The Case Controller is in an [Override-Pull Down] Condition.
4. The RC-2000 defines the suction temperature as invalid.

INVALID SUCTION TEMPERATURE (AS DEFINED AT THE RC-2000)

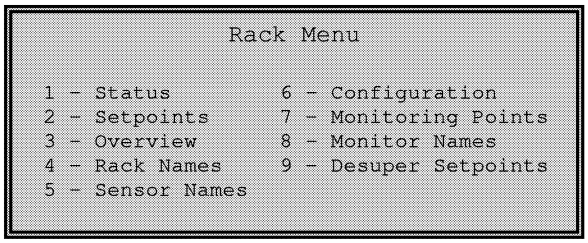
Certain conditions will prompt the RC-2000 to send an invalid suction temperature message to the Case Controller. They are listed below:

1. IF the **suction pressure** is **greater than 95 psi**.
2. IF the **suction pressure** is **greater than the ignore suction temp below setpoint**.
3. IF the **coil inlet temperature = 97 degrees** (failed sensor).

RACK CONTROL

RACK MENU

The Rack Menu in the RC-2000 control software is selected from the Main Menu. It is the Table of Contents to the RC-2000's compressor rack configuration and control functions.



RACK STATUS SCREEN

The Rack Status Screen displays the status of each configured compressor rack. The screen title consists of the rack number and name. The second line of the Rack Status Screen lists the rack compressor speed, suction, and head status fields.

The **Status Fields** contain a **blank** (no alarm) or a **lowercase o** (override). A **reverse video O** to the right of the field indicates an **oil failure alarm** condition. A **v to the right** of the field indicates a **run verify failure** on the indicated compressor or condenser fan.

If **Variable Speed Condenser Fan** is selected, the next line will indicate the condenser fan speed. If **more than six condenser fans** are being used, the **Bank B fans status** will be shown on the **right** of the display. While **Bank A fans status** will be displayed on the **line above** it.

The **ESC Units Status Line** is found next. An **[A]** on this line represents an alarm.

The next line consists of the **actual v. required** capacity (shown as percentages) for the **suction** and **head sides** of the rack.

The next two lines consist of the actual **readings** for **suction and head pressures** and their respective Cut in and Cut out setpoints. A **reverse video H** or a **reverse video L** to the right of the two pressure fields indicates a **high or low pressure condition**, respectively. If the condenser fans are being controlled by temperature differential, the Cut in and Cut out pressure settings will be replaced by the temperature differential settings. A **reverse video A** or a **reverse video F** to the right of the two setpoint fields indicates auxiliary or floating setpoints, respectively. A **reverse video T**, to the right of the suction and pressure readings indicates an alarm override. This override occurs after any power failure and lasts for three minutes. If there is a **head override condition** present shutting down the compressors, a **HV** will be displayed next to the compressor status, see the *Rack Setpoint* section of this manual for more details.

If **Temperature Differential Control** of the condenser fans is configured, the next line will display the temperature difference between the ambient and drop leg temperatures. [A] represents this temperature. It displays only when the condensers are actively controlled by the TD algorithm.

If **Desuperheater Control** is configured, the next line will be the status of the Desuperheater relays and the average (or maximum temperature) of all the Desuperheater manifold temperature sensors.

If **Individual Compressor Oil Monitoring** is configured, two lines will be displayed indicating the compressor number with the oil pressure below it.

The next line will indicate the **Actual Rack kW**, if used. **Phase loss** is indicated by a **reverse video P** beside the power kW line. If neither phase loss or rack kW is used on any rack, this line will not be displayed.

If an **Analog Liquid Level Input** is used, the actual liquid level percentage is displayed next. A **reverse video L** is displayed if the liquid level is lower than the alarm setpoint and in alarm.

When the **Variable Speed** option is selected on the **Rack Configuration Screen**, an additional section labeled **Motor Data** is displayed on the

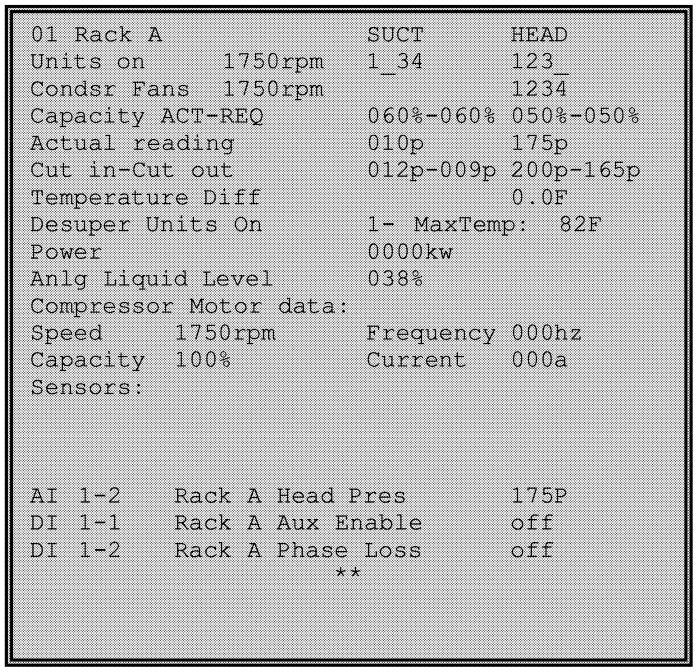
Rack Status Screen. It contains the following data fields:

- Compressor Speed
- Compressor Motor Frequency
- Percentage Capacity
- Compressor Amperage

At the bottom of the screen, all analog and digital sensors assigned are displayed along with their descriptions and actual readings.

Table 15 - Rack Status Screen Status Indicators

Symbol	Status Description
A **blank** by the status fields	No Alarm
Lowercase o by the status fields	Override
Reverse video O to the right of the status fields	Oil Failure Alarm
Lowercase v in place of the load number	Run Verify Failure on the indicated compressor or condenser fan
Reverse video H to the right of the suction and head pressure fields	High Pressure Condition
Reverse video L to the right of the suction or head pressure fields	Low pressure condition
Reverse video A to the right of the suction or head cut in or cut out	Auxiliary setpoints
Reverse video F to the right of the suct cut in or cut out	Floating setpoints
Reverse video T to the right of the suction and readings	Low liquid level
Reverse video O to the right of the suction and head pressure readings	Alarm override
HV next to the compressor status	Head override condition shutting down the compressors
Reverse video P beside power kW line	Phase loss
Reverse video L by liquid level percentage	Liquid level lower than the alarm setpoint and in alarm



RACK STATUS SCREEN

RACK SETPOINT SCREEN

The Rack Setpoint Screen title line contains the rack number and user-defined rack name. Display areas depend on the rack configuration setup. (The screen provides access to all programmable parameters affecting the control of each configured compressor rack.) Pressure is displayed in psi and time in minutes (m) or seconds (s). The rack data fields are explained next.

The **Cut in** and **Cut out** fields set the general operating pressures of the rack. They are a psi value. The **Cut in** value must be higher than or equal to the **Cut out** value.

Aux cut in and **Aux cut out** setpoints are used when the Auxiliary Enable Digital Input Contacts are CLOSED. Compressor and Condenser Control each contain an Aux Cut in and Aux Cut out setting. Each of the Aux Cut in and Aux Cut out setpoints has only one Aux Enable Input. If the setpoints are left in the default 000p state, the Aux setpoint will not enable for that control type.

The **Max cut in** value is used to determine a maximum pressure for the system to operate under when floating setpoints are used. See the *Rack Configuration* section for a control method description.

The **High Alarm** and **Low Alarm** setpoints are values that when exceeded, will cause an alarm in the RC-2000. These alarms will honor the alarm time delay.

The **Shutdown** field allows shutdown of all compressors on the rack if the suction pressure falls below it. Normal operation will resume when the pressure rises above the shutdown value. The compressors must honor the min off time before restarting. The minimum value for proper operation is [001 psi]. To disable this feature, set the shutdown value to [000 psi].

The **Ignore Temperature Below** setpoint is only available when the RC-2000 is configured for a minimum of one case control. If a pressure value is entered in this field, the RC-2000 will not send a suction temperature update to the case controllers when the actual suction pressure is less than the setpoint.

The **Head Override** setpoint sets a high pressure point that, if exceeded, starts an orderly shutdown of the compressors. As this setpoint is exceeded, the suction percentage required decreases, allowing the compressors to shutdown. The higher the compressors are above this setpoint, the faster they will shutdown. When the head pressure drops below the head override setpoint, the compressors will be allowed to return to normal operation.

Alarm Delay is the period that must pass after an alarm condition has been met, before an alarm will be logged.

Liquid level alarm is a percent value. When the analog liquid level sensor falls below it, an alarm will be generated.

The **HR Override level** is the value (in percent) that the liquid level must be below, for the specified time for the HR override relay to de-energize, placing the system into an effective heat reclaim bypass.

HR override diff is the level (in percent) that the liquid level must exceed (HR override level + HR override diff) before the HR override relay is returned to normal operation.

HR override delay is a time setting. The liquid level must be below the HR override level for the period of this setting before an HR override action occurs.

The **Min on** and **Min off times** are time settings that supply time delays for short cycle protection of the compressors and condenser fans. The default settings are thirty seconds for compressors and 0 seconds for condenser fans.

The **Control Gain** regulates the response of the RC-2000 to changes in suction and head pressures. Typical starting values are [10] for suction and [100] for head. The higher the gain, the faster the RC-2000 will respond and calculate capacities. A Control Gain value must be set in order for the system to operate. For optimum performance, ECI recommends that these values be tailored to suit the particular compressor installation. The **minimum value** is [000] and the **maximum value** is [255].

NOTE

If TD head pressure control is being used, the recommended Control Gain on the head side is [25]. This will be used when the temperature is in control. Should the need arise to control with the pressure setpoints, the Control Gain will be four times higher (i.e., 100).

Through the **Derivative Gain** setting, the RC-2000 senses the direction and magnitude of pressure changes. It is useful when the unit experiences sharp rises and falls of pressure. Typical values should start at four times the Control Gain. The higher the Derivative Gain, the faster the RC-2000 will respond and calculate additional capacities. For optimum performance, it can be tailored to suit the particular compressor installation. This feature is optional. If you do not want to set a Derivative Gain, set the fields to [000] and the maximum value to [255].

The **Pos Derivative Gain** field is available when the TD Head Pressure Ctrl is set to Wet B. This is the active derivative gain setpoint when the TD is increasing in this mode.

The method of sequencing compressors and condenser fans on the RC-2000 is called **Unit Combinations**. They are set as Sequential [SEQ] or Alternating [ALT]. Sequential Mode brings the stages on from left to right, and brings them off from right to left. In Alternate Mode, the RC-2000 alternates stages based on run times and required capacity.

The **Pres Sensor** assignments are a psi value. The analog input the pressure sensors are connected to on the termination boards govern the value assigned. Suction pressure is used with a 100 psi transducer; head pressure is used with a 500 psi transducer.

The **Alarm Relay** is the relay assignment that will be activated upon an alarm condition logged by the RC-2000 (use N/C contacts). The suction and head columns may operate with independent alarm relay or with the same alarm relay.

The **Ambient Sensor** is the analog input temperature sensor that will be used for monitoring the outdoor ambient temperature. It will be used only if Temperature Differential for head pressure control or split condenser control are configured in the Rack Setpoints screen. You may assign either high or low temperature sensors in this field unless the TD Head Pressure Control is configured for WET B. When the TD Head Pressure Control is configured for WET B, the ambient sensor is restricted to high temperature only.

The **Condensing Temp Sensor** field is only available when the TD Head Pressure Control is set for [TEMP]. A high temperature sensor will sense the temperature of the drop leg or condensing sensor and then will be used to determine the TD in relation to the ambient temperature.

The **Condensing Pressure Sensor** is only available when TD Head Pressure Control is set for [PRES]. A high pressure transducer senses discharge pressure, converts it to a temperature, then uses it to determine the TD in relation to the ambient temperature.

The **Sump Temp Sensor** is only available when TD Head Pressure Control is set for WETB. It is a high temperature sensor that will sense the temperature of the sump in a water cooled condenser, which then will be used to determine the TD in relation to the calculated ambient wet bulb temperature.

The **Temp Diff Cut in/Temp Diff Cut out** is a temperature setting. It reflects the desired maximum difference of the condensing temperature minus the ambient temperature. If the difference in temperatures is greater than this setpoint, the condenser fans will begin to calculate percent required and stage on. When the temperature difference is less than this setpoint minus the Temp Differential Cut out, the condenser fans will stage off. The Temp Differential Cut out can be set to [00] to allow a single setpoint control strategy.

The **Cut in** and **Cut out** setpoints for standard head pressure control should be set as outside boundaries when using TD Diff Cut in and TD Diff Cut out setpoints. If the discharge pressure value goes beyond the standard Cut in and Cut out pressures, the TD Diff Setpoints control will be replaced by the standard pressure setpoints and the standard discharge pressure value.

The **Min Ambient Temp** setpoint is available when the TD Head Pressure Control is set for TD or Press. This setpoint is the minimum value that will be used in the TD equation for ambient

temperature. [(Condensing Temp) – (Ambient Temp) = TD].

The **Min Wet Bulb Temp** setpoint is a temperature setting. It is available when the TD Head Pressure Control is set for [WETB]. This setpoint is the minimum value that will be used in the TD equation for the calculated Wet Bulb Temperature.
[(Sump Temp) – (Wet Bulb Temp) = TD].

The **RH Sensor** setpoint is an I/O assignment. It is available when the TD Head Pressure Control is set for [WETB]. The RH Sensor is an ambient sensor that is connected to one 0-10V input. The setpoint value is used in conjunction with the ambient temperature to calculate the Wet Bulb temperature.

The **Variable Speed Pressure Override** is a pressure setting. It is available when the TD Head Pressure Control is set for [WETB]. If the discharge pressure exceeds the value of this setpoint, the Variable Speed Condenser will override to one hundred percent (100%) of full speed.

The **Percent Increase** setpoint is a percent setting. It is only available when the TD Head Pressure Control is set for [WETB]. It is used as an anticipator for the water-cooled condenser control strategy. If the discharge pressure is greater than the Variable Speed Pressure Override setpoint, the actual capacity will increase by the amount of this setpoint, anticipating a load increase on the water-cooled condenser. Generally, it is recommended to set this at ten percent, but it is adjustable, as the user deems necessary.

The **Pressure Control** setpoint is a pressure setting. It is only available when TD Head Pressure Control is set for [WETB]. This setpoint determines the manner that the eight discharge pressure inputs are used in the water cooled strategy. The default is [AVG], which will average up to eight discharge pressure inputs for control. The other option is [MAX], which will take the maximum pressure of the eight pressure inputs to use for control.

The **Split Cut in Temp** is a temperature setting. It is only available when the system is configured for Split Condenser. If the ambient temperature is less than this setpoint, the split condenser control becomes the active control. The Split Cut in Temp default setting is [50°F].

The **Split Cut out Temp** is a temperature setting. It is only available when the system is configured for Split Condenser. If the ambient temperature is greater than this setpoint, the split condenser control becomes inactive. The default setting is 55°F.

The **Split Override Pressure** setpoint is a pressure setting. It is only available when configured for split condenser. If the discharge pressure is greater than this setpoint, the split condenser control will be overridden, thus putting the condenser back to the full condensing mode of operation.

The **Split Minimum Off Time** is a time setting. It is only available when the system is configured for Split Condenser. If the condenser control changes from the split mode to the full condensing mode, it will remain in the full condensing mode for the minimum time set via this setpoint.

The **Refrigerant Type** setpoint is used with temperature differential condensing control and case control electronic expansion valve control. It enables you to select the refrigerant look up table that will be used to determine the discharge pressure temperature for the control strategies listed above. The default setting is [R-22].

The **Wet Bulb Pressure Sensors** option in the control software consists of eight pressure transducer assignments. They are only available when the TD Head Pressure Control is set for [WETB]. These discharge pressure inputs will be used as the pressure reference for the Wet Bulb/Water Cooled Condenser control strategy. The pressure inputs used for reference will be either the highest or the average, as determined by the Pressure Control Setpoint.

The **Analog Liquid Level Sensor** is only available when the Refrigerant Liquid Level is configured for analog. There are two types of inputs that are accepted for this sensor, 1-6V and 0-10V DC. (Refer to the sensor specifications and the *RC-2000 Installation Manual* for hardware hookup procedures.) If using a 0-10V input type,

ensure that the board channel setup is set to 0-10V type prior to programming this assignment.

The **Liquid Level** input is only available when the Refrigerant Liquid Level is configured for digital. This assignment is used only when the liquid level sensor is a dry contact digital type sensor. If the contacts are closed, an alarm will be generated by the RC-2000 and a reverse video block with a Small Capital T will be visible in the status screen to the right of the suction pressure reading.

The **HR Override Relay** is the relay that will be de-energized when the liquid level in the receiver falls below the HR Override Level. The HR Override Delay will be active before the relay is de-energized. The relay will energize when the liquid level returns above the HR Override Level plus the HR Override Diff.

Follow these guidelines to set up the HR Override Relay:

- Use **NO contacts** for **valves** that are **energized** for **heat reclaim.**
- Use **NC contacts** for valves that are **de-energized** for **heat reclaim.**
- **Hook it up in series** with the device operating the heat reclaim, (i.e., the EC-1000 relay output).

Aux Enable Input is the digital input that when closed, will activate the **Aux cut in** and **Aux cut out** setpoints. The RC-2000 will immediately react to the new setpoints. When this input is active, a reverse video 'A' will appear next to the setpoints field on the Rack Status Screen.

The **Phase Loss Input** field is a digital input. When it is opened, it will shut down all compressors and associated circuits as defined by the **Circuit Setpoint Screen**. Ensure that this input is closed when all phases are present for operation.

The **Defrost Sense Input** is only available when Defrost Sense Input is configured for [EXTERNAL]. If this input contact is CLOSED, the RC-2000 will lock on the compressor with the smallest capacity to ensure that ample pressure is available for Hot Gas Defrost operation. If Defrost Sense Input is configured for [INTERNAL], the RC-2000 will lock on the smallest compressor stage when any hot gas circuit is in the defrost cycle.

The **Oil Failure Input** is a digital input used to monitor rack oil pressure. This is a monitor only input, no action will occur on rack components. An alarm will be logged upon opening the contacts. All oil fail contacts should be connected in series such that any failure will open the digital input. When the contacts are closed, the alarm condition will clear.

Compressor Relay Assignments (1-8) are available. If [SEQUENTIAL] operation is selected, they should be entered in the order in which they are expected to operate. When using variable speed compressors, sometimes the first assignment is skipped so that it is easier to interpret the status screen. However, if any other places are skipped, the compressor operation will stop at the last valid entry.

The **Capacity** values (HP, BTU, or a percent) should be proportional for all the compressors used. For example: if three compressors at 7.5hp are used, use 75 for all three since 7.5 cannot be entered as a Capacity value. Further, if a Variable Speed compressor is used at a capacity of 10 hp, use 100 as its capacity for compatibility with the fixed compressor capacities. Generally, higher numbers for Variable Speed Capacity, (multiply actual capacity by 10) provide finer control of the Variable Speed Compressor.

The **Unloaders** value is the number of **unloaders** provided for the compressor assigned directly above it. The RC-2000 then assumes that the next Unloaders number of compressors is actually Unloaders. For example, Compressor 1 (10hp total) has four unloaders (each has 1/5 total capacity) relay assignments 1-1 through 1-5, Compressor 3 (15hp) and 4 (15hp) have no unloaders, relay assignments 1-6 and 1-7. The assignments would be as shown in the grid below.

The RC-2000 will not allow a programmed unloader to come on without its master compressor on first.

Compressor-Unloader Assignment Grid

Compr	1	2	3	4	5	6	7	8
Relay	1-1	1-2	1-3	1-4	1-5	1-6	1-7	0-0
Capacity	020	020	020	020	020	150	150	000
Unloaders	4	0	0	0	0	0	0	0

The **Controller Address** consists of eight assignments. The assignments are a communication address value for an Echelon interface with the Encore ESC-200/Bitzer Screw Compressor Control Module. Each individual compressor (i.e., 1-8) relay assignment is in direct order with its controller address assignment. These devices are assigned here and then will be installed via the LonNetwork utility accessed through the Main Menu of the RC-2000.

Once these devices are assigned, the Rack Status Screen will indicate it by displaying a dash on the ESC Units Line for each assigned module directly beneath the corresponding compressor. If there is an alarm condition on the module, it will be indicated there by an [A] symbol and the appropriate alarm will be logged.

The Rack Status Screen will display a [_] below the associated compressor unit, noting that an ESC-200 is assigned to it. If this module is in alarm, it will display an [A] in the place of the dash indicator for that compressor/module and enter the alarm into the alarm log.

The ESC-200 alarm interface does not honor any alarm time delays if the module is in alarm it will be entered into the log immediately. The RC-2000 has a dial out capability for each of these alarms and the alarm relay assigned to the suction alarm will de-energize if an ESC-200 is in alarm.

The Compressor/Module number that is in alarm condition will be indicated by a C# prior to the following descriptions in the alarm or event log.

The alarms received from the ESC-200 will be as follows:

Log Entry	Description	Category
MOTOVR	Motor Overload	Alarm
OIL FLW	Oil Flow	Alarm
OIL LVL	Oil Level	Alarm
GAS TMP	Discharge Gas Temperature	Alarm
PHASE	Phase Failure	Alarm
ROTATE	Rotation Failure	Alarm
RUN PRF	Run Proof	Alarm
FILTER	Dirty Filter	Event

The **Oil Pressure** [Oil pres] inputs are for analog input from pressure transducers monitoring the compressor oil pressure. They range from 0 to 100 lbs. using the SA-100 transducers.

The **Sump Pressure** [Sump pres] inputs are for analog input from pressure transducers monitoring the compressor sump oil pressure. They range from (0 to 100 lbs.) using the SA-100 transducers. If no sump transducer is assigned, the oil pressure will be calculated using the suction pressure transducer.

The **Minimum Difference Oil Pressure** [Min diff oil pres] is the value used to alarm on a low oil condition. The RC-2000 calculates the difference of the [(Oil Pressure) and (the Sump Pressure or Suction Pressure)]. If that value is less than the [Min diff oil pres], an alarm is generated.

The **Run Input** [Run Inpt] setpoints are used for digital proof of run contacts for each compressor. The RC-2000 expects closed contacts when the compressor runs and opened contacts when the compressor turns off. There is a five minute delay incorporated for this input. If the compressor is called to be on for five minutes without sensing a Run Input Closure, an alarm will be generated. The alarm log will indicate a C# prior to the description to indicate the compressor number in alarm. The alarm will not clear from the log until the compressor is being called for and the Run Input is closed.

VARIABLE SPEED COMPRESSOR SETPOINTS

The Inverter Address setpoint is assigned when using the Echelon communication interface for the Danfoss Inverter VLT Series 3000/3500. If this setpoint is assigned, several of the inverter setpoints will appear as n/a indicating that the Echelon interface logic will supply that information without the need for connections or assignments of those points.

The following input and output functions will be performed by the Echelon Interface for variable speed compressor control with a Danfoss Inverter:

- Analog Output (0-10VDC)
- Reset Relay
- Fault Input
- Run Input
- Current Sensor
- Frequency Sensor

When this interface is active, the analog out speed reference and reset function will be sent via the Echelon communications. The RC-2000 will also receive and indicate status for the current and frequency of the compressor motor via the inverter. If a fault or run proof alarm occur, the RC-2000 will receive that information via the Echelon communications and log the appropriate alarm.

Once this setpoint is assigned, an installation process will need to be performed from the Main Menu #8 Lon Network.

NOTE

Ensure that the Echelon Interface instructions are followed to maintain proper control of the inverter. If this interface is being used, carefully read the RC-2000 Installation Manual information about the hardware/software requirements for proper operation. Ensure that all steps are understood and followed before attempting to control the inverters via the Echelon interface. If this interface is not being used, ensure that this setpoint remains set to [00] to avoid an I/O discrepancy in the program.

The **Inverter Controller Address** is set up in the same manner as listed before for the Compressor Controller Address for the ESC-200/Bitzer Screw Compressor Module. When the address is assigned to this setpoint, the alarms will be referenced as Comp Inverter alarms in the log instead of a compressor number.

Max RPM is the maximum value of RPM for the compressor under Variable Speed Control. This corresponds to the maximum output of the analog out card (10VDC). The maximum value allowed is 5000 RPM.

Min RPM is the minimum value of RPM for the compressor under Variable Speed Control. The compressor will never operate below this RPM. The Variable Speed (V.S.) compressor will shut down only when the required capacity is at zero percent.

The **Compressor Inverter Capacity** for Variable Speed Control uses the same capacity setup as that for fixed compressors. The higher the capacity, the more defined increments for the V.S. output.

For example:

Cap = 10	Max RPM = 1750
V.S. steps 175 RPM	
Cap = 100	Max. RPM = 1750
V.S. steps 17.5 RPM	

The **Analog Output** is the output assignment for the 0-10VDC analog output card that is connected to the inverter. This output is used for speed reference and is proportionally outputted in relation to the maximum and minimum RPM

settings. This assignment is not available if the Inverter Address setpoint is assigned.

The **Frequency Sensor** [Freq sensor] is used to externally monitor the operating frequency of the inverter. The signal should be 0-10VDC. This assignment is not available if the Inverter Address setpoint is assigned.

The **Control Relay** is used to control the main power contactor for the inverter. The control relay is energized whenever the analog output is active (use N/C contacts). This control is generally routed through the switchover relay to allow for switchback if there is an inverter failure.

The **Reset Relay** is used to send a reset signal to the inverter. If a fault is detected from the inverter, the reset relay will pulse three times in twenty seconds and attempt to get the inverter running properly. If after three resets the inverter is still in a fault condition, the inverter will go into switchover mode. This assignment is not available if the Inverter Address setpoint is assigned.

The **Switchover Relay** is used to bypass the inverter control and run the inverter as an on/off compressor. If the inverter has a fault and does not recover, the switchover relay will be set on and the external bypass relay will control the compressor. This relay can be connected either N/O or N/C as configured in the rack configuration.

The **Fault Input** accepts a digital fault signal from the inverter. If the contacts are closed, the RC-2000 will attempt to reset the inverter using the reset relay. This assignment is not available if the Inverter Address setpoint is assigned.

Run Input is a digital input that is used for proof of run verification of the V.S. inverter. If the contacts are closed, the compressor is assumed to be running. If the run input does not match the actual run condition of the compressor, an alarm is generated. This assignment is not available if the Inverter Address setpoint is assigned.

The **Current Sensor** is used for an external monitor of the operating current of the V.S. compressor. The signal should be 0-10VDC. This assignment is not available if the Inverter Address setpoint is assigned.

The **Fan Relays Main Bank/Bank A** are six fan relays that are always available for assignment. The functionality of these six relays is the same in all condenser configurations. The six fan relays will cycle on and off according to the required capacity for the condenser control. These relays will cycle on and off in the same manner during full condensing and split condensing mode of operation.

The **Fan Relays Split Bank/Bank B** are six fan relays. They are only available for assignment when configured for twelve fan operation. These relays will always cycle in unison with the corresponding relay in the Main Bank/Bank A. This type of cycling allows the user to control each fan with an individual relay but still uses the fan bank control method. During Split Condenser mode of operation, this bank of fans will not cycle on.

The system has two **Split Control Relays** available only when the system is configured for Split Condenser Control. They will become energized when the RC-2000 calls for split condenser control. One of these relays is generally used to bypass condenser piping and the other is used to electrically bypass the fan control for the split bank when using the six fan relay condenser control. If using the twelve fan control method, the second split relay will not be needed for the electrical bypass.

The **Run Input A** field is six inputs that are the Run Proof Inputs for the six fan relays from the Main Bank/Bank A. The Run Proof will alarm if the fan is being called to be on and the input for the proof is not closed for five minutes. The alarm will log as a [F# Verify] in the alarm log with the # representing the number of the fan bank.

The **Run Input B** field is six inputs that are the Run Proof Inputs for the six fan relays from the Split Bank/Bank B. These inputs are only available when configured for Run Verification and twelve fan operation.

The **Variable Speed Condenser Fan** setpoints are available for a system that is configured for Variable Speed Condenser control. They have the same functionality as the Variable Speed Compressor Control. However, the Variable Speed Condenser Control does not support all of the functionality of the Variable Speed Compressor Control. The following list supplies the setpoints available for Variable Speed Condenser Control. Please refer to the Variable Speed Compressor control descriptions printed earlier in this section.

- Inverter Address
- Max RPM
- Min RPM
- Analog Output
- Control Relay
- Reset Relay
- Switchover Relay
- Fault Input

The Power Sensor is a 0-10VDC input from a kW watt transducer that is generally installed in the rack to monitor power usage. The Max Power field is a scale factor that is used to calculate instantaneous kW usage. The Max Power setpoint will vary according to the model and voltages of the kW transducer and the CTs that are installed. Table 16 provides a list of the transducers, the RC-2000 Installation Manual provides detailed hook up procedures.

TABLE 16 – ECI Watt Transducer Model Numbers, Ratings, and CT Scale Factors

Transducer Model Number	Rating	Maximum kW
CC/20106400	208V, 3 Phase, 3 Wire	.36 x (CT size)
CC/20106401	480V, 3 Phase, 3 Wire	.83 x (CT size)
CC/20106402	208V, 3 Phase, 4 Wire	.36 x (CT size)
CC/20106403	480V, 3 Phase, 4 Wire	.83 x (CT size)

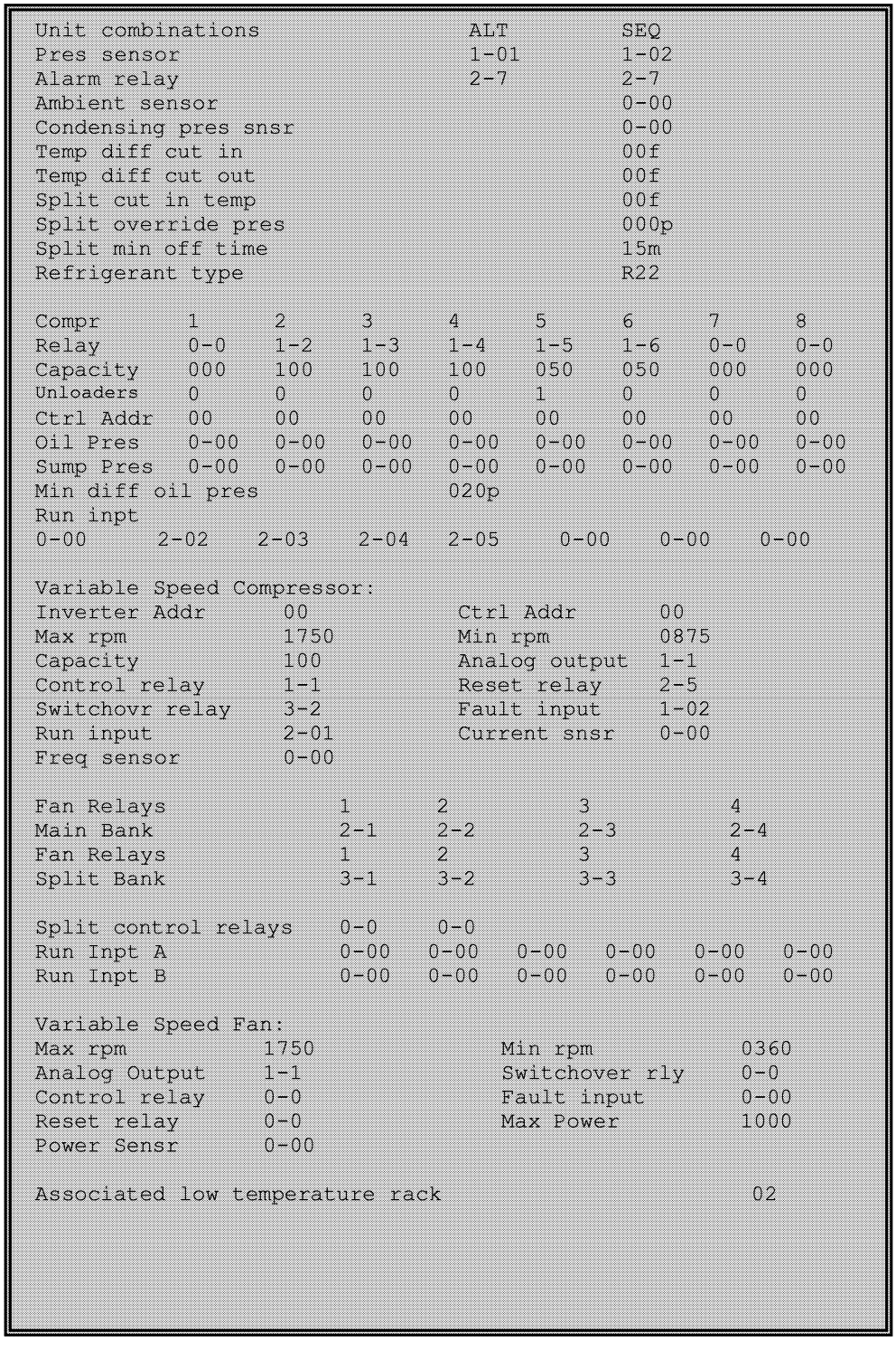
The **Associated Low Temperature Rack** interlocks the rack to another for lock out purposes. It is intended for two stage systems. If the medium temperature rack compressors are not running, the low temperature rack will be locked out (all compressors off). This number should be set on the medium temperature rack. On the associated low temperature rack, this field will show [n/a].

NOTE

The RC-2000 Version 4.50 or higher communicates with a maximum of fifteen digital output boards. Relay assignments may be made for boards 1-9 and A-F, for a total of fifteen assignments.

01 Rack A	SUCT	HEAD
Cut in	012p	200p
Cut out	009p	165p
Aux cut in	020p	250p
Aux cut out	015p	185p
Max cut in	030p	
High alarm	040p	300p
Low alarm	005p	095p
Shut down	015p	
Ignore Temp Below	000p	
Head Override		320p
Alarm delay	15m	20m
Liquid Level Alarm	020%	
HR Override Level	010%	
HR Override Diff	002%	
HR Override Delay	030s	
Min on time	000s	
Min off time	060s	
Control gain	020	100
Derivative Gain	040	150

RACK SETPOINTS SCREEN (continued on next page)



RACK SETPOINTS SCREEN

RACK OVERVIEW SCREEN

The Rack Overview Screen displays rack status information. At a glance, you will see

- Rack number
- Suction pressure
- Variable speed compressor RPM
- Compressor stages on
- Head pressure
- Condenser fan stages
- Variable speed condenser fan RPM

High and low alarms are indicated on this screen; this information may be used for troubleshooting purposes.

RACK NAME SCREEN

The Rack Name Screen enables you to enter descriptive names, a maximum of sixteen alphanumeric characters, for each of the configured refrigeration racks.

IMPORTANT

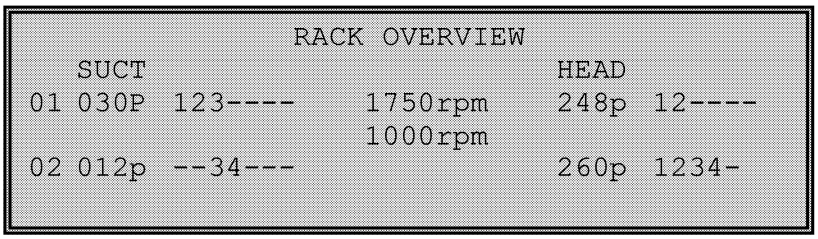
Rack names can only be entered AFTER the racks have been configured in the Rack Configuration Screen.

RACK SENSOR NAMES SCREEN

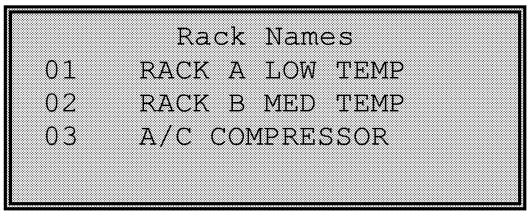
The Rack Sensor Name Screen enables you to enter descriptive names, up to 24 alphanumeric characters, for each sensor assigned to a configured compressor rack.

IMPORTANT

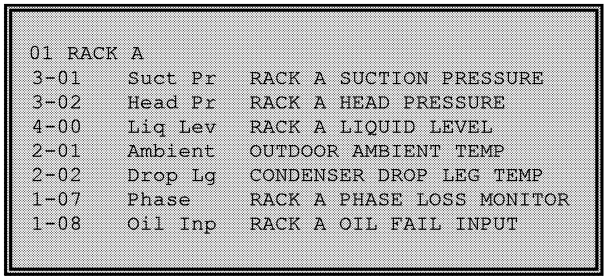
A Rack Sensor can only be named AFTER it is assigned in the Rack Setpoint Screen.



RACK OVERVIEW SCREEN



RACK NAME SCREEN



RACK SENSOR NAMES SCREEN

RACK CONFIGURATION SCREEN

The Rack Configuration Screen contains compressor rack configurations that apply to your refrigeration control system. The most critical field on this screen is the first one, which enables you to specify the number of racks that the RC-2000 control software will control.

IMPORTANT

To view the other Rack Menu screens, a Rack Number must be assigned. As long as the value of this data field is [00], you will be unable to view the other screens listed on the Rack Menu.

The next **Rack Configuration option** is **Variable Speed**. With Variable Speed control, the rack may control one Variable Speed Compressor and/or one Variable Speed condenser fan for each configured refrigeration rack. It has three selection options:

1. Compressor
2. Condenser
3. Compressor/Condenser (Compr/Cond)

When the **Variable Speed** option is selected, additional data fields appear on the status and setpoint screens (see the Rack Status and Rack Setpoint screens for details).

Run Verification senses the actual state of individual compressors and condenser fans (ON or OFF) via digital inputs (i.e., when the compressor turns on, the digital input will close to indicate a run condition).

When this option is selected, eight Run inpt fields (digital input assignments) are added to the Rack Setpoints Screen for compressors and either six or twelve are added for condenser fans (dependent on condenser fan configuration setting).

NOTE

When the state of any of these inputs does not match the desired output of the associated compressor, a suction alarm will occur.

When a suction alarm occurs, a [v] will appear in the Rack Status Screen in place of the compressor number.

The **Auxiliary Setpoints** (Aux Setpoints) are an additional set of setpoints. They appear on the Rack Configuration Screen when a special digital input is [ON] (closed). They control rack suction and head pressure.

An **Auxiliary Cut in** and **Auxiliary Cut out** setpoint field in addition to an **Aux Enable** input field is added to the Rack Setpoint Screen when this option is selected.

NOTE

When configuring for **Auxiliary Setpoints**, an **Aux Cut in** and **Aux Cut out** setpoint will become available for compressor and condenser control.

The **Temperature Controlled** Setpoints option allows the user to "float" the suction pressure Cl and CO upward based on critical case temperatures. By assigning a max Cl value in the Rack Setpoints Screen, and referencing the appropriate rack number at the bottom of each Circuit Setpoints Screen, a control algorithm will be initiated.

NOTE

When **Floating** setpoints are used, all associated circuits will have the setpoints adjusted to 2° below the programmed value.

The Rack Cut in and Rack Cut out setpoints will float up to but not exceed the Max Cut in value. When any associated circuit goes above the setpoint, the Rack setpoints will float back down, but will not go below the standard cut in and cut out values.

During this algorithm, the rack side of the RC-2000 will look at the setpoints of all assigned circuits. One circuit will be used to *float* the suction of Cl and CO. One of two configurations may be used to decide which circuit to use:

1. **Default**, which uses the circuit with the lowest setpoint.
2. **Select,** which uses the circuit with the lowest **Temperature Compensation Priority** (TCP). (The TCP is entered in the Circuit Setpoint screen.) If the ***select*** circuit temperature is at or below setpoint, the Cl and CO will float up.

NOTE
A priority of zero indicates that circuit is not to be used as the ***select circuit*** for temperature compensation.

Floating Rate = [1 psi/(degree × minute)]

The **differential** between **CI** and **CO** will remain **constant**.

- The CI will never float **ABOVE** the max CI or **BELOW** its original value.

IF the controlling circuit goes into defrost and default is chosen, the rack side of the RC-2000 will use the circuit with the next lowest setpoint. If select is chosen, the circuit with the next higher TCP (Temperature Controlled Setpoint) will be used.

NOTE
While a circuit is being used for floating, it will remain in Refrigeration ON mode unless the temperature is two degrees below setpoint. This allows the temperature to be controlled by the rack side via floating.

Phase Loss Input senses an AC power line failure via a phase protect relay into a digital input, then shuts down all configured rack compressors and assigned circuits immediately. Selection of this option adds the Phase Loss Input field to the Rack Setpoint Screen.

NOTE
The OPEN state signals an alarm condition for this input. During normal operation, the contacts need to be closed (digital input - ON).

Refrigerant Liquid Level senses the liquid refrigerant level via a digital or analog input and shuts down the rack heat reclaim system when the level falls below the set minimum. When this option is selected, a 'Liquid level input' field is added to the Rack Setpoint Screen.

When using a digital input for refrigerant liquid sensing, a CLOSED state signals an alarm condition for this input. During normal operation, the contacts need to be open (digital input - OFF). When using an analog input for refrigerant liquid sensing, the use of a liquid level float is incorporated into the RC-2000. The scaling for this sensor is 0-100%. If the percent of liquid goes below the Liquid Level Alarm setpoint, an alarm is generated. A Heat Reclaim override setpoint and a Heat Reclaim override relay are also available for analog input refrigerant liquid sensing. This allows the RC-2000 to bypass heat reclaim if the receiver level falls below a given point.

NOTE
The Heat Reclaim Override feature is available when using Analog Liquid Level Sensors only.

The **Defrost Sense Input** option senses a circuit's hot gas defrost cycle. The option has three choices:

1. **Internal (default)** – Senses hot gas defrost internally from defrost relay states.
2. **External** – Senses hot gas defrost by using an external digital input to indicate defrost
3. **None** – Does not sense a hot gas defrost condition.

If defrost sensing is used, the smallest possible compressor capacity will, at minimum be maintained to supply sufficient hot gas during the defrost cycle. Selection of the external option adds the Defrost Sense Input field to the Rack Setpoint Screen. To monitor external defrost initiation, the contacts need to be closed during defrost.

Oil Failure Input senses an oil failure (digital input is open) and generates an alarm. Selection of this option adds the Oil Failure Input field to the Rack Setpoint Screen. The digital input should be closed under normal conditions. During Oil Failure, the external alarm relay will be activated, and date and time will be stored in the Alarm Log by the unit.

Control Relay Energized On offers the capability to have compressor and/or condenser fan output relays energized either on or off. The following selections are available:

1. **No**: compressors and fans will be energized off
2. **Comp**: the compressor control relay will be energized on
3. **Fans**: the condenser fan control relay will be energized on
4. **Both**: control relays for compressors and fans will be energized on.

Desuperheater Control allows access to the Desuperheater Setpoint Menu. This allows control of up to two relays based on manifold temperature; a rise in temperature will bring on the loads. Up to six manifold temperatures can be assigned and control will be based on the average temperature or the maximum temperature (user selectable).

TD Head Pressure Control controls condenser fans based on differences between condensing temperatures and ambient temperatures. Its general use is to optimize variable speed condenser control. There are four different types of control theory that may be selected from this configuration option.

1. **None**: This is the default setting that allows condensers to be controlled via the conventional Cut in and Cut out of the discharge pressure valves.
2. **Temp**: This selection uses two temperature sensors to control the condenser via a temperature difference algorithm. The user must assign a drop leg/condensing temperature sensor and an ambient temperature sensor for the algorithm to perform properly.
3. **Press**: This selection uses a discharge pressure sensor (converted to a temperature value via an internal pressure temperature table) and an ambient temperature sensor to control the condenser via a temperature difference algorithm. The user must assign a condensing pressure sensor, an ambient temperature sensor, and a temperature difference for the algorithm to perform properly.
4. **WETB**: This selection uses an ambient RH sensor, an ambient temperature sensor and a sump temperature sensor to control a water cooled condenser via a temperature difference algorithm. The user must assign an ambient relative humidity sensor, an ambient temperature sensor, a sump temperature sensor, and a discharge pressure transducer for the algorithm to perform properly.

A **Cut in** and **Cut out** setpoint is available for pressure while in these modes of operation. These setpoints are used for the boundary of operation for the TD control. If the pressure is in between these setpoints, TD control will be activated.

Two Stage Rack Control allows you to link a low temperature rack to a medium temperature rack for lockout purposes. If the medium temperature rack is not running, the low temperature rack will be 'locked out' (i.e.: all compressors off). Normal control of the low temperature rack will resume when at least one compressor is called for on the medium temperature rack.

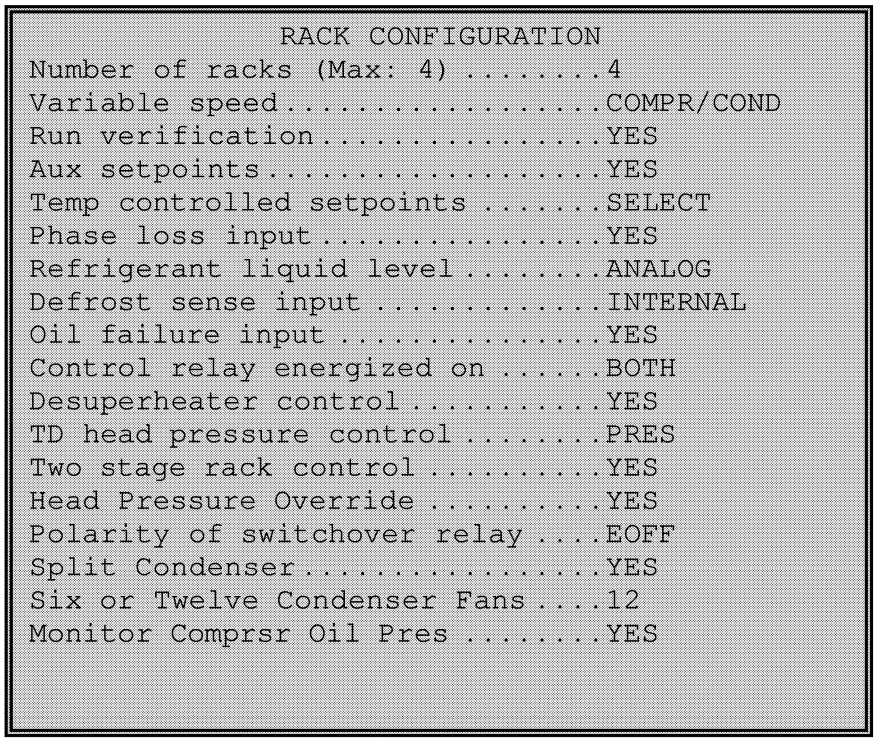
Head Pressure Override allows for a high head pressure setpoint, which if exceeded, will start an orderly shutdown of compressors. This shutdown is achieved by an inverted algorithm that cycles compressors off and on based on the deviation of the head pressure from the head override setpoint.

Polarity of Switchover relay assigns the variable speed switchover relay to either energized on (EON) or energized off (EOFF).

Selecting [YES] for the **Split Condenser** option will add setpoints to operate a split condenser strategy. It provides setpoints for two split control relays that will energize when in split. Typically these relays are wired Normally Open (NO).

The **Six or Twelve Condenser** fans option will allow the user to control a maximum of 12 condenser fans.

The **Monitor Compressor Oil Pressure** (Monitor comprsr oil pres) feature will allow monitoring of oil pressure on non variable speed compressors. Setpoints will be added for a sump and oil pressure transducer per compressor.



RACK CONFIGURATION SCREEN

RACK MONITORING POINTS SETPOINT SCREEN

This screen consolidates a variety of inputs and outputs for monitoring. They have no control function. The inputs and outputs can be either independent assignments or duplicate assignments from any other area of the RC-2000.

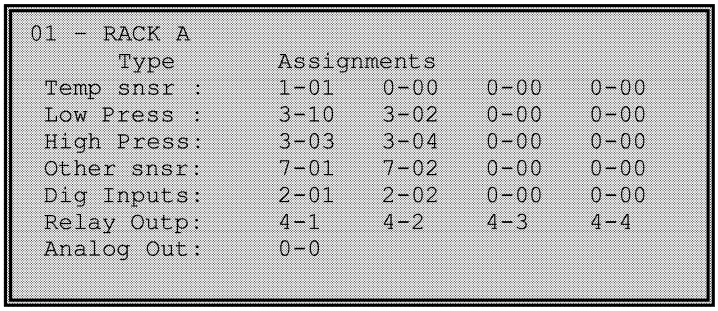
RACK MONITOR NAMES SCREEN

The Rack Monitor Names Screen enables you to enter descriptive names, up to 24 alphanumeric characters, for each sensor assigned to a configured monitor group. The sensor must be assigned in the Monitor Setpoint Screen before it can be named.

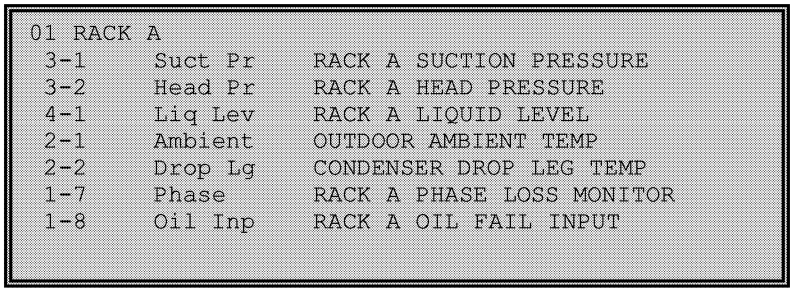
RACK DESUPERHEATER SETPOINT SCREEN

The Desuperheater Setpoint Screen allows setpoints for Desuperheater Relay Control. Up to six manifold temperature sensors can be assigned. The control will operate on the average of these sensors or on the highest temperature (user selectable). The relay will come on when the temperature goes above the setpoint and will go off when the temperature goes below the setpoint minus the deadband temperature.

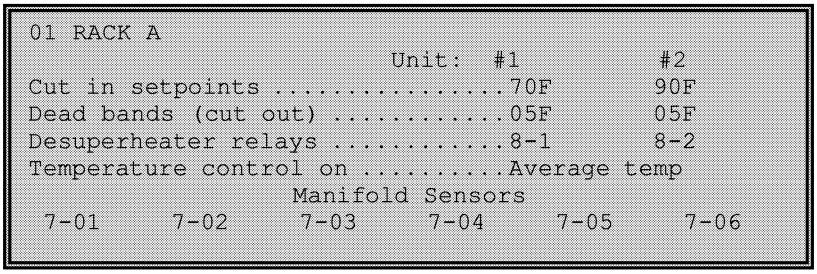
Examples of these screens appear below.



RACK MONITORING POINTS SETPOINT SCREEN



RACK MONITOR NAMES SCREEN



RACK DESUPERHEATER SETPOINT SCREEN

LOGIC CONTROL VIA THE RC-2000 CONTROL SOFTWARE

INTRODUCTION

The RC-2000 controls analog/digital inputs and reference outputs, monitors system setpoints, and alarms on setpoint failure with built-in logic control. Logic control offers the following advantages for your system's operation:

1. Combines various monitoring and control setpoints into one programmed statement.
2. Accommodates specialized monitoring and setpoint control for your refrigeration system.
3. Supports alarm log entry and alarm dialout on monitored setpoints.
4. Enables the control software to compare various setpoints; then subsequently act on the result of the comparison according to the statement setup.

LOGIC CONTROL

Logic control is accomplished through logic statements. They are IF…THEN propositions that use input and output configurations to produce a control software action. A logic statement sets up a TRUE/FALSE condition, which forms the basis of logic control in the RC-2000. It is identified in the control software by number and a user defined description.

Logic conditions consist of status fields for all associated inputs and outputs assigned to the statement, INCLUDING TRUE/FALSE CONDITIONS. They are linked together by the general operators AND, OR, XOR. A logic statement written for RC-2000 Logic Control can override the normal operating mode of an output if a logic statement output is assigned to an output being used elsewhere.

IMPORTANT

For logic control to be enacted by the RC-2000 control software, the logic statement result MUST BE TRUE.

LOGIC CONTROL STATEMENT BASICS

The logic statement proposes an IF…THEN situation.

For Example:

This logic statement for the RC-2000 control software:

[IF 1-01 > 50°…THEN 1-1 + 1-2 + 1-3 ON]

Can be interpreted as:

IF temperature sensor 1-01 is greater than a setpoint setting of 50°**…THEN** turn output relays 1-1, 1-2, and 1-3 ON.

LOGIC CONTROL STATEMENT RESULTS

A logic statement has a result. It is TRUE or FALSE.

For a TRUE result, **ALL** conditions for a logic line or statement must be met. Otherwise the statement is FALSE.

Consider the example statement again:

[IF 1-01 > 50°…THEN 1-1 + 1-2 + 1-3 ON]

According to this statement,

IF [1-01] = 40°, the result is FALSE
IF [1-01] = 65°, the result is TRUE

REMEMBER

For logic control to be active, the statement(s) MUST have a TRUE result.

LOGIC STATEMENT MENU SCREEN

Active RC-2000 Logic Control programming on your part begins by maneuvering the Logic Statement Screen displays. The Logic Statement Menu offers six choices: they serve as the Table of Contents to the RC-2000's logic control statements, output configuration, and control functions. If you want to program logic control into your unit, ECI recommends that you become familiar with the form and function of the screens available on the Logic Statement Menu. An example of this screen appears on the following page.

To access the Logic Statement Menu:

1. Press Main Menu choice [3].

LOGIC STATEMENT STATUS SCREEN

The Logic Statement Status Screen contains a title line, data line(s), and a status line. A count operator choice is also available.

The title line displays the logic statement number and description. The data lines display the status fields for all associated inputs and outputs assigned to the logic statement. The status line shows the overall status of the entire logic statement. It will be true or false, depending on the condition of all the logic lines contained in the statement. If the count operator is enabled, the count will be displayed.

NOTE

The true/false conditions later in the status screen indicate the condition of the specific logic line ONLY.

LOGIC STATEMENTS SETPOINTS SCREEN

The Logic Statement Setpoint Screen consists of a title line and all output setpoints controlled through the logic function.

REMEMBER

Logic statements customize your refrigeration control; they are based on a variety of input and output configurations.

```
                LOGIC STATEMENT MENU

 1 - Status              4 - Logic Statement Names
 2 - Setpoints           5 - Sensor Names
 3 - Clear Latch         6 - Configuration
```

LOGIC STATEMENT MENU

```
01 -BOL HOT WATER HEATER
STATUS: FALSE
OUTPUTS 1-1 OFF
(AIGR1 0   F   [>]AIGR2      0   F    >=FALSE
[OR ]      (Digital Inp Group  <or > ) = FALSE
[OR ]      (Refer Input Group <or > ) = FALSE

#  Group     Val.   Eval.     Name
1-1AI-GR1 -30F   (min) SENSOR 1-1
```

LOGIC STATEMENT STATUS SCREEN

```
01 -BOL HOT WATER HEATER
 IF Analog       [0-00  0-00   0-00   ( min)]
  > Analog       [0-00  0-00   0-00   ( avg)]
OR Digital       [0-00  0-00   0-00   ( or  )]
             ON     ON     ON
THEN Dig Out [0-0       0-0    0-0    ( nrm) ]
              ONON     ON
Energized is      ONON     ON

True if count equals (Min 2)      000
Sensor Type Lo-T      Setpoint    N/A
Time Delay  0-10 Sec   Min on     000 Sec
Log Alarm No         Log Event    No
Message (10 chars)  N/A
Scale factor         N/A
Clear latch input    N/A
Logic is on from     00:00 to 00:00
```

LOGIC STATEMENT SETPOINT SCREEN

MULTIPLE ANALOG INPUT (A/I) LOGIC INTERACTION

Multiple analog input interact with the control software logic control as listed in the Table below:

TABLE 17 – MULTIPLE ANALOG INPUTS LOGIC CONTROL OPERATORS

LOGIC OPERATOR	DESCRIPTION
AVG	Average of all the A/I sensors assigned
MIN	Minimum value of ANY individual sensor assigned
MAX	Maximum value of any individual sensor assigned
SPT	User defined setpoint value, NO sensor used

For Example:

The Multiple Analog Input Interactive Logic Statement:

IF 1-01 1-02 1-03 (AVG) > 50°**…THEN** 1-1 off

Can be interpreted as:

IF temperature sensor 1-01, 1-02, 1-03 averaged together is greater then (>) the setpoint of 50°**…THEN** output relay 1-1 goes off.

According to this statement, the control software would compare the setpoint of 50° to the AVERAGE of the three sensors 1-01, 1-02, and 1-03. AND **IF** that AVERAGE was GREATER than the 50° setpoint, **THEN** the output 1-1 would go off.

MULTIPLE DIGITAL INPUT (D/I) LOGIC INTERACTION

Multiple digital input can be combined into one logic statement by using the operators listed in the table below:

TABLE 18 – MULTIPLE DIGITAL INPUTS LOGIC CONTROL OPERATORS

LOGIC OPERATOR	DESCRIPTION
AND	All digital inputs assigned must be TRUE at the same time for the entire statement to be true.
OR	One or more digital inputs must be TRUE for the entire statement to be true. As long as any one digital input is true, the statement will be true.
XOR	Only one input at a time can be TRUE for the entire statement to be true. If more than one input is true, the statement will become false.

The digital input reaction is set to ON or OFF; ON = CLOSED, OFF = OPEN.

For Example

If assigned to ON, the condition will be TRUE if the digital input is ON.

MIXED INPUT/OUTPUT LOGIC INTERACTION

Mixed logic control (or reference outputs) refers to analog inputs and digital inputs combined into one logic statement. Individually, the analog input and digital input are set up the same; they are then combined by using the operators listed in the table below.

TABLE 19 – MIXED LOGIC CONTROL OPERATORS

LOGIC OPERATOR	DESCRIPTION
AND	The analog input statement AND the digital input statement must both be true for the entire logic statement to be TRUE.
OR	Either the analog input statement OR the digital input statement OR both can be true for the entire logic statement to be true.
XOR	Either the analog input statement OR the digital input statement must be true, but NOT BOTH for the entire logic statement to be true.

LOGIC CONTROL REFERENCE OUTPUT REACTION

Reference output is an element that can be added to a logic statement. It allows the statement to react based on the condition of a relay status that is assigned elsewhere in the unit.

For Example
The circuit relay or a rack output relay might act as reference outputs in logic control. A relay acting as a reference output is labeled REF OUT on the Logic Setpoint Screen.

Reference output logic is similar to digital input logic. An ON/OFF status is set to indicate the reference relay setting for a TRUE condition.

IMPORTANT
The Change choice is an option for Reference Output Logic. It allows the logic statement to be true on any CHANGE (CHG) for the relay status (i.e., On-to-Off/Off-to-On).

For Example

IF analog input temperature 1-02 is less than (<) setpoint of 100° AND reference output (circuit load) 1-1 is ON**…THEN** output 1-2 comes on.

Let analog input 1-02 be water temperature.
Let reference output be compressor 1-1.
Let output relay 1-2 be the water heater load.

This might be saying: **IF** the water heater temperature (1-02) is less than 100° AND compressor load (1-1) is on**…THEN** the water heater output load (1-2) stays on.

IF the temperature goes above 100°**…THEN** the water heater load (1-2) goes off.

In addition, **IF** the reference relay is off, indicating an off condition**…THEN** the water load (1-2) goes off.

Logic statements may be simple or complicated, depending on the conditions required for a reaction.

IMPORTANT
Take care that each statement is thought out completely to insure correct system operation.

Output from the logic statements can be set on/off and the energized state can be set on/off. When using an output assigned elsewhere, the energized on/energized off state must be the same. The way the outputs react can be programmed for several conditions, depending on the needs of the user and equipment being controlled. Reference output logic control reactions are listed in Table 20.

TABLE 20 – REFERENCE OUTPUT LOGIC CONTROL REACTIONS

Reaction	Description
NRM (Normal)	Changes the output to the desired state. The output will revert to its previous state when the logic goes false. Typically used when relay outputs are not shared in the program.
CHG (Change)	Changes the output On-to-Off or Off-to-On depending on the last state of the relay, when a true condition occurs
SHD (Shutdown)	Normal change of state with more than one assignment to a relay. This is for sharing control of a relay. This selection can turn a load off, but cannot turn it back on.
MTY (Momentarily)	Momentarily energizes the output for approximately five seconds when a true condition occurs for the logic statement.
LCH (Latch)	Normally changes and latches the output relay when a true condition occurs for the logic statement. This condition must be cleared from the Clear Latch Menu, or through the digital input clear latch input.

The logic statement counts true occurrences by the **True if Count Equals** setpoint. Enter the number desired for the logic statement reaction at this line. When the evaluation of the statement sees that number of true occurrences, the entire statement will be true.

SENSOR TYPE SETTINGS

ECI Sensor types may be set through the logic control. Selections are listed in the Table 21.

TABLE 21 – ECI SENSOR TYPES

Sensor Type	Description
Lo-T	Low Temperature ranges: (-30°F to 97°F)
Hi-T	High Temperature ranges: (0°F to 255°F)
Lo-P	Low Pressure ranges: (0 to 100 lbs.)
Hi-P	High Pressure ranges: (0 to 500 lbs.)
KW	Kilowatt input: 0 to 10VDC
10V	0 to 10VDC
Lite	Analog light level sensor: 2.55 to 3.09VDC
Leak	Analog refrigerant leak sensor: 0 to 10 VDC

LOGIC CONTROL SETPOINT OPTIONS

When programming sensor settings via logic control, they must agree with the type of board installed and the sensor assignments used. The setpoint value is programmed when SPT is selected for analog comparison in the logic statement. If SPT is not used in the logic statement, no entry is permitted and the display will show N/A.

IMPORTANT

SPT must be selected for analog comparison in the logic statement to be activated. If SPT is not selected, no analog comparison will be permitted via the control software.

Time Delay allows a programmable time delay to be set before an output reaction occurs. Use this for anti-short cycling or to prevent transient changes in output.

The **Min On Time** is the minimum time that the outputs will be on regardless of the evaluation of the statement.

Log Alarm and Log Event Yes/No settings allow logging to be enabled or disabled for the logic statement. When the logic statement changes state a log is recorded that identifies the description, time, date, and a user defined message.

Message is the user-defined identification for the logic statement (max. ten characters). If the alarm and event logs are set to NO, this area will display N/A.

The **Scale Fact** setpoint is used when a kW, 10V or LEAK type of input is being used. This value scales the reading from zero to the maximum (scale factor) value.

Clear Latch Input provides for a digital input to be used for clearing a logic statement once it has been latched. It activates on a closure. Use this for a remote switch or button to reset the logic statement.

Each logic statement can be operational based on a **Time of Day** schedule. The active times for the logic statement is set by the **Logic is on from** setpoint area. Enter a starting and ending time in twenty four hour format.

IF the logic statement is not active based on the TOD schedule, the status field will indicate: STATUS: False on time. Since the statement is not being evaluated, the status screen will not update in the OUTPUTS area.

LOGIC STATEMENT CLEAR LATCH SCREEN

If the digital output is set up to latch (lch) when a logic statement is true, this screen allows the user to clear the latching and reset the output to normal condition through the keypad.

The cursor is moved to the appropriate statement number latched condition. Press [ENTER], use the up, and down arrow to toggle the condition on-to-off.

```
        Clear Latch
01  HOT WATER HEATER    OFF
02  SUB COOLER TEMP     OFF
03  LIQUID LEVEL        OFF
```

LOGIC STATEMENT CLEAR LATCH SCREEN

LOGIC STATEMENT NAMES SCREEN

The Logic Statement Names Screen allows you to enter descriptive names for each of the logic statements configured. Alphanumeric data entry is permitted.

```
        Logic Stmt Names
01     HOT WATER HEATER
02     SUB COOLER TEMP
03     LIQUID LEVEL
```

LOGIC STATEMENT NAMES SCREEN

LOGIC STATEMENT SENSOR NAMES SCREEN

The sensor names screen allows you to enter descriptive names for each sensor and input assigned to a logic statement. Alphanumeric data entry is permitted.

```
01 -BOL   HOT WATER HEATER
 1-1     Sensor       HEATER TEMP
 1-2     Sensor       OUTPUT TEMP
 1-3     Sensor       INPUT TEMP
```

LOGIC STATEMENT SENSOR NAMES SCREEN

LOGIC STATEMENT CONFIGURATION SCREEN

The Logic Statement Output Configuration Screen allows you to specify the number of logic statements that the RC-2000 is to control. As long as the value of this field is '00,' you cannot view the other screens listed on the logic statement menu.

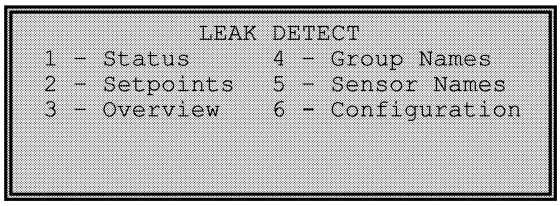
```
            Configuration

Number of Logic Stmt (Max: 32) . . 02
```

LOGIC STATEMENT CONFIGURATION SCREEN

LEAK DETECT

The Leak Detect Menu is selected from the RC-2000 Main Menu. The Leak Detect Menu contains screens from which setpoints and descriptions are entered and from which status is viewed. An example of the Leak Detect Screen appears below.



LEAK DETECT MENU

LEAK DETECT STATUS SCREEN

The Leak Detect Status Screen shows the status of each sensor within a group. The group status is indicated at the top of the page below the group name. The group state for all configurations will be either [ALARM] or [NORMAL].

NOTE

If the RC-2000 Controller is configured for the ECI Infrared Refrigerant Information System (IRIS), two additional messages may be displayed for group status: **Trouble** and/or **Off Line**.

A **Trouble** message indicates an equipment malfunction with the IRIS Unit. An alarm will generate to the alarm log for a period of five minutes. This alarm condition will clear as soon as the RC-2000 establishes successful communication with the IRIS.

IMPORTANT

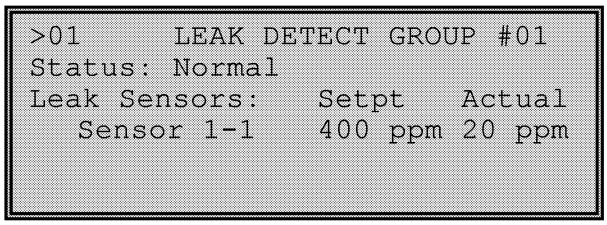
An IRIS **Off Line message** indicates that the RC-2000 has not had successful communication with the IRIS Unit for five minutes. An off line alarm will be generated to the alarm log. This alarm condition will clear as soon as the RC-2000 establishes successful communication with the IRIS.
This alarm may signal a serious malfunction with the IRIS Unit that requires on site service.

CHANNEL STATUS LINE(S)/SENSORS

Each **ECI Analog Sensor** in a group will be listed by name alarm setpoint and actual PPM level on a per line basis. **Digital Leak Sensors** have only one channel per group. The channel status displays either [NORMAL] or [LEAK]. (A digital leak status is recognized via a closed digital input.)

CHANNEL STATUS LINE/IRIS

All eight sensors in the group will be displayed based on the configuration of the group. The IRIS is a channel-sampling device; therefore, the channel being sampled will have an arrow pointing to that line. Each line will display the sensor name alarm setpoint and the actual PPM level. IF there is a negative two (-2) or lower PPM reading from an IRIS channel, the channel needs recalibrated. If this condition occurs, the RC-2000 will display a reverse video c next to the actual PPM status of the channel. Additionally, an IRIS Calibration Alarm along with a channel reference number will be generated to the alarm log. If this alarm is encountered, service will be required on site to correct the problem. An example of this screen appears below.



LEAK DETECT STATUS SCREEN

LEAK DETECT SETPOINTS

The Leak Detect Setpoints Screen display will depend on the leak detection's configuration. Generally, the setpoint functions are the same for each type of leak detection.

The Leak Detect Configured Screen contains a setpoint page for each group that is configured. The group name and number are at the top.

You may assign a group name in the Leak Detect Group Name Screen.

Each leak sensor input is displayed on its own line on the Leak Detect Setpoint Screen. Assign the sensor name in the first field; assign the board and channel number that is used for leak detection in the next field.

NOTE

When configured for IRIS or Yokogawa Leak detection, this board channel setpoint cannot be set. For IRIS or Yokogawa Leak detection, the RC-2000 will assign the board and input value according to the leak configuration allocation process.

An Alarm setpoint can be programmed into the control software for each leak detection input. It is located alongside the associated leak sensor. The Alarm setpoint must be adjusted according to the application being used. The table below lists the recommended alarm settings for each leak sensor type.

TABLE 22 – ALARM SETTING/SENSOR

Leak Sensor Type	Alarm Setting
ECI Analog	400 PPM
IRIS	20 PPM
Digital	No Alarm

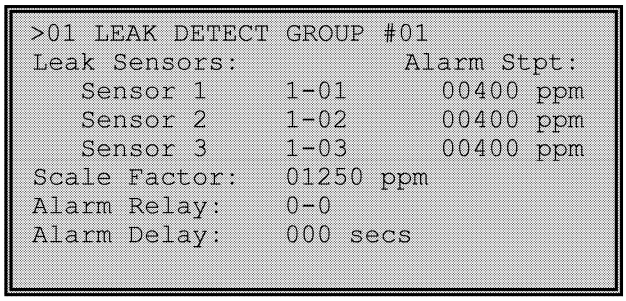
The control software uses a **Scale Factor** to calculate the PPM level from the input data. ECI recommends scale factor settings for each leak sensor input type. They are listed in the table below.

TABLE 23 – SCALE FACTOR/SENSOR

Leak Sensor Type	Recommended Scale Factor
ECI Analog	01250
IRIS	00250
Digital	Not Used

The Alarm Relay de-energizes upon an alarm condition for refrigerant leak. During normal operation, this relay is energized.

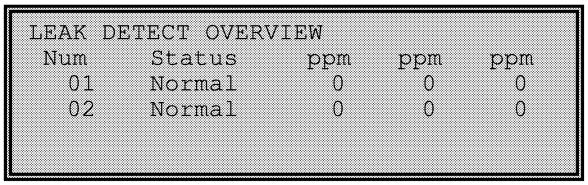
The RC-2000 control software will delay the period before it logs an active leak alarm, changes the state of the alarm relay, and/or dials out the alarm. It is called the Alarm Delay. It has a range of 0-300 seconds.



LEAK DETECT SETPOINTS SCREEN

LEAK DETECT OVERVIEW

The Leak Detect Overview completely overviews all configured systems. For an analog sensor, the leak detector value (PPM) and status (Normal or Alarm) are shown. For a digital sensor, the status (Normal or Alarm) and leak indicator (No Leak or Leaking) are shown.

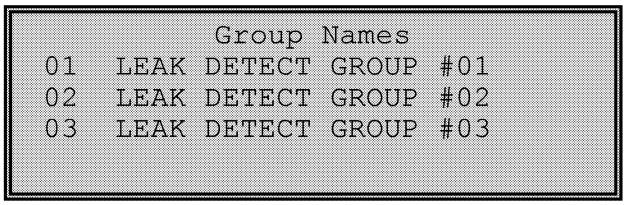


LEAK DETECT OVERVIEW SCREEN

LEAK DETECT GROUP NAMES SCREEN

Assign names for each system here.

NOTE
The assignment should describe the system and indicate the general area of the sensors.

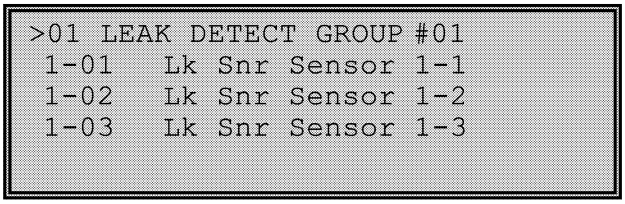


LEAK DETECT GROUP NAMES SCREEN

LEAK DETECT SENSOR NAMES

Assign names for each individual sensor in a system.

NOTE
The name should describe the sensor and indicate its precise location. This will provide for faster location of leaks when alarms occur.



LEAK DETECT SENSOR NAMES SCREEN

LEAK DETECT CONFIGURATION SCREEN

The Leak Detect Configuration Screen allows you to select the number of leak groups and the type of sensor used to detect refrigerant levels within the site.

LEAK SENSOR TYPES

ECI Analog: The ECI Analog Leak Sensor is an electronic leak sensor that connects to a digital input type. The ECI Analog Leak Sensor contains 1-4 leak groups. Three sensors are available in each group. This input will calculate a PPM level using a scale factor that is assigned in the Setpoint Screen.

Digital: The Digital Leak Sensor is an electronic leak sensor that connects to a digital input type. The Digital Leak Sensor contains 1-4 leak groups. Each group has one sensor available. When this input closes, the RC-2000 control software generates a refrigerant leak alarm.

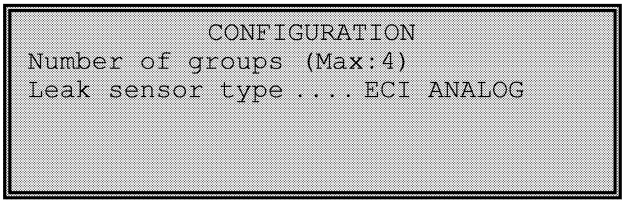
Yokogawa: The Yokogawa Leak Detector may be selected when the RC-2000 Controller is interfacing with the Yokogawa HGM200 gas monitor. The Yokogawa Device contains 1-4 leak groups. The RC-2000 will allocate an Analog Input 8 (SAI8) board for the first group and allocate the boards for the remaining groups in a descending board number sequence (i.e., if three groups are selected, board 8, 7, and 6 will have its analog inputs allocated for Yokogawa inputs).

IRIS: The IRIS Leak Detect option may be selected when the IRIS Device is interfaced with an RC-2000. When selecting IRIS, you may select ONE group. The RC-2000 will allocate eight channels of analog inputs for logging and displaying the IRIS data. This analog input allocation is done by converting the board channel setup for Board 8 to Serial 8 and allocating the 8 analog inputs recognized as board 8 for IRIS inputs.

The IRIS interface uses an RS-232 interface to display and log PPM levels that are reported by the IRIS to the RC-2000. The RC-2000 uses an allocation process to take the PPM levels and store them as if they were an input from a standard serial analog input board (number 8). The user may graph this data by using the same procedure as to graph serial analog input board 8.

NOTE

When configuring for IRIS Leak Detection, make sure that there are not any input assigned to Board 8 prior to configuring for IRIS, as this creates I/O discrepancies within the program.



LEAK DETECT CONFIGURATION SCREEN

LOG MENU

The Log Menu is the Table of Contents to the RC-2000 control software status and performance logs. Select [5] at the Main Menu to enter the Log Menu. An example of this screen appears below.

```
                LOG MENU
1 - Run Time Log  5 - I/O Logs
2 - Note Logs     6 - Override Log
3 - Alarm Log     7 - Power: hourly
4 - Event Log     8 - Power: daily
                  9 - User Access Log
```

LOG MENU SCREEN

RUN TIME LOG MENU SCREEN

Selection [1] on the Log Menu Screen will take you to the Run Time Log Menu. This screen provides access to the actual circuit, rack, and case logs for your system. An example of this screen appears below.

```
        Run Time Log
1 - Circuit Log
2 - Rack Log
3 - Case Log
```

RUN TIME LOG MENU SCREEN

CIRCUIT LOG SCREEN

The Circuit Log Screen displays the number of refrigeration cycles recorded for the following periods:

- from system start-up
- from 00:00:01 a.m. of the current day
- during the previous 24 hour day (00:00:01 to 23:59:59)

With appropriate access, press [ENTER] to reset any of the above fields. An example of this screen appears below.

```
01 CIRCUIT A01
 Total refrigeration cycles      345
 Refrigeration cycles today       10
 Refrigeration cycles yesterday   27
```

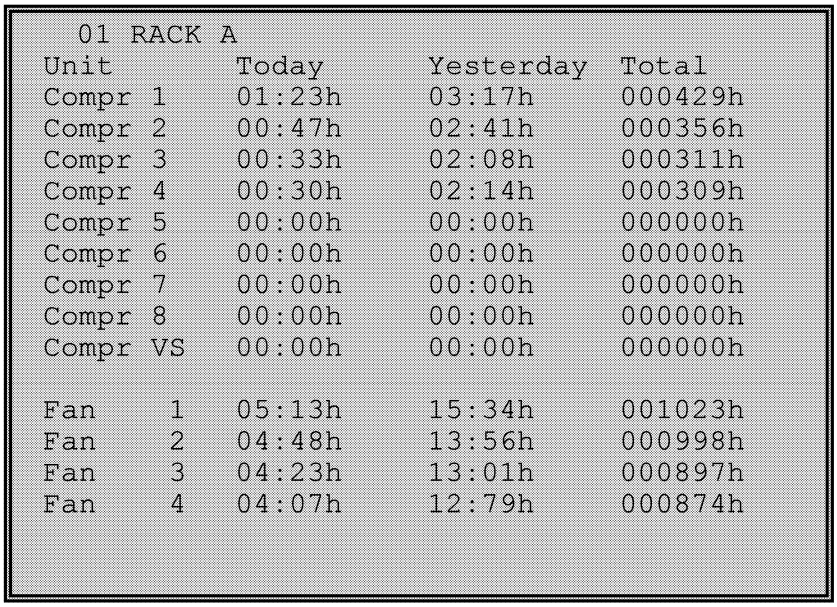
CIRCUIT LOG SCREEN

RACK LOG SCREEN

The Rack Log Screen displays the recorded run-times of refrigeration rack compressors and fans for the following periods:

- from system start-up
- from 00:00:01 a.m. of the current day
- during the previous 24 hour day (00:00:01 to 23:59:59)

With appropriate access, press [ENTER] to reset any of the above fields. An example of this screen appears below.



```
  01 RACK A
Unit       Today      Yesterday  Total
Compr 1    01:23h     03:17h     000429h
Compr 2    00:47h     02:41h     000356h
Compr 3    00:33h     02:08h     000311h
Compr 4    00:30h     02:14h     000309h
Compr 5    00:00h     00:00h     000000h
Compr 6    00:00h     00:00h     000000h
Compr 7    00:00h     00:00h     000000h
Compr 8    00:00h     00:00h     000000h
Compr VS   00:00h     00:00h     000000h

Fan    1   05:13h     15:34h     001023h
Fan    2   04:48h     13:56h     000998h
Fan    3   04:23h     13:01h     000897h
Fan    4   04:07h     12:79h     000874h
```

RACK LOG SCREEN

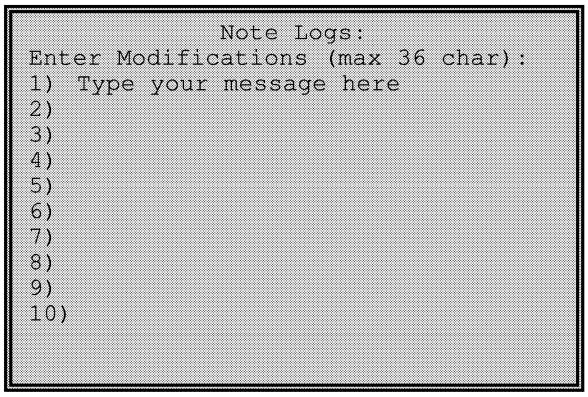
CASE LOG SCREEN

This feature is not implemented at this time.

NOTE LOG SCREEN

The Note Log is selection [2] on the Log Menu. A maximum of ten lines, thirty six alphanumeric characters long can be entered on the Note Log Screen.

Some uses for this feature include recording system information, remotely monitoring changes made, and transferring messages from the remote terminal to the unit.



NOTE LOG SCREEN

ALARM LOG SCREEN

The Alarm Log is selection [3] on the Log Menu. When selected, the Alarm Log Screen lists the date and time of the occurrence, the name of the rack or circuit in alarm, and the type of the alarm for a maximum of fifty recorded system alarms. Table 24 catalogs the alarm types listed on this screen. An example of this screen follows.

IMPORTANT

When an alarm condition is corrected, an updated alarm log entry displays an [OK] message after the alarm type.

TABLE 24 – ALARM LOG TYPES

Alarm Log Type:	Screen Display
High Temperature:	Hi Temp
Low Temperature:	Lo Temp
Sensor Fault:	Sensor Flt
High Suction Pressure:	Hi suct p
Low Suction Pressure:	Lo suct p
Phase Loss:	Phase loss
Run Verify:	Run verify
Liquid Level:	Liq level
Oil Failure:	Oil fail
Dial Failure:	Dial Fail
Oil Pressure:	Oil pres
High Head Pressure:	Hi head p
Low Head Pressure:	Lo head p
Power Failure:	Power fail
Power Up:	Power up

ALARM LOG SCREEN

EVENT LOG SCREEN

The Event Log Screen is selection [4] on the Log Menu. The screen displays recorded system events in the areas of:

- emergency defrost
- defrost skip (dew point)
- clear log (indicates that the I/O logging has been cleared)
- miscellaneous non-alarm events

The system records the date and time, name of the affected rack or circuit, and type for each event. Fifty events (at a maximum) are displayed per screen. An example of this screen appears below.

```
                EVENT LOG
01-03  08:11  CIRCUIT A01   Temp term
01-03  08:00  CIRCUIT A01   Emrg defr
                    **
```

EVENT LOG SCREEN

I/O GRAPHICS

The I/O Graphics Menu is selection [5] from the RC-2000 Log Menu. It is a Table of Contents to the control software input and output logged data. An example of the screen appears below.

```
                I/O Graphics
1 - Analog Inputs      4 - Digital Inputs
2 - Analog Outputs     5 - Case Graph
3 - Digital Outputs
```

I/O GRAPHICS MENU SCREEN

ANALOG INPUTS SCREEN
ANALOG OUTPUTS SCREEN
DIGITAL OUTPUTS SCREEN
DIGITAL INPUTS SCREEN

The Analog Inputs, Analog Outputs, Digital Outputs, and Digital Inputs Screens are a Table of Contents to the data logs in the RC-2000 control software. They contain two choices: Select Board and Display Data. An example of the Analog Inputs Screen appears below.

```
          Analog Inputs
1 - Select Board
2 - Display Data
```

SELECT BOARD SCREEN

This screen shows the data logs of all configured analog/input boards in the system. Enter the board and channel number of the A/I to be graphed. Press [EXIT] and proceed to [Display Data].

```
Board 1              Analog Inputs
Enter the channel number: 01
1-1 unused
1-2 unused
1-3 unused
↓
1-16 unused
```

DISPLAY DATA SCREEN

The data file is displayed on this screen in a graphical format. Its contents are dependent on the logging interval chosen. Use the left and right arrow to scroll back and forth through the data. Press [EXIT] when done viewing the graph.

READ FROM/SAVE TO A FILE

This screen allows you to access and move specific data in the control software. An example of this screen appears below.

```
Data file for 1-1 does not exist
Date: 00/00/00            Time:
00:00:00

Read or Save Tabular Data ? No Action
```

OVERRIDE LOG

The override log keeps track of system overrides. The system logs the following types of overrides: Software (Dig Out), Hardware (Dig Out), and Software (Dig In). They are abbreviated as follows:

- Rly Ovrd – Software (Dig Out)
- Rly Hrd – Hardware (Dig Out)
- DI Ovrd – Software (Dig In)

An example of this screen appears below.

```
 07-06  15:14  Bd: 2   Ch: 5   Rly Ovrd CLR
 07-06  15:12  Bd: 2   Ch: 5   Rly Ovrd ON
 07-06  12:00  Bd: 1   Ch: 4   Rly HRD CLR
 07-06  11:30  Bd: 1   Ch: 4   Rly HRD Ovrd
```

Override Log

POWER: HOURLY LOG SCREEN

The Power: Hourly Log Screen logs the day and time, average kWh for that hour, the PEAK (highest reading logged) and the exact minute it was reached.

```
 1 RACK A            kWh       Peak kW
 Wed Time: 11:00     20         43 kW @ 11:15
 Wed Time: 10:00     40         44 kW @ 10:50
 Wed Time:  9:00     30         42 kW @  9:05
```

Power: Hourly Log Screen

POWER: DAILY LOG SCREEN

The Power: Daily Log Screen logs the date, total kWh for that day, the peak kW reached, and the exact time. An example of the screen appears below.

1 Rack A	kWh	Peak kW
Date: 07-07	434	47 kW @ 01:25
Date: 07-06	930	57 kW @ 18:03
Date: 07-05	1012	61 kW @ 15:50

Power: Daily Log Screen

USER ACCESS LOG

To access the User Access Log, follow this path from the Main Menu:

1. Press [5], Log Menu
2. Press [9], User Access Log

This log maintains a chronological list of user access, and each line shows the user name, the functional group accessed (i.e., rack setpoints, sensor offset, emergency circuit defrost, etc.) as well as the date and time.

NOTE
This screen is accessible only to the "Superuser" or through the ECI backdoor.

DATE	TIME	USER NAME	USAGE RECORD
04-01	21:55	StoreSer	Case Install
04-01	13:59	SuperUsr	System Dial
04-01	10:01	SuperUsr	^Case Install
04-01	09:55	ECIBckDr	^Data Download

*Please Note: [^] represents a change made by remote access.

USER ACCESS LOG SCREEN EXAMPLE

I/O OVERRIDE

The Override Menu is selected from the RC-2000 Main Menu. It is the Table of Contents to the RC-2000's I/O control override functions. Security access is required to override any software-controlled input or output. An example of this screen appears below.

```
          I/O Override
1 - Digital Inputs
2 - Digital Outputs
3 - Sensor Offset
4 - Master Alarm Override
```

DIGITAL INPUT AND OUTPUT OVERRIDE SCREEN

The control software can be programmed to override individual digital inputs and outputs, board-by-board via two screens available through the I/O Override Screen. They are the Digital Input Override Screen and the Digital Output Override Screen. Examples of these screens appear below.

Use the following procedure to **perform OR remove** a soft override.

1. Press [←, →] to navigate to the desired board.
2. Press [ENTER] when you reach the desired board.
3. Press [←, →] to navigate to the desired channel.
4. Press [ENTER] when you reach the desired relay.
5. Press [↑, ↓] to select the override action.

NOTE

The override choices are:

- on
- off
- none

6. Press [ENTER] to activate the override.
7. Press [EXIT] to complete the action.

IMPORTANT

Overrides **MAY ONLY BE REMOVED** by **performing the process** used **to program them.**

Override conditions on/off depend on the load assignment; they are not an indication of an energized or de-energized relay.

```
Board> 1  Digital Inputs
 ovrd    1: none    2: ON      3: none    4: OFF
         5: none    6: none    7: none    8: none
         9: none   10: none   11: none   12: none
        13: ON     14: OFF    15: none   16: none
```

DIGITAL INPUT OVERRIDE SCREEN EXAMPLE

```
Board > 1   Digital Outputs
 ovrd   1: none      2: none      3: none      4: none
        5: none      6: none      7: none      8: none
```

DIGITAL OUTPUT OVERRIDE SCREEN EXAMPLE

SENSOR INPUT OFFSET SCREEN

Via the Sensor Input Offset Screen, add or subtract from data from any sensor, board by board. The calculations are done in the units (indicated at the bottom of screen) that correspond to the type of board. Follow these steps to offset a sensor input.

1. Select the board that contains the sensor.
2. Press [←, →, ↑, ↓] to select the specific input number.
3. Press [ENTER] to program the offset value desired.

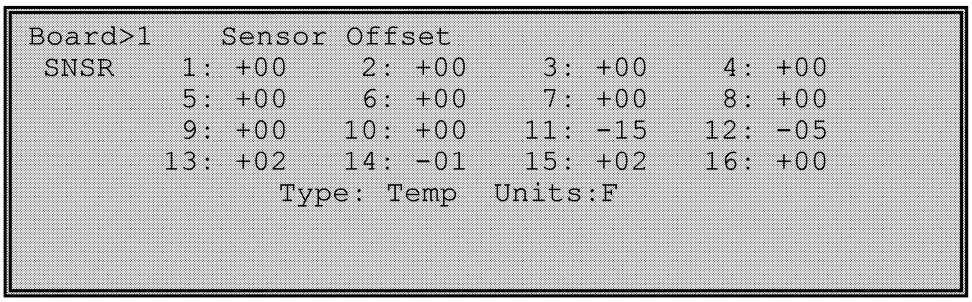
NOTE
Enter [00] as the offset value; this will return a sensor to normal operation.

The bottom of this screen contains a line that indicates the type of board configured (temperature, pressure) and the units that are using the board.

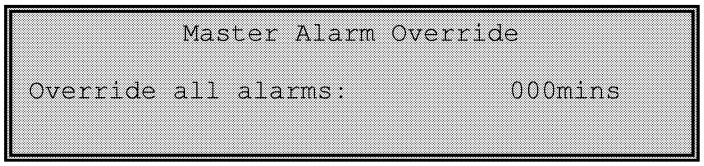
MASTER ALARM OVERRIDE SCREEN

The control software will override all alarms in the system for a programmable period. The override periods are performed via the Master Alarm Override Screen.

NOTE
Entering [999] will put the system in Master Alarm Override. The system will stay in Master Alarm indefinitely until [999] is MANUALLY removed.



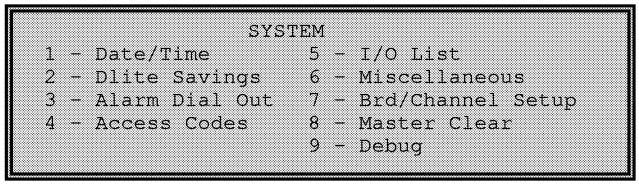
SENSOR INPUT OFFSET SCREEN EXAMPLE



MASTER ALARM OVERRIDE SCREEN

SYSTEM MENU

The System Menu is selected from the RC-2000 Main Menu. It is a Table of Contents to the RC-2000's miscellaneous system configuration and status screens. It is selection [7] on the Main Menu.

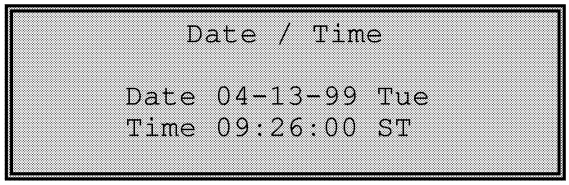


NOTE

Level 1 access is required to program the screens of this menu. A Level 2 access code is required to change or view the access codes screen.

DATE/TIME SELECTION

Selection [1] from the System Menu, Date/Time will display the day of the month, the day of the week, and the time. An example of the menu appears below.

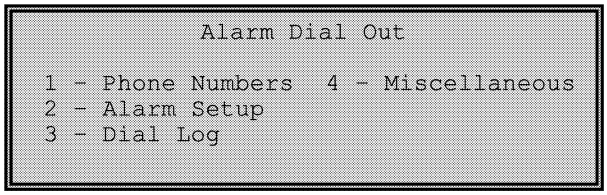


DLITE SAVINGS SELECTION

Selection [2] from the System Menu, Dlite Savings, will display the guidelines for setting standard and daylight time. An example of this screen appears below.

ALARM DIAL OUT SELECTION

The Alarm Dial Out Menu is selection [3] from the System Menu. An example of this screen appears below.



NOTE

Level 1 access is required to program the sub screens on this menu.

PHONE NUMBERS SCREEN

Selection [3] from the System Menu, Phone Numbers, takes you to the Phone Numbers Screen. Here, you may specify alarm dial out phone numbers to be used by the RC-2000. The Dial out System may be split in two. Each System can be configured to dial either group.

During an alarm state, the RC-2000 will attempt to dial out to a remote serial printer, a dumb terminal, or the ECI Smart Alarm. Besides the alarm, a device ID (up to thirty characters long) is transmitted. Press [ENTER] to bring the arrow to the desired display area and enter data.

Dial out dials [Occupied Phone #s] during the occupied schedule times. [Unoccupied Phone #'s] are dialed at all other times or if the occupied schedule stop time for the current day is [00:00].

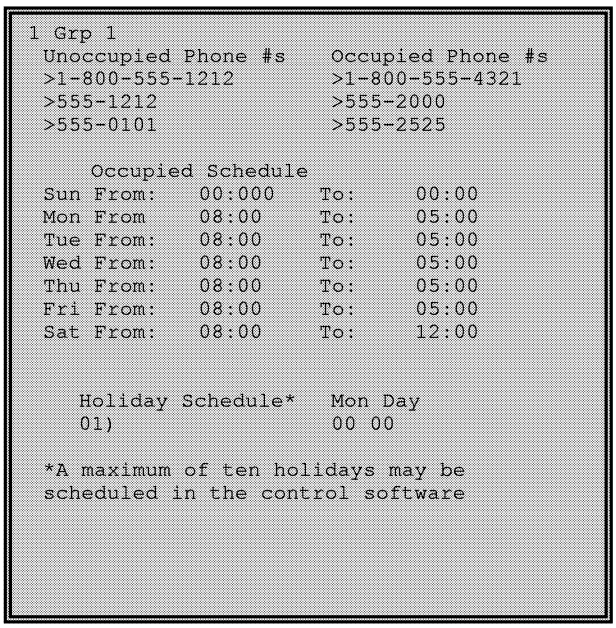
All numbers are dialed regardless of whether the modem answered the previous number. If an alarm occurs and Dial out has not completed before the time changed from occupied to unoccupied, Dial out will stop trying to call the unoccupied numbers and start calling the first occupied number. If a new alarm occurs during a dial out sequence, the RC-2000 will add the new alarm to the numbers left to be dialed out and then redial any numbers that did not receive the new alarm.

Dial out is effectively disabled if there is not a valid phone number in the list for the specified time of day. Phone numbers must be entered in order starting at the top of each list. All numbers must be left justified.

The maximum amount of 'on' time in any given day is twenty four hours. Keep in mind that the RC-2000 uses military time (e.g., 04:00 = 4:00 a.m., 16:00 – 4 p.m.)

IMPORTANT

If a start time equals a stop time, nothing will happen. 00:00 is a valid start time, but not a valid stop time.



ALARM SETUP MENU

The Alarm Setup selection on the Alarm Dial out Menu is choice [2]. Once accessed, you may select the alarm type that will initiate an alarm dial out sequence. Enter [the desired field] to proceed to each system on the RC-2000.

```
          Alarm Setup
 1 - Circuit   4 - Leak Sensor
 2 - Case      5 - Logic Statement
 3 - Rack      6 - System
```

NOTE

On the alarm setup instructions, if LOCAL is selected, the alarm will be sent locally in the store to a dumb terminal or Smart Alarm. For reliable operation, the Smart Alarm requires the Smart Alarm parameter be setup on the RC-2000. An example of this menu appears below.

CIRCUIT ALARM SETUP

The first line on this screen shows the circuit name. Each configured circuit has a dial out screen. To move between circuits, use the arrow keys.

Dial out selections include:

- **Local:** enables a locally connected dumb terminal or smart alarm
- **Group 1 and Group 2:** enables or disables the phone numbers and time of day schedule for Group 1 and Group 2, respectively
- **Delay:** is a delay before the alarm is dialed out

NOTE

If Grp1 and Grp 2 are not being used, the [Delay] fields will show N/A.

High or Low Temperature: the circuit's high or low temp alarms.
Valve Verify: the circuit valve verification alarm.
Bad Sensor: a sensor has failed alarm.
OK (Cleared): the OK indication that an alarm is cleared.

```
>24' Ice Cream Doors
 Alarm Type        Local   Grp1    Grp2    Delay
 ------------      -----   -----   -----   -----
 High Temperature  NO      YES     YES     001m
 Low Temperature   NO      YES     NO      001m
 Valve Verify      NO      YES     NO      001m
 Bad Sensor        NO      YES     NO      001m
 OK (Cleared)      NO      YES     NO      001m
```

Circuit Alarm Setup Screen

CASE ALARM SETUP

The dial out parameters may be set up by each individual case. The first line shows the Case name; each configured case has an alarm setup screen. Use the right and left arrows to navigate through the circuits. The dial out selections are listed below:

1. **Local:** enables a locally connected dumb terminal or smart alarm.
2. **Group 1(Grp 1):** enables or disables the phone numbers and time of day schedule for Group 2.
3. **Delay:** a delay before the alarm is dialed out.

NOTE
If the Grp 1 and Grp 2 fields are not being used, the Delay fields will show [N/A].

The alarm functions are as follows:

- **High or Low Temperature Alarms:** the Case high or low temperature alarms
- **Offline:** a case control has lost communication with the RC-2000.
- **Intlk Open:** the interlock switch (typically a door switch or case cleaning switch) has been open too long.
- **Evap Sensor:** the Refrigeration In or Refrigeration Out sensor has failed.
- **OK (Cleared):** the OK indication that an alarm is cleared.

```
                >1 24' Ice Cream Doors
   Alarm type      Local     Grp1      Grp2     Delay
 ---------------   -----     -----     -----    -----
        -
 High                NO       YES       NO      001m
 Temperature
 Low Temperature     NO       YES       NO      001m
 Offline             NO       YES       NO
 Intlk Open          NO       YES       NO
 Evap Sensor         NO       YES       NO
 OK (Cleared)        NO       YES       NO      001m
```

Case Alarm Setup Screen Example

RACK ALARM SETUP SCREEN

The first line shows the rack name. Each configured rack contains an alarm setup screen. Use the arrow keys to navigate through the screens. The dial out selections are:

1. **Local:** enables a locally connected dumb terminal or smart alarm
2. **Group 1 (Grp 1):** enables or disables the phone numbers and time of day schedule for Group 1
3. **Group 2 (Grp 2):** enables or disables the phone numbers and time of day schedule for Group2
4. **Delay:** a delay before the alarm is dialed out. If Group 1 and Group 2 are not being used; the Delay Fields will show [N/A].

Delay is not applicable with the Local selection.

High Pressure or Low Pressure Alarms: High and low pressure alarms.

Run Verify Alarms: Compressor and condenser fan run verify alarms.

Miscellaneous Alarms: Phase Loss, Low Liquid Level and Oil Pressure Alarms.

LON Network: Alarms from Danfoss Inverters and ESC-200 Bitzer Screw Modules

```
>01 Medium Temp Rack
 Alarm Type     Local   Grp1     Grp2     Delay
 ------------   -----   -----    -----    -----
 High           NO      YES      YES      001m
 Pressure
 Low Pressure   NO      NO       YES      001m
 Run Verify     NO      YES      NO       001m
 Miscellaneou   NO      YES      NO       001m
 s
 LON Network    NO      YES      NO       001m
 OK (Cleared)   NO      NO       NO
```

Rack Alarm Setup Screen Example

LEAK DETECT ALARM SETUP

The Leak Detect Alarm Setup Screen is only one page. The leak detect name is found under the Name selection. This screen allows setup of the dial out parameters by each individual leak detect group. The dial out selections are listed below:

1. **Local:** enables a locally connected dumb terminal or smart alarm
2. **Group 1 (Grp 1):** enables or disables the phone numbers and time of day schedule for Group 1
3. **Group 2 (Grp 2):** enables or disables the phone numbers and time of day schedule for Group 2
4. **Delay:** a delay before the alarm is dialed out.

NOTE

If Grp 1 and Grp 2 are not being used, the Delay fields will show [N/A]. This delay does not apply to local.

Since there is only one type of alarm generated by the leak detect groups, each group is only configurable for the local and phone number groups.

OK (Cleared) Indication: the OK indication that an alarm is cleared.

```
              Leak Detect
      Name          Local   Grp1    Grp2    Delay
---------------     -----   -----   -----   -----
Compressor Room     NO      YES     NO      001m
Refrig Pit          NO      YES     NO      001m
                      - - - - - - - - - -
OK (Cleared)        NO      YES     NO
```

Leak Detect Alarm Setup Screen Example

LOGIC STATEMENTS ALARM SETUP

The Logic Statements Alarm Setup Screen consists of one page. This screen allows setup of the dial out parameters by each logic statement group. The description under [Name] shows the logic statement name. Dial out has four categories. They are defined as follows:

1. **Local:** enables a locally connected dumb terminal or dumb terminal
2. **Group 1 (Grp 1):** enables or disables the phone numbers and time of day schedule for Group 1
3. **Group 2 (Grp 2):** enables or disables the phone numbers and time of day schedule for Group 2
4. **Delay:** a time delay before the alarm is dialed out.

NOTE

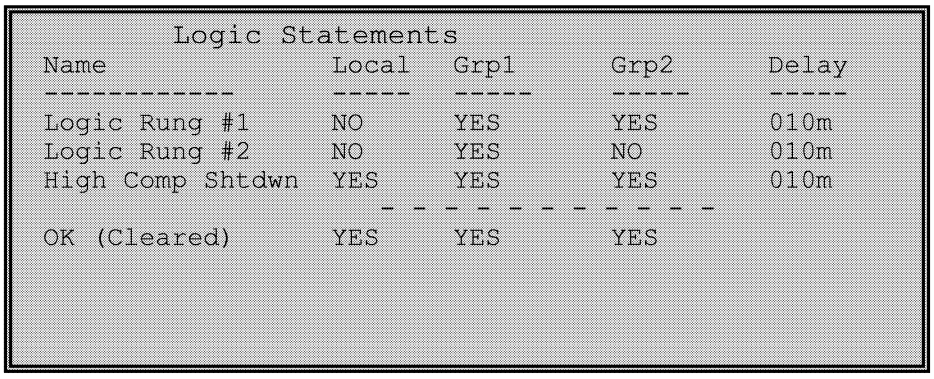
If Group 1 (Grp 1) and Group 2 (Grp 2) are not being used, the Delay fields will show [N/A].

This delay does not apply to local.

If the logic statement is not configured for alarming from the setpoint screen, all these fields will show [N/A].

Since there is only one type of alarm generated by the logic statement groups, each group is only configurable for the local and phone number groups.

OK (Cleared) Indication: the OK indication that an alarm is cleared.



Logic Statements Alarm Setup

SYSTEM ALARM SETUP

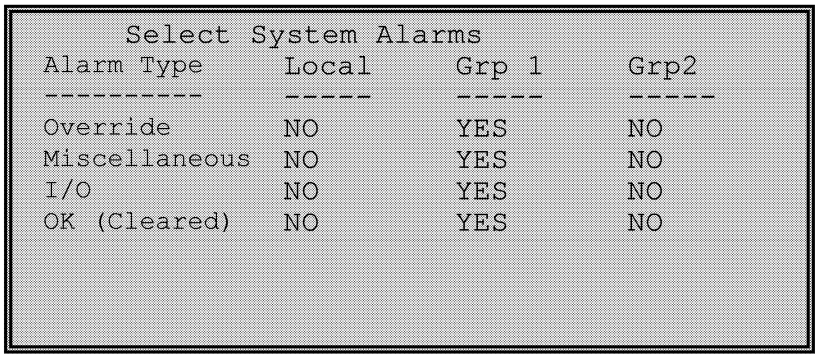
The System Alarm Setup screen allows setup of system related alarms for dial out. Each category can be set up for local and dial out phone number groups. The control software will alert you to the following alarm conditions:

Override: any override condition (either hard or soft)

Miscellaneous: power up, power fail, low battery and master clear alarm conditions

I/O: Input or output board offline

OK (Cleared): the OK indication that an alarm is cleared



Select System Alarms

Alarm Type	Local	Grp 1	Grp2
Override	NO	YES	NO
Miscellaneous	NO	YES	NO
I/O	NO	YES	NO
OK (Cleared)	NO	YES	NO

System Alarm Setup Screen

DIAL LOG

This screen shows a list of all dial out attempts (successful and unsuccessful). This should provide a check that alarms have been sent and to which numbers. If there are failures, the source of the problem can be tracked by this log.

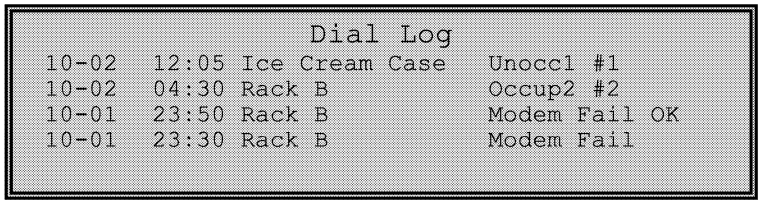
Each line of the log will show the date and time the dial out occurred, the alarm source (rack, circuit, logic statement), the phone number associated with that alarm type, and which group it was set up under. The RC-2000 will try each number five times before noting a failure.

Modem Fail indicates the modem at the RC-2000 failed to call out (i.e., phone line bad or modem problem).

Dial Fail indicates the modem dial out but did not get a correct answer (i.e., busy signal or remote printer modem failure).

Table 25 – Dial Log Listings

Unocc1 #1	The first unoccupied number in Group 1.
Unocc2 #1	The second unoccupied number in Group 1
Unocc3 #1	The third unoccupied number in Group 1
Unocc1 #2	The first unoccupied number in Group 2
Unocc2 #2	The second unoccupied number in Group 2
Unocc3 #2	The third unoccupied number in Group 2
Occup1 #1	The first occupied number in Group 1
Occup2 #1	The second occupied number in Group 1
Occup3 #1	The third occupied number in Group 1
Occup1 #2	The first occupied number in Group 2
Occup2 #2	The second occupied number in Group 2
Occup3 #2	The third occupied number in Group 2



Dial Log Screen
Required Access Level: None

MISCELLANEOUS SCREEN

The Miscellaneous Screen allows data entry of miscellaneous alarm related parameters.

The first line is the user defined **[Device ID]**. The Device ID is a user defined description that will dial out with any alarm. It typically includes the store location and number.

The next line is the **Dial Test Choice**. Use the up arrow to scroll through the options Local, Grp1, and Grp2 to send an immediate alarm dial out test.

The **Retry Dialing In** (0-24 hrs) line serves the following purpose: If the unit detects a dial fail or modem fail, it will try to dial out after this period is up.

The **Time Between Dialing** line is used to set a time delay between dialing alarms when a modem error is encountered. The unit will wait this period before attempting to redial an alarm.

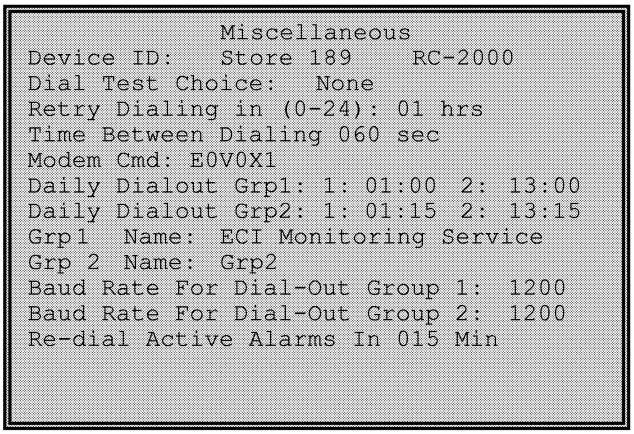
The **Modem Cmd** line allows entry for a modem string depending on the type of modem used for dial out.

The **Daily Dial Out Grp1 and Grp2** allows for two daily dial out tests per group.

The **Grp1 and Grp2 Name** is a user defined name that will display in the phone number section to identify the outgoing dial outs.

The **Baud Rate** for **Dial Out Group 1 and 2** is a setting that reflects the baud rate or the modem on the receiving end of the dial out. Use the up arrow to toggle through different options (300, 1200, 2400, and 9600 baud).

The **Re-dial Active Alarms In** is the period the unit will wait to re-dial alarms that have not cleared. To disable this function set the field to 00 minutes.



Miscellaneous Screen Example
Required Access Level: None

ALARM MONITORING PRINTER AND DUMB TERMINAL SETUP

Use the following settings for a remote alarm monitoring printer or dumb terminal:

1. Serial Interface
2. 8 data bits
3. 1 stop bit
4. No parity
5. Baud rate set the same as the RC-2000

The setup string for alarm monitoring modems varies according to the baud rate setting. They are listed below.

NOTE
The [0] in the setup strings that follow is a zero.

TABLE 26 – ALARM MONITORING MODEM SETUP STRINGS VIA BAUD RATE

Baud Rate	Modem Setup String
1200	AT&K0&Q6&C1E0Q1S10=5S37=5N0S0=1&W
2400	AT&K0&Q6&C1E0Q1S10=5S37=6N0S0=1&W
300	AT&K0&Q6&C1E0Q1S10=5S37=3N0S0=1&W

ACCESS CODES SELECTION

The Access Code Selection consists of the following:

1. A single line for "Superuser" access.
2. Multiple lines for additional users.

To access the screen, follow this path from the Main Menu:

1. Press [7], System
2. Press [4], Access Codes

The Access Code Screen will appear, and you will be able to view system users by name and password.

IMPORTANT

This screen can only be viewed and cleared by the "Superuser" or through the ECI backdoor. The User Access screen will record an entry for the user who cleared the log.

ACCESS CODES

NAME	PASSWORD
Superusr	5678
Manager	6789
StoreSer	7890
ECIServ	1111

Access Code Screen Example

I/O LIST SELECTION

The I/O List Menu Screen is selection [5] of the System Menu. It is a Table of Contents to the RC-2000's I/O List Screens. These screens provide a board-by-board I/O map detailing all current RC-2000 relay, analog output, sensor, and input assignments.

```
                I/O LIST MENU
 1 - Analog Inputs    4 - Digital Outputs
 2 - Analog Outputs   5 - Board Status
 3 - Digital Inputs
```

I/O List Menu Screen Example

ANALOG INPUTS LIST SCREEN

The Analog Inputs List Screen shows the RC-2000 temperature and pressure sensor assignments. The board number and the screen title are displayed on the title line. The data lines describe:

- the sensor board-channel number,
- the number of logical inputs to which the sensor is assigned,
- the sensor type,
- the user-defined sensor name, and
- the 'raw counts' reading from the input module.

A maximum of eight Analog Input Boards may be assigned. Each input assignment will support a maximum of sixteen channels. An example of this screen appears below.

```
Board>1   Analog Inputs
 1-1    1 Lo-P   Suct Press 1-1   102
 1-2    1 Hi-P   Head Press 1-2   224
 1-3    unused
 1-4    unused
 1-5    unused
 1-6    unused
 1-7    unused
 1-8    unused
 1-9    unused
 1-10   unused
 1-11   unused
 1-12   unused
 1-13   unused
 1-14   unused
 1-15   unused
 1-16   unused
```

Analog Inputs List Screen Example

ANALOG OUTPUTS LIST SCREEN

The Analog Outputs List Screen shows the RC-2000 variable-speed compressor control assignments. The title line consists of the board number and the screen title.

Each data line describes a control output as follows:

- board-channel number
- the output type
- the user-defined name of the associated compressor rack

Each unit will support a maximum of eight analog outputs. Each analog output consists of four channels. An example of this screen appears below.

```
Board>1   Analog Outputs
 1-1 Comprsr speed    VARUNIT RACK A
 1-2 Comprsr speed    VARUNIT RACK B
 1-3 Comprsr speed    VARUNIT RACK C
 1-4 Comprsr speed    VARUNIT RACK D
```

Analog Outputs List Screen Example

DIGITAL INPUTS LIST SCREEN

The Digital Inputs List Screen shows the RC-2000 digital input assignments. The title line consists of the board number and the screen title. Each data line describes a digital input by:

- board-channel number
- the input type
- the user-defined name of the associated circuit or rack
- the current state of the input (0 = open, 1 = closed).

```
Board>1    Digital Inputs
 1-1     Defrost init        CIRCUIT A01     0
 1-2     Defrost term        CIRCUIT A01     1
 1-3     Aux setpoints       RACK A          0
 1-4     Phase ok            RACK A          1
 1-5     Liquid level        RACK A          1
 1-6     Defrost input       RACK A          0
 1-7     Oil Pressure        RACK A          0
 1-8     Comprsr 1           RACK A          1
 1-9     unused
 1-10    unused
 1-11    unused
 1-12    unused
 1-13    unused
 1-14    unused
 1-15    unused
 1-16    unused
```

Digital Inputs List Screen Example

DIGITAL OUTPUTS LIST SCREEN

The Digital Outputs List Screen shows the RC-2000 relay assignments. The title line shows the board number.

Each relay is described by

- channel number
- the number of times the relay is assigned in the program
- the type of output to which the relay is assigned
- the user-defined name of the rack or circuit associated with the relay
- the number of times the relay is being called on
- the polarity of the relay for energized on (EON) or energized off (EOFF).

```
Board>1     Digital Outputs
 1-1 1 Compr 1   RACK A                EOFF 1
 1-2 1 Compr 2   RACK A                EOFF 1
 1-3 1 Compr 3   RACK A                EOFF 1
 1-4 1 Compr 4   RACK A                EOFF 1
 1-5 1 Compr 5   RACK A                EOFF 1
 1-6 1 Compr 6   RACK A                EOFF 1
 1-7 1 Compr 7   RACK A                EOFF 1
 1-8 1 Compr 8   RACK A                EOFF 1
```

Digital Outputs List Screen Example

BOARD STATUS SCREEN

The Board Status Screen (see below) in the RC-2000 will help troubleshoot any serial communication problems. The RC-2000 scans each serial module for correct communication and shows the status of the serial modules connected to the RC-2000. This screen displays the following status messages:

- On Line
- Off Line
- Unused
- Need Cnfg
- Checksum

On Line indicates the module is responding correctly.

Off Line indicates the module is assigned in the setpoints, but is not responding.

Unused indicates the module is not assigned in the setpoints program.

Need Cnfg indicates a board is assigned as one type, but the hardware is configured for another.

Checksum indicates that the board assigned is communicating with a lot of errors.

This status data will aid in troubleshooting serial communication, and help you identify specific board problems.

For example,

The Board Status screen will display a "**NeedCnfg**" message if a board is assigned as one type but the hardware is configured for another.

It will also display a **checksum** message if the board assigned is communicating with a lot of errors. (This is possibly caused by high voltage.)

To access this screen from the Banner Screen:

1. Press [ENTER].
2. Press [YOUR LEVEL 2 ACCESS CODE], or [ENTER] again.
3. Press [7] (System).
4. Press [5] (I/O List).
5. Press [5] (Board Status).

```
                  Board Status

 Anlg In     Dig In      Anlg Out    Dig Out

 1 On Line   OffLine     Unused      On Line
 2 On Line   Unused      Unused      On Line
 3 Off Line  Unused      Unused      OffLine
 4 Unused    Unused      Unused      Unused
 5 Unused    Unused      Unused      Unused
 6 Unused    Unused      Unused      Unused
 7 Unused    Unused      Unused      Unused
 8 Unused    Unused      Unused      Unused
```

Board Status Screen Example

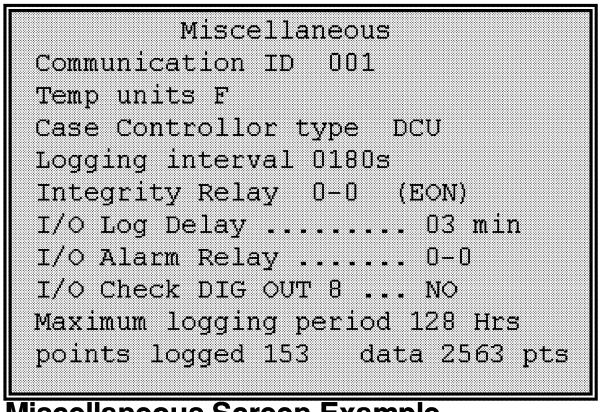
MISCELLANEOUS SELECTION

The Miscellaneous selection allows you to enter data for miscellaneous alarm-related parameters.

The first line is the User ID; the User ID can be a maximum of thirty alphanumeric characters.

The parameters shown consist of the following:

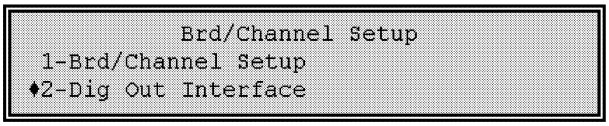
1. **Communication ID:** (a numeric means of unit identification)
2. **Temperature Units F:** (displays measured temperature units in Fahrenheit)
3. **Case Controller Type:** (specifies case controller type used, the Distributed Control Unit is the ECI Electronic Case Controller)
4. **Logging Interval:** measured in seconds; the RC-2000 will dial each number five times before noting a failure. If a number fails, the RC-2000 will continue to the next number. If the number fails five times, it is logged as a failure.
5. **Integrity Relay:** a relay that is always energized if the RC-2000 has a program (configuration). If the RC-2000 fails and loses its program, the relay will de-energize. Controls switch back in racks by connecting the switch backs circuit to the normally closed position.
6. **I/O Log Delay:** a time delay that must expire before offline input or output boards log an alarm.
7. **I/O Alarm Relay:** a digital output that will de-energize if an input of output board go offline.
8. **I/O Check Dig Out 8:** setting this field to NO will disable the offline check for digital output board 8. Used for reference relays in logic statements that don't physically exist.
9. **Maximum Logging Period:** dependent on the logging interval, reflects the number of hours the RC-2000 will log for each point.
10. **Points Logged**
11. **Data Points:** the total number of intervals logged. Dependent on the logging interval.



Miscellaneous Screen Example

BOARD CHANNEL SETUP

The Board/Channel Setup is selection [7] on the System Menu. The System Menu is selection [7] on the Main Menu. The Board/Channel Setup Screen contains two selections: Board/Channel Setup, and Dig Out Interface. They allow you to configure input and output boards at the control software. An example of this screen appears below.



Board Channel Setup Menu Screen Example

BOARD/CHANNEL SETUP SCREEN

Input boards may be manually configured at the Board/Channel Setup selection.

The first line displays the input board number. The left and right arrow keys can be used to toggle through the board numbers, or the number can be entered with the numeric keypad.

Board type selections follow; they may be toggled between:

- Universal 16 Channel
- Serial 8 Channel

IMPORTANT

If 16 Channel Boards are used in the 8 Channel Mode, set the boards for the 8 Channel mode.

The next group of fields allows you to configure each channel on a 16 channel board.

NOTE

With [Serial 8 Channel] board type, the configuration for Channel 1 also applies to Channels 2 through 8, and Channels 9 through 16 will display [N/A] under the Mode column.

With [Universal 16 Channel] board type, each channel mode (1-16) can be set individually.

The control software supports seven mode types for the Universal 16 Channel mode. They are listed in Table 27 below.

TABLE 27 – UNIVERSAL 16 CHANNEL MODE TYPES SUPPORTED BY THE RC-2000 CONTROL SOFTWARE

Mode Type	Usage Information
TP1	Use this mode when a TP-1 temperature sensor is attached to the channel. This is the default mode.
TP1H	Use this mode to read TP-1H high temperature sensors.
TP2	Use this mode to read TP-2 low temperature sensors.
TP2H	Use this mode to read TP-2H high temperature sensors.
10V	Use this mode to read sensors with a 0-10V output.
1-6V	Use this mode to read SA-100 or SA-500 pressure sensors. This mode is also used for liquid level transducers with a 1-6V output.
DigIn	Use this mode to configure the channel for a digital input.

IMPORTANT

The 16 Channel Input Boards are also configured by on-board jumpers. **IF THE JUMPERS ARE SET INCORRECTLY, THE CHANNEL READING WILL BE INACCURATE.** Consult the 16 Channel Board section in the *RC-2000 Installation Manual*, ECI Form # 4464402700 for 16 Channel Input Board jumper configuration instructions.

RC-2000 DIGITAL OUTPUT CONFIGURATION PROGRAMMING

The RC-2000 must be configured to address network or serial digital output boards. Version 4.50 and higher (of the RC-2000 software) is equipped with the following Setup screen:

To access the Dig Out Interface screen, follow this path:

1. Enter [YOUR ACCESS CODE] into the Main Menu.
2. Press [7], System.
3. Press [7], Board/Channel Setup.
4. Press [2], Dig-Out Interface.

The screen below appears.

```
            DIG OUT INTERACE
Dig Out      Interface   Network Node
Board        Type
1            Network     001
2            Network     001
3            Network     001
4            Network     001
5            Network     001
6            Serial      n/a
7            Serial      n/a
8            Serial      n/a
9            NotUsed     n/a
A            NotUsed     n/a
B            NotUsed     n/a
C            NotUsed     n/a
D            NotUsed     n/a
E            NotUsed     n/a
F            NotUsed     n/a
```

Dig Out Interface Screen Example/
RC-2000 Control Software Version 4.50 Device Initialization

RC-2000 DIG OUT INTERFACE SCREEN EXPLANATION

Interface Type: Select the interface type for each Dig Out Board here.

Network Node: Defaults to n/a unless Network is selected for interface type. Then, it reverts to 001.

NOTE: Network node is a user-selectable setpoint. For example, each "Network" KWIC Echelon Assembly with an Engine Board must be connected to the RC-2000 controller. (The selectable range is 001-007).

NOTE

Serial is the default interface type on the Dig Out Interface Screen. Echelon Network Boards such as the Kysor Warren KWIC Module must be selected for network. Change your selection to network for the corresponding network boards.

IMPORTANT

If the Dig Out Interface Screen is set up incorrectly for network or serial boards, you may experience inconsistent communication with KWIC Modules and Relay Boards.

MASTER CLEAR SCREEN

The Master Clear Screen allows a CPU soft reset, alarm log reset, or a master clear from the keypad. Press [ENTER] to activate the master clear choices, navigate through them via the [↑ or ↓] to select one of the following:

- **Reset CPU:** Resets the CPU as if power was turned off and back on again.
- **Clear Alarm:** Erases the contents of the alarm log and the event log.
- **Master Clear:** Clears all the memory; restores default parameters.
- **No action**
- **Clear DialQ:** Clears any alarms waiting to dial out.

Upon selection, press [ENTER] to perform the action. Exit the screen; the action will occur within a few seconds.

MASTER CLEAR EXPLANATION

Corrupt data (i.e., scrambled sensor names, strange characters such as ♦: >*) will cause your RC-2000 system to malfunction. If this happens, your system has a Master Clear function. Perform a Master Clear if your data is corrupted.

IMPORTANT
The Master Clear function DESTROYS all existing data in RAM. Use the Master Clear function as a last resort.

MASTER CLEAR PROCEDURE

Follow the ten steps listed below to perform a Master Clear of your data in RAM.

1. Press [ENTER] from the Banner Screen.
2. Press [your Level 2 Access Code] to access the Main Menu.
3. Press [7] (System).
4. Press [8] (Master Clear).
5. Press [ENTER], the screen will display a "→ No Action" message.
6. Press [ENTER] again. The "N" will start to blink.
7. Press the [↑ or ↓] arrow until "Master Clear" appears.
8. Press [ENTER] when you reach "Master Clear" to confirm your choice.
9. Press [EXIT].
10. Wait a few seconds for your RC-2000 to Master Clear.

EEPROM DATA RETRIEVAL

The RC-2000 automatically backs up all setpoints in EEPROM. Automatic saves occur when you make changes to setpoints and then exit to the Banner Screen.

EEPROM DATA RESTORATION

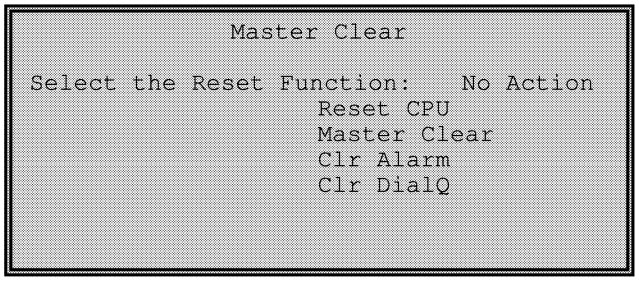
To restore the setpoints saved in EEPROM after a Master Clear, follow these steps:

1. Go to the Master Clear screen. (For the path to this screen, see the "Master Clear Procedure" steps listed previously in this section.)
2. Press the [↑ or ↓] arrow until you reach "Reset CPU."
3. Press [ENTER] to confirm your choice.
4. Press [EXIT].
5. Wait a few seconds for your RC-2000 to reset. All setpoints will be restored.
6. The Banner screen will display "Retrieving Setpoints From Flash."

EEPROM DATA DESTRUCTION

To destroy the setpoints saved in EEPROM (for a complete clear) after a Master Clear, follow these steps:

1. Enter [your Level 2 access code].
2. Press [2] (Racks).
3. Press [6] (Configuration).
4. Press [ENTER] two times.
5. Press [EXIT] to the Banner Screen.



Master Clear Screen Example

DEBUG SELECTION

Selection [9] of the System Menu is the Debug Selection. Select Debug to access the Debug Menu.

DEBUG FEATURE

The Debug feature will also help you track down a problem I/O Board.

To use the Debug feature:

1. Press [ENTER] from the Banner Screen.
2. Press [YOUR LEVEL 2 ACCESS CODE].
3. Press [7] (System).
4. Press [9] (Debug).

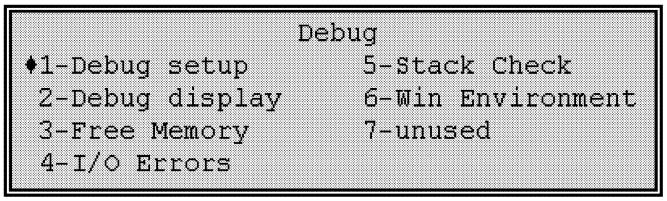
The Debug Menu will appear.

An example of the Debug Menu appears below.

IMPORTANT

The Debug Selection provides high level debugging for ECI Engineering. Much of the selections are not intended for everyday use. They include:

- 1 – Debug setup
- 2 – Debug display
- 3 – Free Memory
- 5 – Stack Check
- 6 – Win Environment



Debug Menu Screen Example

I/O ERRORS MENU

I/O ERRORS SCREEN

This screen is choice 4 of the Debug Menu. This screen will also help you troubleshoot serial module communication problems in your RC-2000. It lists each board with the number of communication errors. A high error count may lead you to the problem I/O Board.

NOTE
To access this screen you need a Level 2 access code.

To access the I/O Errors Screen, follow the path listed for the Debug Menu. Once you are in the Debug Menu:

1. Press [4] (I/O Errors).

```
                I/O Errors

      Reset error ? NO

   Anlg In   Dig In    Anlg Out  Dig Out

01 000       000       000       000
02 000       000       000       000
03 000       000       000       000
04 000       000       000       000
05 000       000       000       000
06 000       000       000       000
07 000       000       000       000
08 000       000       000       000
09 000       000       000       000
```

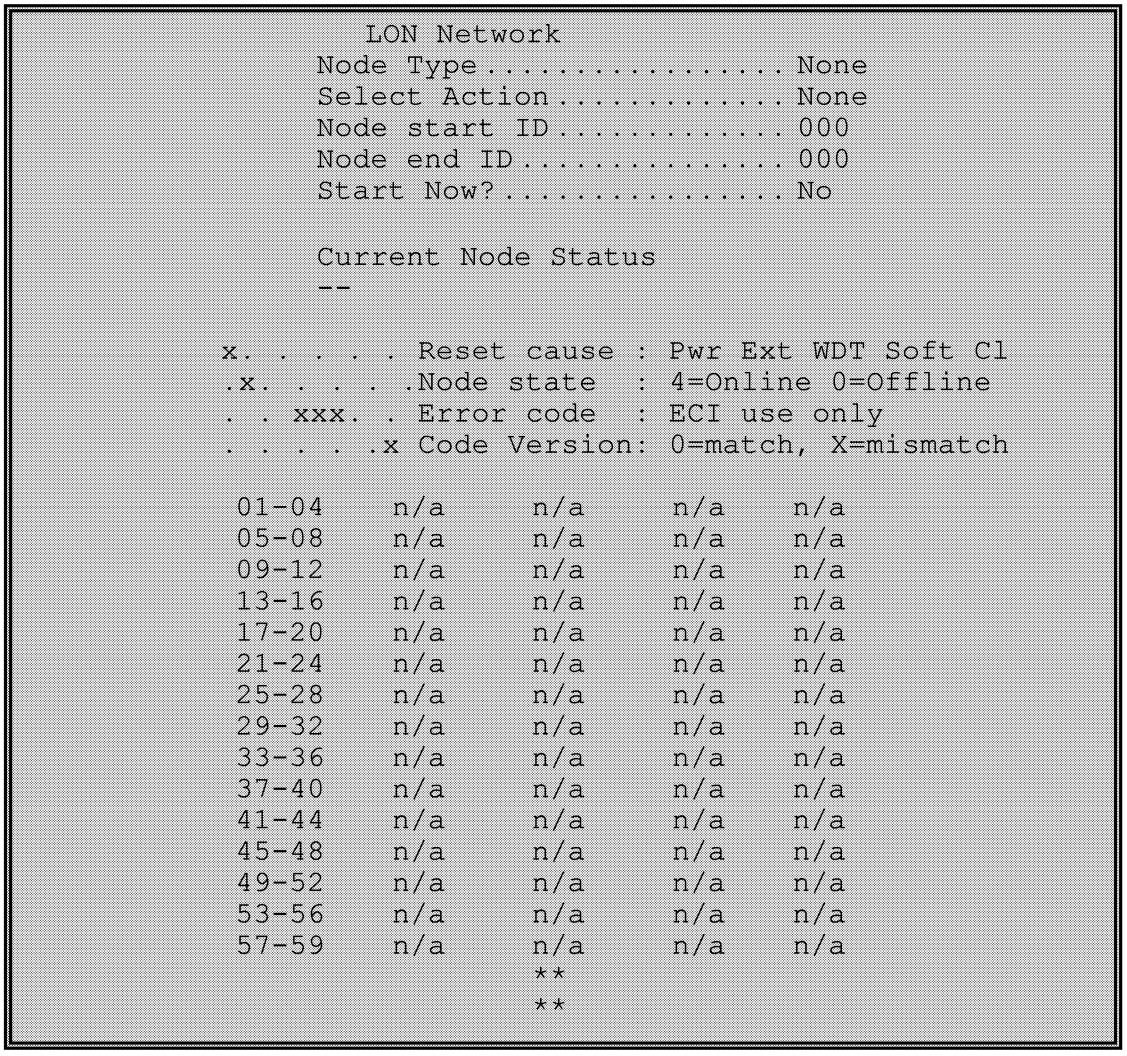
I/O ERRORS SCREEN EXAMPLE

RC-2000 LON NETWORK SCREEN

RC-2000 Version 4.40 and higher Control Software includes all Echelon devices in the LON Network Screen. With the addition of the LON Network Screen, the RC-2000 is able to centrally manage the Echelon Devices that interface with it.

To access the LON Network Screen, follow this path:

1. Enter [YOUR ACCESS CODE] into the RC-2000.
2. Press [8], LON Network.
3. The LON Network screen appears. (An example of this screen appears below.)



RC-2000 LON NETWORK SCREEN EXAMPLE

RC-2000 ECHELON DEVICE INTERFACE ACTIONS

The RC-2000 Versions 4.40 and higher Control Software programs centralize the Echelon Device Interfaces in the LON Network Screen, where they interface with the RC-2000. Versions 4.40 and higher require that you identify the Echelon Device interface types under "Node Type." The options are listed in Table 28 below. Table 29 lists the device actions.

NOTE
The actions listed in Table 29 are LON functions.

TABLE 28 - NODE TYPE OPTIONS/RC-2000 VERSIONS 4.40 and HIGHER

Node Type Selection	Maximum per RC-2000	Description of Node Type
Case Contr	59	ECI Distributed Control Unit (DCU)/Hill Phoenix Degree Master™[1]* running case control application code.
KW Contr	7	Kysor Warren Interface Control (KWIC) Device/ Echelon Assembly
Danfoss Inv	8	Echelon interface to Danfoss Inverters, VLT Series 3000 and higher
ESC	8	ESC-200 Module used for Bitzer Screw Compressors. Must be Version 2.90 or higher
***NOTE:** RC-2000 Version 4.60 or higher Control Software is required to interface with the Hill Phoenix Degree Master.		

TABLE 29 – ECHELON COMMUNICATION DEVICES AND THEIR CONTROL ACTIONS VIA THE LON NETWORK SCREEN/RC-2000 VERSIONS 4.40 and HIGHER

*Case Controllers***	*ESC-200 Module, Version 2.90 (or higher)*	*Danfoss Inverter, VLT Series 3000 and higher*	*Kysor//Warren Interface Control Device*
1. Check Node*	1. Check Node*	1. Check Node*	1. Check Node*
2. Install Node	2. Install Node	2. Install Node	2. Install Node
3. Remove Node	3. Config Node	3. Config Node	3. Remove Node
4. Install code	4. Show Node Ver*	4. Show Node Ver*	4. Config Node
5. Setpt RC → Node			5. Show Node Ver*
6. Setpt Node → RC			
7. Show Node Ver*			

*No access code required.
****NOTE:** RC-2000 Version 4.60 or higher Control Software is required to interface with the Hill Phoenix Degree Master. Slight differences in functionality and programming may exist between the ECI Distributed Control Unit and the Hill Phoenix Degree Master.

[1] Degree Master is a trademark of Hill Phoenix.

ECHELON DEVICE ACTIONS

INSTALL NODE FUNCTION

Install Node is the process of addressing a particular node on the Echelon Network. It is necessary to make the RC-2000 "see" the other device on the network. This process must be performed on all node types. Follow the steps below to address the software.

1. Enter [YOUR ACCESS CODE] into the RC-2000.
2. Press [8], LON Network.
3. The LON Network screen appears.
4. Install the node address by making the selections listed below in the LON Network screen.
   For:
   a. Node Type.....Enter [THE NODE TYPE*]
   b. Select Action ...Enter [INSTALL NODE]
   c. Node Start ID...Enter [001] or the [NODE ADDRESS NUMBER TO BE INSTALLED]
   d. Node End ID ....Enter [001] or [NODE ID NUMBER TO BE INSTALLED LAST]
   e. Start Now?.....Enter [YES]

> ***NOTE**
> The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 28 and Table 29 for information on the device type options and their actions.

5. On the **Current Node Status Line**, you will see this display "**Press Node 1 ServPin**"

6. **For the KW Ctrl node type:**
   PRESS and hold the install button on the PIB for one second.

   For the Case Contr node type (DCU):
   INSERT the install tool into the handheld port and **HOLD** the button for one second.

   For the Case Contr node type (Degree Master):
   PRESS and hold the service button for one second.

   For the Danfoss Inv. Node type:
   PRESS down switch SW2 on the Danfoss Inverter for 5 seconds.

   For the ESC-200 node selection type:
   PRESS down SW3 until the yellow service LED stops blinking.

7. After a successful node installation the **Current Node Status Line** will display:

   - A Clear Line or
   - 'Press Node # Serv Pin' (# = next Node in succession to install)

INSTALL CODE FUNCTION

The **Install Code** step is **ONLY PERFORMED** when the Echelon Interface is a **case controller**. (**Case Contr** is entered in the **node type** line of the LON Network Screen.)

Once the case controller has a node address, it **MUST** have code installed. The application code for the case resides in the firmware chip of the RC-2000. Install code sets up the network communication with the RC-2000 and installs the setpoints in the case.

Follow the steps below to **install** the **code**:

When in the LON Network Screen, for
a. Node Type ..... Enter [CASE CONTR]
b. Select Action ... Enter [INSTALL CODE]
c. Node Start ID... Enter [001] or the [NODE ADDRESS NUMBER TO BE INSTALLED]
d. Node End ID .... Enter [001] or [NODE ID NUMBER TO BE INSTALLED LAST]
e. Start Now?..... Enter [YES]

The display will count from 0 to 100% as the code is loaded. Once the screen returns to default settings, the download is finished. If a range of nodes has been set, it will automatically proceed to the next one.

CONFIGURE NODE FUNCTION

Configure the function of the node in the LON Network screen. Access the LON Network screen by following these steps:

1. Enter [YOUR ACCESS CODE] into the RC-2000 upon start up.

2. Press [8], LON Network.

3. The LON Network screen appears.

4. To configure the Node Function in the LON Network screen, follow these steps:
   For:
   a. Node Type ..... Select [THE NODE TYPE*]
   b. Select Action.... Select [CONFIGURE NODE]
   c. Node Start ID .. Enter [001] or [NODE ADDRESS NUMBER TO BE CONFIGURED]
   d. Node End ID.... Enter [001] or [NODE ID NUMBER TO BE CONFIGURED LAST IN SUCCESSION]
   e. Start Now?..... Enter [YES]

***NOTE**
The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 28 and Table 29 for information on the device type options and their actions.

CHECK NODE FUNCTION

The RC-2000 software has a node verify function built into it. It will poll all nodes that are configured via the LON Network Screen. The Check Node function checks the online status of the node, the cause of the last reset, and the version of application code. It can be performed on all node types currently available. Use it to verify successful node addressing.

To verify successful node address installation, perform the following steps:

1. Enter [YOUR ACCESS CODE] into the RC-2000 upon start up.
2. Press [8], LON Network.
3. The LON Network screen appears.
4. To check your node function in the LON Network screen, follow these steps:
   For:
   a. Node Type.....Select [THE NODE TYPE*]
   b. Select Action ....Select [CHECK NODE]
   c. Node Start ID ...defaults to 001
   d. Node End ID ....defaults to end # checked
   e. Start Now? .....Enter [YES]

***NOTE**
The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 28 and Table 29 for information on the device type options and their actions.

The lower portion of the LON Network screen will display the node status. S40000 or C40000 indicates a successful node installation. This Check Node process can be performed at any time to verify status.

SHOW NODE VERSION FUNCTION

The RC-2000 control software will poll a particular node and display the application code version the node has installed. This function is available with all node types. To perform a Show Node Version, follow the steps below:

1. Enter [YOUR ACCESS CODE] into the RC-2000 upon start up.
2. Press [8], LON Network.
3. The LON Network screen appears.
4. To check your node function in the LON Network screen, follow these steps:
   For:
   a. Node Type.....Select [THE NODE TYPE*]
   b. Select Action....Select [SHOW NODE VER]
   c. Node Start ID...[001] or [NODE ADDRESS NUMBER TO BE SHOWN]**
   d. Node End ID ....[001] or [NODE ADDRESS NUMBER TO BE SHOWN]**
   e. Start Now?.....Enter [YES]

***NOTE**

The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 28 and Table 29 for information on the device type options and their actions.

****NOTE**

This action can only be performed on one node (device) at a time.

REMOVE NODE FUNCTION

This process removes the node from the RC-2000's ID table. When this process is complete the RC-2000 will no longer receive or transmit information to that node. This process is only available with the ECI CASE and the KWIC Echelon Assembly node types.

To perform the Remove Node function, follow the steps listed below:

1. Enter [YOUR ACCESS CODE] into the RC-2000 upon start up.
2. Press [8], LON Network.
3. The LON Network screen appears.
4. To check your node function in the LON Network screen, follow these steps:
   For:
   a. Node Type ..... Select [THE NODE TYPE*]
   b. Select Action.... Select [REMOVE NODE]
   c. Node Start ID... Enter [001] or [NODE ID NUMBER TO BE REMOVED]**
   d. Node End ID.... Enter [001] or [NODE ID NUMBER TO BE REMOVED]**
   e. Start Now?..... Enter [YES]

***NOTE**

The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 29 and Table 29 for information on the device type options and their actions.

****NOTE**

This action can only be performed on one node (device) at a time.

IMPORTANT

The Remove Node action can only be performed with an ECI Case or a KWIC Echelon Assembly node type.

SETPOINT RC → NODE FUNCTION

Through this action, you may transmit setpoints from the RC-2000 Controller to a specific device on the Echelon Network. Follow the steps listed below to perform this action:

1. Enter [YOUR ACCESS CODE] into the RC-2000 upon start up.
2. Press [8], LON Network.
3. The LON Network screen appears.
4. To check your node function in the LON Network screen, follow these steps:
   For:
   a. Node Type ..... Select [THE NODE TYPE*]
   b. Select Action.... Select [SETPT RC → NODE]
   c. Node Start ID .. Enter [001] or [NODE ID NUMBER TO BE SENT]**
   d. Node End ID.... Enter [001] or [NODE ID NUMBER TO BE SENT]**
   e. Start Now?..... Enter [YES]

***NOTE**
The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 28 and Table 29 for information on the device type options and their actions.

****NOTE**
This action can only be performed on one node (device) at a time.

SETPOINT NODE → RC FUNCTION

Through this action, you may transmit setpoints from a specific device on the Echelon Network to the RC-2000. Follow the steps listed below to perform this device action:

1. Enter [YOUR ACCESS CODE] into the RC-2000 upon start up.
2. Press [8], LON Network.
3. The LON Network screen appears.
4. To check your node function in the LON Network screen, follow these steps:
   For:
   a. Node Type.....Select [THE NODE TYPE*]
   b. Select Action ....Select [SETPT NODE → RC]
   c. Node Start ID...Enter [001] or [NODE ID NUMBER TO BE SENT]**
   d. Node End ID ....Enter [001] or [NODE ID NUMBER TO BE SENT]**
   e. Start Now? .....Enter [YES]

***NOTE**
The entry in the Node Type line will depend on the device type being interfaced with the RC-2000 control software. See Table 28 and Table 29 for information on the device type options and their actions.

****NOTE**
This action can only be performed on one node (device) at a time.

LON NETWORK SCREEN/ERROR MESSAGES FOR ECHELON DEVICES

INTRODUCTION

The RC-2000 LON Network Screen presents enhanced status and troubleshooting messages for all Echelon node types currently available. It is a good resource during installation, when checking device communication status, and during a node check from the install screen.

To access the RC-2000 LON Network Screen, follow the steps below.

1. Enter [YOUR ACCESS CODE] into the system.
2. Press [8], LON Network.
3. The LON Network screen appears. Use this screen to ID/configure and review status on the LON Network Devices.

The LON Network Screen will also display error messages for up to four devices at a time. Each device will have its own line, and the error message will run from left to right. A screen example at the end of this section, shows a LON Network Screen configured for an ECI Case node type. The screen also reflects the messages you will see upon successful node installation (C40000). The text that follows explains the different messages you may see on the screen.

CASE CONTROL SCREEN ERROR MESSAGE EXAMPLE: C4000X

In the error message example, C4000X, the first position can be interpreted as **C: Cleared**. This error message equals the cause of the last reset. (See Table 30 below for a list of other first position error messages.)

EXPLANATION (for C: Cleared): IF the check node function is performed twice in a row, the C should show up on all messages because the reset message has been cleared at this point. BE AWARE that a watchdog reset generally indicates a serious problem that most likely will require follow up service attention.

NOTE

The first letter in the error message represents the cause of the last reset, see Table 30 below.

TABLE 30 – CASE CONTROL INSTALL SCREEN FIRST POSITION CHARACTER ERROR MESSAGE CHART

INITIAL	LAST ERROR RESET CONDITION
C	Cleared
S	Software
P	Power Up
E	External Watchdog
W	Watchdog

SECOND POSITION CHARACTER IN THE ERROR MESSAGE

The first number after the letter will display the online status. In the case of the example, C4000X, four equals "online satisfactory."

EXPLANATION (for 4: online satisfactory):
The second character in the error message will display the online status. After a node check, the first number displays a four. After an upgrade or a node install without a code download, a zero may display. In general, a four shows successful online communication status. Any other number in this position indicates a problem state (see Table 31 for a complete list of second position characters in the error message and their explanation).

TABLE 31 – SECOND POSTION CASE CONTROL INSTALL SCREEN ERROR MESSAGE CHART

ERROR CODE	ERROR DESCRIPTION
0	Offline or node install without code download
2	Application unconfigured
3	No application unconfigured
4	Online satisfactory
6	Offline

ERROR MESSAGE EXPLANATION: 000

The next three characters in the error message usually will display 000. When 000 is displayed in this portion of the message, assume a satisfactory message. Any other combination of digits will represent an error.

IMPORTANT

If a message other than 000 shows up in this portion of the error message, you have an operation error.

Record the error message and contact your ECI representative for further details.

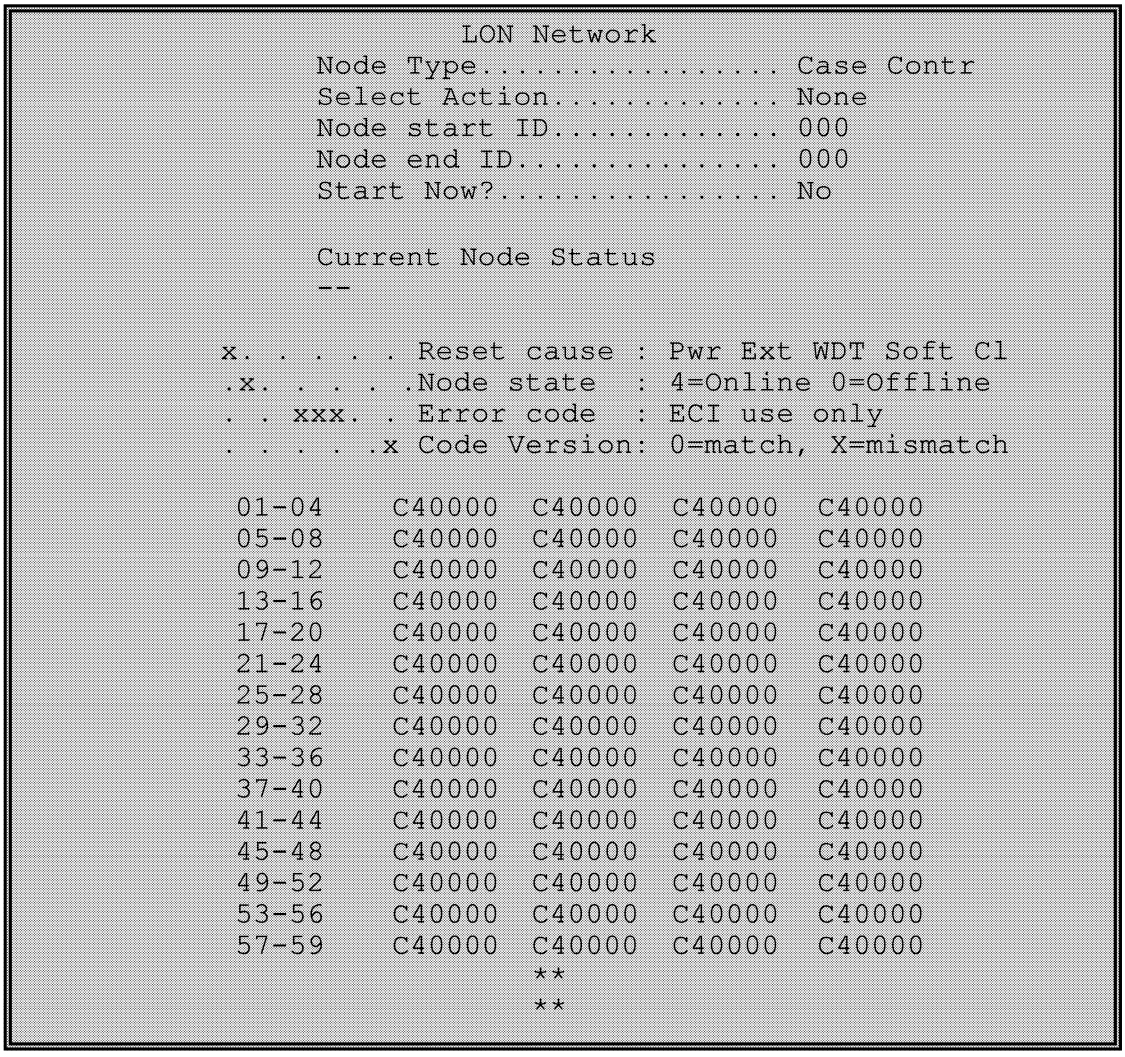
ERROR MESSAGE EXPLANATION: LAST CHARACTER

The final character in the error message represents the application code match between the RC-2000 and the addressed device.

The two characters that will be displayed in this slot are X or 0. They are defined below:

X = Application code installed in case control DOES NOT match the code merged into the RC-2000 firmware.

0 = The application code in the case control DOES match the code merged into the RC-2000.



EXAMPLE OF LON NETWORK SCREEN CONFIGURED FOR CASE CONTROLLER

ECHELON INTEROPERABILITY

ECHELON INTERFACE WITH THE DANFOSS INVERTER

The RC-2000 Version 4.10 and higher incorporates an Echelon Interface with the Danfoss Inverter. This feature eliminates the need for several analog and digital connections between these two devices. This information will be transferred via the Echelon network (16 gauge non-shielded twisted pair Belden #8471).

HARDWARE REQUIREMENTS

The Danfoss Inverter will need to be equipped with an Echelon™ Option card. Please refer to your Danfoss manual for further information.

The RC-2000 requires a "new-style" CPU (part # 5120001400) equipped with a MIP daughterboard. The firmware must be level 4.10 or higher. The network wiring follows the Echelon network termination rules for an FTT-10 transceiver (free-topology). The Danfoss Inverter has a switch on the option card for network termination. These switches should be set according to the Echelon termination guidelines (on is up, and off is down).

When configuring for this mode, **DO NOT MAKE** THE CONNECTIONS between the **DANFOSS INVERTER** and the **RC-2000** LISTED BELOW:

Analog Output:	Speed control (0-10V)
Digital Input:	Fault Input
Digital Input:	Inverter Run Verify
Digital Output:	Reset Relay
Analog Input:	Frequency Status
Analog Input:	Current (Amps) Status

When configuring in this mode, the following connections are required between the Danfoss Inverter and the RC-2000:

Echelon communication:	(Will replace all connections previously listed)
Digital Output:	Switchover Relay
Digital Output:	Control relay for compressor (has an auxiliary connection for the start command to the inverter)

The interface will still require a hardware connection for the start command to the inverter. Make this connection with a series circuit through the auxiliary contact on the variable speed compressor contactor (ECI control relay for the inverter) and the switchover relay. The condenser fans should have a hardware start wired in series through the ECI inverter control relay and the switchover relay. The condenser fans should have a hardware start wired in series through the ECI inverter control relay and the switchover relay.

The Danfoss Inverter will be set to require a hardware and a software start to run forward. By placing the switchover relay in override, the interface will be able to be placed in hard override. If the switchover relay is placed in hard override, the RC-2000 will recognize the override condition and will not transmit control word via the Echelon Network.

SOFTWARE REQUIREMENTS

This interface has many similarities to the case control interface being done via the Echelon Network. Each Danfoss Inverter is assigned a node address number for network identification. This node address number can be the same number as one that is used for case controls or other devices because each device type resides on an individual subnet.

IMPORTANT
Danfoss Inverters connected to the same RC-2000 should not be assigned duplicate node addresses.

Set the software interface as follows:

1. Configure the variable speed option in the Rack Configuration Screen as done in previous versions. You may select condensers, compressors, or both as needed for your application.

2. Select the polarity of the switchover relay (if you are using it in the application) in the rack configuration screen.

IMPORTANT
If the **POLARITY** is set IMPROPERLY, the Danfoss Inverter will NOT RECEIVE the START COMMAND and the interface will **FUNCTION INCORRECTLY!**

3. You should only assign the inverter address to a setpoint in the variable speed section of the rack setpoint screen when you are using the ECHELON DANFOSS INTERFACE. This setpoint renders some setpoints unnecessary; they will display as N/A. Actual control of the device per these setpoint assignments occurs when the binding process is completed; however, they can be assigned before then.

   ECI recommends setting the inverter address setpoint assignments at: 01, 02, 03, etc.; these assignments are dependent on the number of inverters being controlled.

4. After you assign the inverter address, you have only two more setpoints to assign the control relay, and the switchover relay. Assign them now to fit the individual application.

5. Next, bind with or node address the device via the main menu. Press [8 LON Network]. The screen will look like this:

   LON NETWORK

Device Type:	Danfoss Inverter
Select Action:	Install Node
Start Node ID:	001 (Dependent on the desired address)
End Node ID:	001 (Dependent on the desired address)
Start Now?:	Yes
Current Node Status:	This will prompt user that the RC-2000 is ready for the inverter to be addressed.

   Once you set the LON NETWORK screen, you need to toggle the service pin switch (SW2) on the Danfoss Echelon Option Card. (The switch will be set in the normal or up position, move it to the down position and then back to normal.) Once the node address is successfully installed, the current node status line will clear and the controller will be ready for the next address.

6. Once the node address is complete, the Danfoss Inverter is on-line and ready to be controlled. At this point, the frequency and current displays at the RC-2000 Rack Status screen will be live status.

SAFETY CONSIDERATIONS AND SETTINGS

You should be aware of the following settings in order to benefit from the safety or switchover benefits of the interface:

1. When the binding process is complete, the Danfoss Inverter is set for a **THREE-MINUTE MAXIMUM receive time**. The inverter defaults to a predetermined state if no messages are sent to it from the RC-2000 within this three-minute time interval.

   Set this predetermined state on **Parameter 824 TIME-OUT F** in the Danfoss Inverter. **ECI recommends MAXIMUM** as the setting because it will default the inverter to a 100% run if communication is terminated.

2. If a technician needs to service the system, or if software upgrades require extensive code download to case controls, the SWITCH-OVER RELAY should be placed into OVER-RIDE until the work is finished. Once the switchover relay is placed in override, communication to the inverter will stop. The inverter will receive a stop command via hardware and the variable speed compressor will cycle as a fixed capacity (on/off).

3. The Danfoss Inverter can be configured for software or hardware start/stop commands. The present interface requires that Parameter 506 START be set to "AND." By setting this parameter to "AND" the inverter requires a software and hardware start prior to a RUN condition. This will ensure that an override can always be accomplished when you put an ECI control point in hardware or software override.

4. This interface doesn't use a reset relay. The inverter has it's own reset function that will attempt a reset prior to sending a fault condition to the RC-2000. Once a Fault condition is recognized, the RC-2000 will immediately go to a switchover state (No Delay) and the fault will be entered into the alarm log. Once the fault is entered into the alarm log, the inverter will not receive transmissions until the fault condition is reset manually.

5. This interface is a communication protocol; therefore, ECI recommends that a Boolean statement be installed into the RC-2000 for fail-safe back up. This statement should reference the operating pressures and if they exceed safe ranges, the switchover should be shut down and an alarm should be generated. Refer to the RC-2000 Programming manual, or contact your ECI representative for further details.

NOTE

When **OPERATING** a split suction group rack with a common condenser, **BE AWARE** that **HIGH PRESSURE CONDENSER SAFETIES** need **INSTALLED** for **BOTH SUCTION GROUPS**.

PARAMETER SETTINGS FOR THE DANFOSS INVERTER

PARAMETER	SETTING
506 "START"	AND
*824 "TIME-OUT F"	MAX
*927 "ACC PARA W"	WITH LONWORKS
*928 "ACC PROC C"	WITH LONWORKS
***Parameter Groups 800** and **900** are **ONLY AVAILABLE** when the **OPTION CARD** is **installed** and **initialized**.	

ECHELON INTERFACE WITH THE ENCORE ESC-200 BITZER SCREW COMPRESSOR MODULE

The RC-2000 Version 4.10 and higher incorporates an Echelon interface with the Encore ESC-200 Bitzer Screw Compressor Module. The Echelon Network will send Alarm status information to the RC-2000 via the Echelon Network (16 gauge, non-shielded twisted pair, Belden # 8471).

Each Bitzer Screw Compressor has an individual ESC-200 module assigned for control, alarm safeties and long term alarm logging. This interface will allow each individual ESC-200 module to send any alarm status to the RC-2000 when it occurs and send an OK when the alarm clears. The RC-2000 will recognize the compressor number (as assigned to the RC-2000) and the alarm type. This information will be logged and will dial out as required by the application.

This interface will eliminate the need for several interposing relays that were previously required to signal different alarm conditions. It also adds the ability to recognize individual alarm types on individual compressors and to reset the alarm condition without requiring a visit to the site.

HARDWARE REQUIREMENTS

The ESC-200 module will need to be equipped with a compatible Echelon chip and transceiver. Please refer to your Encore manuals for more complete information.

The RC-2000 will require a "new-style" CPU (Part # 512001400) that must be equipped with a MIP daughterboard (Part # CC/20056400). The firmware will have to be at a 4.10 level or higher. The network wiring will follow the Echelon network termination rules for an FTT-10 transceiver using a 16 gauge, non-shielded twisted pair, Belden #8471.

CONTROLLER INTERFACE

The ESC-200 uses a hardware DipSwitch setting to initially set the board address. This is marked as DipSwitch #2 (SW2). This switch should be set prior to performing the install node function.

Follow the procedures listed below and on the following page when installing an ESC-200 on the RC-2000 Echelon network.

1. The ESC-200 module needs to have a controller address assigned to its associated compressor. This setpoint can be assigned in the rack setpoint screen directly below the compressor relay setpoints as follows:

Compr:	1
Relay:	0-0
Capacity:	010
Unloaders:	0
Ctrl Addr:	00

NOTE

The variable speed compressor also has a setpoint field for a Controller Address assigned to the variable speed compressor. This will require configuring for variable speed control and entering the setpoint screen. The top line of the variable speed setpoints will have fields for Invertr Addr and Ctrl Addr in this listed order from left to right. The ESC-200 will be assigned to the Ctrl Addr as listed above.

IMPORTANT

Make certain that the number assigned to the control address matches the switch selection made on DipSwitch #2 on the ESC-200 module.

(next page →)

2. Set the Install Node function. This is done from the main menu by selecting number [8 LON NETWORK]. Set the screen as follows:

LON NETWORK

Device type:	ESC-200
Select Action:	Install Node
Start Node ID:	001 (Dependent on the desired address)
End Node ID:	001 (Dependent on the desired address)
Start Now?:	Yes
Current Node Status:	This will prompt you that the RC-2000 is ready for the module to be addressed.

3. When this is set there is an alarm reset button that will need to be pressed on the ESC-200 module. This is SW3 located to the right of the DipSwitches on the ESC-200. This button will need to be depressed for approximately five seconds for the node to be installed.

There is an amber service LED "I16" located at the bottom left corner of the ESC-200 module. When the node is initialized, this light will illuminate. This light will also be in a blinking state if the module is not configured prior to node installation. Once this process takes place, the Current Node Status line on the RC-2000 will clear, displaying the success of the install process.

NOTE

The rack status screen will display a "_" below the associated compressor unit, noting an ESC-200 is assigned to that unit.

If this module is in alarm, it will display an "A" in the above mentioned space and enter the alarm into the alarm log.

ALARM STATUS

The ESC-200 does not honor any alarm time delays. If the module is in alarm it will be entered into the log without delay. The RC-2000 has a dialout capability for each of these alarms and the alarm relay assigned to the suction alarm will deenergize if an ESC-200 is in alarm.

The alarms received from the ESC-200 will be as follows:

MOTOVR	Motor Overload
OIL FLW	Oil Flow
OIL LVL	Oil Level
GAS TMP	Discharge Gas Temp.
PHASE	Phase Failure
ROTATE	Rotation Failure
RUN PRF	Run Proof

For Example:

The RC-2000 will log the following "Run Proof" alarm like this:

01-01 00:11	Rack A	C2RunPrf

It displays the date, time, and rack assignment. The C2 represents the compressor number and the alarm type.

This information will conclude that on Jan. 1 at 12:11 a.m., Rack –A compressor #2 went off on the Run Proof Alarm.

NOTE

The RC-2000 will dialout the above information for each alarm.

The RC-2000 logs the following as an event:

FILTER	Dirty Filter

ECHELON INTERFACE WITH THE KYSOR-WARREN INTERFACE CONTROL

The RC-2000 Version 4.40 and higher supports an Echelon interface with the Kysor-Warren Interface Control (KWIC). The KWIC module is an output control device that allows for centralized mounting of all circuit and compressor output modules. An Echelon FTT-10 Chassis Assembly may be purchased with the KWIC to communicate directly with the RC-2000 via an Echelon network (16 gauge, non-shielded twisted pair, Belden # 8471).

HARDWARE REQUIREMENTS

The RC-2000 will require a "new style" CPU (Part # 512001400) that must be equipped with an MIP daughterboard (Part # CC/20056400). The firmware will have to be at a 4.40 level or higher. The network wiring will follow the Echelon network termination rules for a FTT-10 transceiver using a 16 gauge, non-shielded, twisted pair, Belden #8471.

CONTROLLER INTERFACE

Use the KWIC Echelon FTT-10A Chassis Assembly to communicate directly with the RC-2000. This chassis assembly uses an Echelon Engine Board to support the Echelon communication.

NOTE

The Echelon Engine Board provides:

1. The connector to terminate the Echelon network.

2. Two switch blocks for this chassis assembly setup. They are marked S1 and S2, located left to right, respectively, when looking directly at the KWIC Echelon FTT-10A Chassis Assembly.

3. Subnet and Node addressing capability on dipswitches within S1 and S2, respectively.

ECHELON ENGINE BOARD SWITCHES

SWITCH BLOCK 1 (S1)

This switch block contains eight dipswitches, 1-8. They are used to set a portion of the communication address called the subnet address. The subnet address is a portion of the Echelon address required to communicate on the Echelon network. The Echelon FTT-10A Chassis Assembly is designed to allow the RC-2000 to assign this address through software initialization or by using the dipswitch and reading the value from the switch.

NOTE

To assign a subnet address via a software initialization process, set all eight switches on S1 to the "Off" position.

SWITCH BLOCK 2 (S2)

This switch block contains eight dipswitches, split into two groups: Dipswitches 1-3, and dipswitches 4-8.

Dipswitches 1-3 are used to set a second portion of the Echelon communication address (node address). When these dipswitches are set to off, the RC-2000 initializes the node address via a software message.

NOTE

To assign a node address via a software initialization process, set dipswitches 1-3 on Switch Block 2 (S2) to the "Off" position. The node address will then be assigned.

Dipswitches 4-8 on Switch Block 2 (S2) are used to reference the number of relays per board as assigned in the RC-2000. The KWIC Assembly may be set via these dipswitches to support different formats relating to numbers of relays per board.

NOTE

Dipswitches 4-8 on Switch Block 2 (S2) set to "Off" will support an eight relay per board I/O format. Table 32 below shows the I/O Control Formats capable with the KWIC Device.

TABLE 32–DIPSWITCH I/O FORMAT GUIDE

Switches Set "On"	Relays per Board
None	8
5, 7	10
5, 6	12
5, 6, 7	14
4	16

SOFTWARE REQUIREMENTS

Before you install the Echelon Address for the KWIC Assemblies, the system output control needs to be reviewed to configure the RC-2000.

NOTE

The majority of the software setup is configured at the RC-2000.

The RC-2000 Version 4.50 or higher communicates with a maximum of fifteen digital output boards.

The RC-2000, Version 4.50 uses a hybrid output communication scheme. With this scheme, you have two options:

1. To configure the Digital Output boards to be the conventional serial type communication.

   Or

2. To select the Digital Output boards for Network Communication via the Echelon Network.

NOTE

The RC-2000, Version 4.50 defaults to serial relay output control at the original start up. To communicate with the RC-2000 via the Echelon Network, you must determine how many output boards will be controlled and then configure the RC-2000 to meet the requirements.

DIGITAL OUTPUT SETUP FOR ECHELON COMMUNICATION

To set up the RC-2000/KWIC control interface, the programmer must first determine which digital output boards should be allocated for KWIC control.

ECI recommends that all KWIC Network Output Modules are allocated first and that all Serial Relay Boards are allocated second.

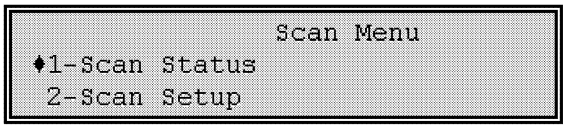
NOTE

Serial Digital Output boards will generally be used for condenser fan control, master hot gas etc. on a KWIC control system.

Prior to configuring the RC-2000 for serial/network output control, verify and document the configuration.

SCAN MENU

The Scan Menu lists options for setting up and using the Scan feature in the RC-2000. This feature is only available in units that have a communication ID of #1. By implementing this feature, RC-2000 number one will scan other 2000 series and 1000 series units for program integrity and CPU function based on the parameters programmed in the Scan Setup screen.



Scan Menu Screen Example

SCAN STATUS MENU

The Scan Status Screen displays the status of the units that have been setup to be scanned. Each line displays a unit name and communication ID, which are set up in the setpoint screen. A message that indicates the unit's integrity is displayed to the left of the first eight lines as follows:

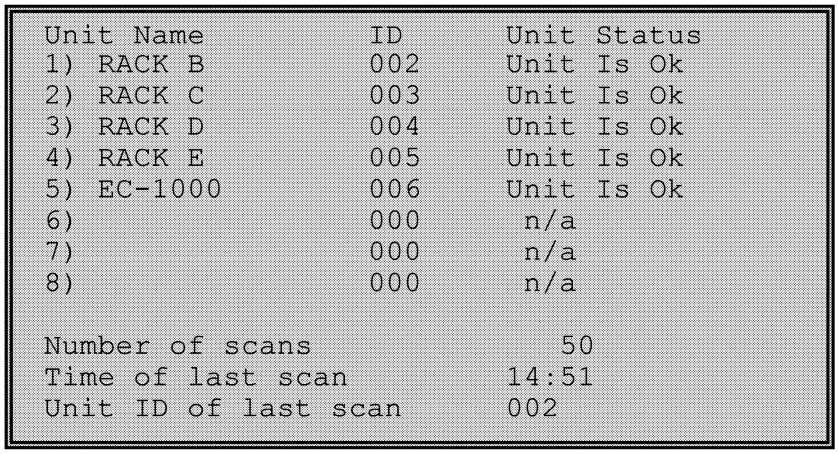
Unit is OK: unit is functioning properly.

Unscanned: unit has not yet been scanned

No Response: unit is not responding; possible reasons include

- a bad CPU
- faulty communication line
- power outage

Not configured: unit is without program or is partially locked up.



Scan Status Example Screen Example

SCAN SETUP MENU

This screen allows the user to assign:

- the units to be scanned
- the scan interval
- the alarm dial out information

The first eight lines contain a user-defined name and the communication ID of the unit to be scanned.

NOTE

Unit 1 cannot scan itself.

The unit must have a Communication ID of 2 or higher to be scanned.

The **scan interval** is a programmable value that controls the time between scans. It is measured in minutes. Once one unit has been scanned, the RC-2000 will wait the programmed interval before scanning the next unit.

For example,
If the scan interval is set at ten minutes for four units, 40 minutes will be needed to scan all four units.

An **alarm relay** can be assigned in the next line to alarm when there is a response other than [Unit OK].

The next area of this screen details the alarm dial out setup for dial out of the scan alarms. By saying [YES] to a group, the RC-2000 will dial the alarm to that number. (The group phone numbers are programmed in the Alarm Dial Out Menu found under the system functions on the Main Menu.) The programmable delay time (in minutes) will delay the alarm dial out for that time. This feature allows the situation to clear before an alarm is dialed out.

Reset Scan Errors allows for the reset of the alarm relay if an alarm was caused by working on the units. By placing the cursor in front of the [NO] and pressing [ENTER] the [NO] will change to [YES] and reset the alarm until the next scan.

```
        Unit Name                ID
        1) RACK B          . . . .  002
        2) RACK C          . . . .  003
        3) RACK D          . . . .  004
        4) RACK E          . . . .  005
        5) EC-1000         . . . .  006
        6)                 . . . .  000
        7)                 . . . .  000
        8)                 . . . .  000
    Scan interval 10m per unit
    Alarm relay   0-0

         Name          Local   Grp1    Grp2    Delay
    ---------------   -----   -----   -----   -----
    Scan Alarm        NO      NO      NO      001m
    OK (cleared)      NO      NO      NO
```

Scan Setup Screen Example

APPENDIX A
PROGRAMMING WORKSHEETS

CIRCUIT CONFIGURATION WORKSHEET

Store #:	**Location:**

CONFIGURATION:

Number of circuits (max. 32): _____ (0-32)
Number of temp snsrs per ckt: 6 / 12
Refrig relay control: Suction / Liquid
Temperature dead band: YES / NO
Defrost initiation: TIME or TIME/DIG
Defrost termination: TIME/TMP or TIME/DIG
Defrost restart: YES / NO
Multi-case defrost term: YES / NO
Hot gas defrost: YES / NO
Pumpout phase: YES / NO
Equalize phase: YES / NO
Evap fan control: YES / NO
Dew point controlled skip: YES / NO
Digital alarm override: YES / NO
Valve verification: YES / NO
Disable Lo Temp Alrm at (-30°F): YES / NO
Alternate Alarm Setpoints: YES / NO
View Rack Status: YES / NO

CIRCUIT SETPOINT WORKSHEET

Store #:	**Location:**

SETPOINTS:

Circuit #:	**Description:**

Cut in setpt (°F):		Cut out setpt (°F):				
High alarm (°F):		Low alarm (°F):				
Defr Term (°F):		Defr Restart (°F):				
Evp fan start (°F):						
Skip def @dp (°F):		Max dp skips:				
Refrig delay (in minutes):		Alarm delay (in minutes):				
Pumpout time (in minutes):		Defrost time (in minutes):				
Equalize time (in minutes):		Evap fan dly (in minutes):				
Defrost Start Times:	_____:_____	_____:_____	_____:_____	_____:_____	_____:_____	_____:_____
Alt Alarm Digital Inputs:	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
Temp Sensors:	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
Alrm Sensors:	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
Term Sensors:	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____

CIRCUIT SETPOINT WORKSHEET (continued)

Store #:	**Location:**

SETPOINTS (continued):

Circuit #:	**Description:**

Case Defr Relays	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
Suction Relay: _____ - _____		Liquid Relay: _____ - _____				
Master Hgas Rly: _____ - _____		Evap Fan Rly: _____ - _____				
Equalize Relay: _____ - _____		Alarm Relay: _____ - _____				
Def Vrfy Inputs:	___-_____	___-_____	___-_____	___-_____	___-_____	___-_____
Suct Vrfy Inpt: ___-_____		Liq Vrfy Inpt: ___-_____				
Defrost initiates on OPEN / CLOSED						
Defrost Init. Inputs:	___-_____	___-_____	___-_____	___-_____		
Maximum Defrost Off (in hours):						
Defr Term Inpt: ___-_____		Alrm Ovrd Input: ___-_____				

Temp Compensation Priority: _____
Rack Number: _____

RACK CONFIGURATION WORKSHEET

Store #:	Location:

CONFIGURATION

Number of racks (maximum of four): _____ (0-4)
Variable Speed: COMPR / COND / BOTH
Run Verification: YES / NO
Aux Setpoints: YES / NO
Temp Controlled Setpoints: NO / SELECT / DEFAULT
Phase Loss Input: YES / NO
Refrigerant Liquid Level: NOT USED / ANALOG / DIGITAL
Defrost Sense Input: NO / INTERNAL / EXTERNAL
Oil Failure Input: YES / NO
Control Relay Energized On: NO / COMP / FANS / BOTH
Desuperheater Control: YES / NO
Additional Monitoring Points: YES / NO
TD Head Pressure Control: NO / TEMP / PRES
Two Stage Rack Control: YES / NO
Head Pressure Override: YES / NO
Polarity of Switchover Relay: EON / EOFF
Split Condenser: YES / NO
Six or Twelve Condenser Fans: 6 / 12
Monitor Comprsr Oil Pres: YES / NO

RACK SETPOINT WORKSHEET

Store #:	Location:

RACK SETPOINTS

Rack #:	Description:

Cut in: _____p _____p
Cut out: _____p _____p
Aux Cut in: _____p _____p
Aux Cut out: _____p _____p
Max Cut in: _____p _____p
High Alarm: _____p _____p
Low Alarm: _____p _____p
Head Override Shutdown: _____p
Alarm Delay: _____m _____m
Liquid Level Alarm: _____%
HR Override Level: _____%
HR Override Diff: _____%
HR Override Delay: _____s
Min on time: _____s _____s
Min off time: _____s _____s
Control Gain: _____ _____
Derivative Gain: _____ _____
Unit Combinations: ALT/SEQ SEQ/ALT
Pres Sensor: ___-_____ ___-_____
Alarm Relay: ___-_____ ___-_____
Ambient Sensor: ___-_____ ___-_____

RACK SETPOINT WORKSHEET (continued)

Store #:	Location:

RACK SETPOINTS (continued)

Rack #:	Description:

Condensing Temp/Pres Sensor: ___-_____
Temp Diff. Cut in: _____
Temp Diff Cut out: _____
Min Ambient Temp: _____
Refrigerant Type: R22 / R134 / R404 / R507 / R717
Split Cut in Temp: _____
Split Cut out Temp: _____
Split Override Pres: _____
Split Minimum Off Time: _____
Analog Liquid Level Sensor: ___-_____
HR Override Relay: ___-_____
Aux Enable Input: ___-_____
Phase Loss Input: ___-_____
Defrost Sense Input: ___-_____
Oil Failure Input: ___-_____

RACK SETPOINT WORKSHEET (continued)

Store #:	Location:

RACK SETPOINTS (continued)

Rack #:	Description:

Compr	1	2	3	4	5	6	7	8
Relay:	___-___	___-___	___-___	___-___	___-___	___-___	___-___	___-___
Capacity	_____	_____	_____	_____	_____	_____	_____	_____
Unloaders:	___	___	___	___	___	___	___	___
Oil Pres:	___-___	___-___	___-___	___-___	___-___	___-___	___-___	___-___
Sump Prs:	___-___	___-___	___-___	___-___	___-___	___-___	___-___	___-___
Min Oil Diff Pres:	_____							
Run Inpt:	___-___	___-___	___-___	___-___	___-___	___-___	___-___	___-___
Ctrl Addr:	_____	_____	_____	_____	_____	_____	_____	_____

RACK SETPOINT WORKSHEET (continued)

Store #:	Location:

RACK SETPOINTS (continued)

Rack #:	Description:

Variable Speed Compressor:						
Inverter Addr: _____						
Max RPM: _____		Min RPM: _____				
Capacity: _____		Analog output: _____p				
Freq sensr: ____ - ____		Sump pres snsr: ____ - ____				
Control relay: ____ - ____		Reset relay: ____ - ____				
Switchover relay: ____ - ____		Fault input: ____ - ____				
Run input: ____ - ____		Current sensr: ____ - ____				
Fan relays	**1**	**2**	**3**	**4**	**5**	**6**
Main bank	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____
Fan relays	**1**	**2**	**3**	**4**	**5**	**6**
Split bank	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____
Run inpt A	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____
Run inpt B	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____	____ - ____
Variable Speed Fan:						
Max RPM: _____		Min RPM: _____				
Analog output: ____-_____		Switchover rly: ____-_____				
Control relay: ____-_____		Fault input: ____-_____				
Power sensr: ____-_____		Max power: ____-_____				
Associated medium temperature rack: _____						

DESUPERHEATER SETPOINTS

Store #:	Location:

Unit:	#1	#2
Cut in Setpoints:	(in °F)	(in °F)
Dead Bands (cut out):	(in °F)	(in °F)
Desuperheater Relays:	____-_____	____-_____
Temperature on: Highest temp / Average temp		

Manifold Sensors:

____-_____	____-_____	____-_____	____-_____	____-_____	____-_____

Monitor Only Setpoints

Type:	Assignments:			
Temp Snsr:	____-_____	____-_____	____-_____	____-_____
Low Press:	____-_____	____-_____	____-_____	____-_____
High Press:	____-_____	____-_____	____-_____	____-_____
Other Snsr:	____-_____	____-_____	____-_____	____-_____
Dig Inputs:	____-_____	____-_____	____-_____	____-_____
Relay Outp:	____-_____	____-_____	____-_____	____-_____
Analog Out:	____-_____			

LEAK DETECT WORKSHEET

Store #:	**Location:**

Configuration:
Number of groups (Max: 4): _____ (0-4)
Leak sensor type: ECI ANALOG / DIGITAL / YOKOGAWA

ANALOG SETPOINTS:

Leak Sensors:	**Alarm Setpt:**
Sensor 1: ____-_____	_____ppm
Sensor 2: ____-_____	_____ppm
Sensor 3: ____-_____	_____ppm
Sensor 4: ____-_____	_____ppm
Sensor 5: ____-_____	_____ppm
Sensor 6: ____-_____	_____ppm
Sensor 7: ____-_____	_____ppm
Sensor 8: ____-_____	_____ppm
Scale Factor: _____ppm	
Alarm Relay: ____-_____	
Alarm Delay: _____secs	

DIGITAL INPUT
Leak Input: ____-_____
Alarm Relay: ____-_____
Alrm Delay: _____secs

LOGIC STATEMENT WORKSHEET

Store #:	**Location:**

Unit: RC-2000

Statement #:	**Description:**
If Analog [___ - ____ ____ - ____ ____ - ____] a(vg, max, min, any)	
Analog [___ - ____ ____ - ____ ____ - ____] a(vg, max, min, spt)	
OR, AND XOR Digital [____ - ____ ____ - ____ ____ - ____] (or,xor, and, chg) ON / OFF ON / OFF ON / OFF	
OR, AND XOR Ref Out [____ - ____ ____ - ____ ____ - ____] (or,xor, and, chg) ON / OFF ON / OFF ON / OFF	
THEN Dig Out[____ - ____ ____ - ____ ____ - ____] (nrm, lch, mty, chg, shd) ON / OFF ON / OFF ON / OFF	
Energized is ON/OFF ON/OFF ON/OFF	
True if count equals (min 2): _____	
Sensor Type: Lo-T / Hi-T / 0-10V / Leak / Lite / Lo-P / Hi-P / kW **Setpoint**_____	
Time Delay (sec.):	Min On (sec.):
Log Alarm: YES / NO	Log Event: YES / NO
Message (10 chars): _____	
Scale Fact: _____	
Clear Latch Input: _____ - _____	
Logic is on from (enter time period): _____:_____ to _____:_____	

ALARM DIAL OUT WORKSHEET

Store #:	Location:

DIAL OUT PHONE NUMBERS:

GROUP 1

Unoccupied Phone #'s	Occupied Phone #s
> _____	> _____
> _____	> _____
> _____	> _____

Occupied Schedule

Sun: From: _____:_____	To: _____:_____
Mon: From: _____:_____	To: _____:_____
Tue: From: _____:_____	To: _____:_____
Wed: From: _____:_____	To: _____:_____
Thu: From: _____:_____	To: _____:_____
Fri: From: _____:_____	To: _____:_____
Sat: From: _____:_____	To: _____:_____

ALARM DIAL OUT WORKSHEET (continued)

Store #:	Location:

DIAL OUT PHONE NUMBERS:

GROUP 2

Unoccupied Phone #'s	Occupied Phone #s
> _____	> _____
> _____	> _____
> _____	> _____

Occupied Schedule

Sun: From: _____:_____	To: _____:_____
Mon: From: _____:_____	To: _____:_____
Tue: From: _____:_____	To: _____:_____
Wed: From: _____:_____	To: _____:_____
Thu: From: _____:_____	To: _____:_____
Fri: From: _____:_____	To: _____:_____
Sat: From: _____:_____	To: _____:_____

MISCELLANEOUS DIAL OUT PARAMETERS WORKSHEET

Device ID: _____		
Dial Test Choice:		
Modem Cmd: _____		
Retry Dialing in (0-24): _____hours		
Daily Dialout Grp1	1: _____:_____	2: _____:_____
Daily Dialout Grp2	1: _____:_____	2: _____:_____
Group 1 Name: _____		
Group 2 Name: _____		
Baud rate for dial-out group 1: 300 / 1200 / 2400		
Baud rate for dial-out group 2: 300 / 1200 / 2400		
Redial active alarms in _____minutes		

SYSTEM MISCELLANEOUS CONFIGURATION

Communication ID _____
Temp Units °F / °C
Case Controller Type: DCU / CSC
Logging Interval _____ seconds
Integrity Relay _____-_____ (EON)
I/O Log Delay _____-_____ minutes
I/O Alarm Relay _____-_____
I/O Check Dig Out 8: Yes/No

GLOSSARY

CIRCUIT SETPOINTS

Alarm Delay: The period that an alarm condition must be active before an alarm is logged.

NOTE
The alarm is inactive:
- DURING defrost
- 15 minutes plus the alarm delay AFTER defrost

Alarm Override Input: Available when the system is configured for digital alarm override. When this input is CLOSED, all alarms from that circuit will be overridden. For the override condition to clear, the input must be OPEN.

Alarm Relay: The relay used for all alarm functions on a circuit. It is energized if nothing is in alarm (use with N/C contacts).

Alarm Sensor: An assignment for an alarm sensor. Up to six or twelve alarm sensors can be assigned, depending on the number of sensors configured. The alarm sensor inputs are used for circuit alarm reference. The lowest value is compared against the low alarm setpoint; the highest value is compared against the high alarm setpoint.

Alt High and Alt Low Alarms: They will be available when the system is configured for alternate alarms. The Alt Alarm setpoints provide an additional alarm setpoint for dual temp applications that are in the same column as an assigned Alt Alrm Dig Input that is in closed position.

Alternate Alarm Digital Inputs: They are available when the RC-2000 is configured for Alternate Alarms. When the Alternate Alarm Input is CLOSED, the RC-2000 will compare the associated alarm sensor with the Alternate Alarm setpoints and will allow temperature setting changes to the dual temperature cases without changing setpoints. The system will provide six or twelve Alt Alrm Inputs, depending on the number of sensors configured per circuit. Each Alt Alrm Input is associated with one alarm sensor in that circuit. For example, the first input in the first row is associated with the first alarm sensor in the first row; the second input in the first row is associated with the second alarm sensor in the first row.

Defrost Initiates on OPEN/CLOSE: This field is a polarity setting. If defrost initiation is set for time/digital, then this field will be available to select the polarity of the defrost sense input. When defrost is scheduled to begin, the RC-2000 will check the defrost sense inputs to ensure that at least one of the inputs matches this setting. If there is not a match, defrost will be skipped for that cycle.

Defrost Off: This setpoint is a time setting. When defrost initiation is set for time/digital, this field selection is available. It is the maximum time that defrost can elapse when the defrost init input setting(s) do not match the defrost initiates on setting(s) during a call for defrost.

Defrost Relay: The defrost relay is used for a defrost load (use with N/O contacts).

Defrost Restart Setpoint: This setpoint is a temperature setting. If the temperature of all assigned termination sensors fall below this setpoint during the current defrost period, a defrost restart will occur. For example, defrost restart will restart defrost if there is an icing problem with a case.

Defrost Start Times: The Defrost Start Times setpoints are six separate time fields. They are set as **HOURS: MINUTES** (military time).

IMPORTANT

[00:00] is not a valid field!
To set defrost at midnight enter [24:00].

Defrost Term Input: The Defrost Term Input is available when configured for time/digital defrost termination. If this input is assigned, defrost will terminate when it is closed. This input must be open at the Defrost initiation time for defrost to occur.

Defrost Term Setpoint: The Defrost Term Setpoint is a temperature setting. If all Term Sensors are greater than this setpoint, refrigeration defrost will terminate BEFORE timing out. For the defrost term setpoint to be active, the system must be configured for temperature, a Term sensor must be assigned and this setpoint (defrost term) must be assigned.

Defrost Time: The Defrost Time setpoint is the maximum time a *normal-time initiated, normal defrost* will last UNLESS it is terminated by temperature or digital input.

Defrost/Suction/Liquid Verify Input: Def vrfy inpt (Defrost Verify Input), **Suct vrfy inpt** (Suction Verify Input) and **Liq vrfy inpt** (Liquid Verify Input) are digital inputs used for proof of run verification. If a system is in defrost or refrigeration, the corresponding digital contact should be closed.

Dew point Controlled Skip: A dew point temperature. It is selected on the Circuit Configuration Screen. When it is selected, the data fields **Skip defr @dp** and **Max dp skips** are added to the Circuit Setpoint Screen. The **Skip defr @dp** field is a setting that will allow the system to inhibit or skip the next defrost cycle if the dew point temperature has been below it for the interval between a complete defrost cycle. The **Max dp skips** field sets the maximum number of times that the dew point will be permitted to skip the defrost cycle before the system goes into mandatory defrost.

Dew point Sensor: An input that is only available when configured for dew point controlled skip. This input value will be referenced by the RC-2000 to determine if defrost should be skipped based on current store dew point temperature.

Equalize Relay: Controls the equalize valve (use with N/O contacts). The circuit must be configured for Equalize Phase for this relay to be available.

Equalize Time: The time allowed for equalizing pressures when the Equalize Phase option is configured. Following a defrost cycle, the equalize relay will be energized for this period before normal refrigeration control is resumed.

Evaporator Fan Relay: (Evap fan rly) Controls the evaporator fan (use with N/C contacts). The circuits must be configured for EVAP FAN control for this relay to be available.

Evaporator Fan Start: A temperature setting. It will hold the evaporator fan off after defrost until the termination sensors fall at or below this temperature. If this temperature setpoint is not reached, the fan will start after the evaporator fan delay time has expired as a fail-safe to ensure a fan restart.

Evaporator Fan Delay: (Evp Fan Dly) The maximum time after a defrost that the evaporator fan will stay off, *see Evap fan start*.

High and Low Alarms: Temperature alarms for the circuit. If their value is exceeded in either direction (greater than high or less than low) for the time assigned to the alarm delay, an alarm will be generated. These setpoints will only be activated when an alarm sensor is assigned to the circuit. If more than one is assigned, the lowest temperature will be used for the low alarm, and the highest temperature will be used for the high alarm.

Individual Case Defrost Relays: Available when configured for Multi-Case Defrost. All of these defrost relays will initiate defrost from a single defrost schedule for the circuit. Each defrost relay references an individual termination sensor thus terminating defrost from that valve. The defrost relay is paired with the term sensor input that is in the same row on the setpoint screen. For example, the first relay in the first row is associated with the first termination sensor in the first row. The second relay in the first row is associated with the second termination sensor in the first row.

Liquid Relay: Liquid Relay is used for controlling the liquid line solenoid on a circuit (use with N/C contacts). The RC-2000 can be configured to use only a liquid relay or both suction and a liquid relay.

Master Hot Gas Relay: (Mstr Hgas rly) Controls the hot gas defrost valve (use with N/O contacts). The circuits must be configured for the Hot Gas option for this relay to be available.

Max Cut in: The rack setpoints will float (up to the **Max Cut in** setpoint on the Rack Setpoint Screen) only if the priority 1 circuit is satisfied. If the priority 1 circuit is in defrost, the rack setpoints will float only if the priority 2 circuit is satisfied, and so on. The rack setpoints will float down to normal when the circuit with priority 1 refrigeration comes on.

Pumpout Time: The time allowed for pumpout when the pumpout phase is configured. When defrost is initiated, the liquid relay will turn off for the programmed time to allow the circuit to pumpout. Afterwards, normal defrost will occur.

Rack Number: Specifies the rack that a circuit uses. The number should correspond to an actual RC-2000 rack number.

IMPORTANT

The **Rack Number** setpoint is used by the software as a key when using the **Defrost Sense** and **Temperature Controlled** setpoints; both are affected by this parameter.

NOTE

When **Floating** setpoints are used, all associated circuits will have the setpoints adjusted to 2°F below the programmed value. The **Rack Cut In** and **Rack Cut Out** setpoints will float up to but not exceed the **Max Cut In** value.

Refrig Delay: The minimum off time between refrigeration relay cycles.

SUGGESTION

Use the **Refrig Delay** setpoint to prevent short cycling of the refrigeration system.

Runoff Time: The period after defrost that the refrigeration relay will be off. Afterwards, normal circuit refrigeration will begin. Runoff time allows evaporator coils to drip off completely before refrigeration begins again.

NOTE

When Pumpout Phase is configured, the Runoff Time setpoint will not be shown.

Suction Relay: Used for controlling the suction line solenoid on the circuit (use with N/C contacts). This relay is available with circuit default configuration.

Temp Compensation Priority: Assigns priorities to each circuit when using floating setpoints on the rack. To enable the Temp Compensation Priority in the Rack Configuration Screen, Temp Controlled Setpoints must be set to [SELECT] or [DEFAULT]. When [SELECT] is chosen, priorities may be assigned to the circuit(s) that will be referenced to float rack suction pressure setpoints. When [DEFAULT] is chosen, the circuit with the lowest setpoint will be referenced to float rack suction pressure setpoints.

CASE SETPOINTS

Alarm Delay: This field is always available in all modes of operation. It is the minutes that an alarm condition must be active at the case before becoming an active alarm.

Alarm1-4: Assign channel numbers for up to four alarm sensors. The alarm sensor channel numbers will be used for comparison to the Hi and Lo alarm setpoints.

ASH Hi: A temperature setting always available for programming. The anti-sweat heaters will be on for the entire ASH duty cycle when the dew point temperature falls below this setpoint value.

ASH Lo: A temperature setting always available for programming. The anti sweat heaters will be off for the entire ASH duty cycle when the dew point temperature falls below this setpoint value.

ASH Period: This field is always available in all modes of operation. This is the time in minutes that the ASH algorithm will use to cycle the case anti-sweat heaters. The ASH cycle is determined using the following formula:

ASH Cycle Formula to determine ASH cycle time:

ASH ON TIME:

$$\frac{[(\text{Actual Dew point Temp}) - (\text{ASH Lo Setpoint})]}{[(\text{ASH High Setpoint}) - (\text{ASH Lo Setpoint})]}$$

multiplied by

ASH Period Setpoint

= # OF MINUTES OF ASH ON TIME.

NOTE

ASH OFF TIME = (ASH period – ASH on time).

Copy Master Schedule Now?: This field enables you to copy the schedule entered in to the Master Config Screen if you enter [YES]. Leave this field [NO] to customize the time schedule.

Cut in: Assigns the temperature on which refrigeration will cycle on. It is always available.

Cut out: Assigns the temperature on which refrigeration will cycle off. It is always available.

DchCtrl: The Discharge Sensor that will be averaged with other Control Sensors to cycle the case based on the control setpoint.

DchMon: The Discharge Sensor that is assigned as a monitoring point only.

NOTE
The **DchMon** setpoint will have no effect on the control of the case.

Defrost Duration: This field is always available in all modes of operation. It is the maximum time in minutes that a defrost cycle will occur. If the defrost doesn't terminate on temperature or input, this is the final and highest level condition that will terminate the cycle.

Defrost Min On Time: This field is always available in all modes of operation. It is the minimum period in minutes that a defrost cycle will occur even if the temperature of defrost termination input calls for the defrost cycle to terminate. The defrost cycle will have to meet this minimum time requirement prior to terminating.

Defrost Start Times: These setpoints are six separate time fields that are set as **HOURS: MINUTES** (military time).

IMPORTANT
[00:00] is not a valid field. To set defrost at midnight enter either [00:01] or [23:59]

Defrost Term: A temperature setting. If all **TERM SENSORS are greater than this setpoint**, refrigeration defrost will terminate **BEFORE** timing out. **For the defrost term setpoint to be active,** the system must be configured for temperature, a Term sensor must be assigned and the defrost term setpoint must be assigned.

DefTerm1-4: This setpoint enables you to assign channel numbers for up to four defrost termination sensors. The defrost termination sensor channel numbers will be used for comparison to the termination setpoints.

Evap TD: This setpoint is **ONLY AVAILABLE** when selected for the **EEV (pulse type expansion valve)** or **SEEV (stepper drive expansion valve)**.

NOTE
The Evap TD setpoint is the target for the electronic expansion valve algorithm. The Case Controller will take the difference of the Refr In-Refr Out sensors and cycle the valve to target the TD setpoint.

High and Low Alarms: Temperature alarms for the case. If their value is exceeded in either direction (greater than high or less than low) for the time assigned to the alarm delay, an alarm will be generated. These setpoints will only be activated when an alarm sensor is assigned to the case. If more than one is assigned, the lowest temperature will be used for the low alarm, and the highest temperature will be used for the high alarm.

Interlock On Time: (Intlk On Time) This field is only available when the Intlk Switch Action is set for [time]. It is the time in minutes that the interlock action (i.e., refrigeration off, case off) will remain active after the case control senses a momentary closure of the door interlock switch.

Interlock Switch: (Intlk Sw) Assigns the channel number for the digital input connected to the door switch or case cleaning switch.

Light ON Times: Separate time fields in which the case lights are on. They are programmed in military time.

Offsets for Low Temp: Available when Aux Refrig Control is selected for Medium Temp. The setpoint for Cut in and Cut out and High and Low Alarm will be offset by this setpoint and used for control and alarming when in the low temperature mode of operation.

NOTE

[Medium Temp] is a dual temperature control mode.

The case will operate in low temperature mode when the dual temperature switch is closed.

Only **NEGATIVE offset values** can be **entered** for this setpoint.

Offsets for Medium Temp: Available when Aux Refrig control is selected for low temperature. The setpoints for Cut in/Cut out and High and Low Alarm will be offset by the value of this setpoint and used for control and alarming when in the medium temp mode of operation.

NOTE

Low temperature is a dual temp control mode.

The case will operate in low temp mode when the dual temp switch is closed.

Only **POSITIVE offset values** can be **entered** in the **High and Low Alarm** field.

Offsets for Second Evap: This setpoint **IS AVAILABLE** when **Aux Refrig Control** is set for **Dual Evap**. Its range is [(-40° to 97°F)]; the default setting is [00].

NOTE

If the default setting is active, both evaporators will function from the same setpoint values.

The value of this setpoint will offset the entered setpoints for Cut in/Cut out and High Alarm and Low Alarm for operation of the second evaporator. The Control Alarm and Defrost Term sensors are grouped by evaporator, which allows each evaporator's sensors to reference the appropriate setpoints. (The

value driven by the second solid state output on the 3 Chan SSR daughter board, ECI Part # 5120045404 is for Evap 2.)

Refr In1: Enables you to assign the channel for the number one evaporator coil inlet sensor. The sensor is used only to calculate the evaporator coil TD.

NOTE
The Refr In1 field must be used with EEV or SEEV control.

Refr In2: This field enables you to assign the channel for the number two evaporator coil TD.

NOTE
This field must be used with Dual EEV or Dual SEEV control.

Refr Out1: This field enables you to assign the channel for the number one coil outlet sensor. The sensor is used only to calculate the evaporator coil TD.

NOTE
The Refr Out1 field must be used with valid EEV or SEEV control.

Refrig Off Time: This field is always available in all modes of operation. It is the minimum time in seconds that the refrigeration will remain off after the case satisfies on the temperature setpoint.

RtnCtrl: The Return Sensor that will be averaged with other Control Sensors to cycle the case based on the control setpoint.

RtnMon: The Return Sensor that is assigned as a monitoring point only.

NOTE
The **RtnMon** setpoint will have no effect on the control of the case.

Runoff Time: The period after defrost that the refrigeration relay will be off. Afterwards, normal case refrigeration will begin. Runoff time allows evaporator coils to drip off completely before refrigeration begins again.

NOTE
When Pumpout Phase is configured, the **Runoff Time** setpoint will not be shown.

SpcCtrl: The Space Sensor that will be averaged with other Control Sensors to cycle the case based on the control setpoint.

NOTE
At least one Ctrl (control) of any type is needed for all case applications.

SpcMon: is the Space Sensor that is assigned as a monitoring point only.

NOTE

The **SpcMon** setpoint will have no effect on the control of the case.

Temperature Controlled Setpoints: When default is selected on the Rack Configuration Screen for Temp Controlled Setpoints, the circuit with the lowest setpoint must be satisfied for the rack setpoints to float. When the circuit with the lowest setpoint goes above that point, the rack setpoints will float back down, but will not go below the standard cut in and cut out values.

Temperature Setpoint: A single setpoint that represents the cut out temperature of the circuit.

NOTE

When temperature deadband control is selected in circuit configuration, the **Temp Setpoint** will be replaced by **Cut In** and **Cut Out Setpoints**.

Temperature Sensor: Inputs that are used to compare against the circuit temp setpoint to cycle refrigeration. The RC-2000 can be configured for six or twelve input sensors. One to twelve temperature sensor inputs can be assigned to be used for each circuit. The RC-2000 will average the values of all assigned temperature sensors.

Termination Sensor: Input that is a temperature assignment for a defrost term sensor. Up to six or twelve term sensors can be assigned, depending on the number of sensors configured. The termination sensors are used to terminate the defrost cycle by temperature, restart the evaporator fan, and restart defrost depending on circuit configurations. For defrost termination to occur, all term sensors must exceed the term setpoint. For evap fan start to occur, all term sensors must fall below the Evap Fan Start Temperature. For Defrost Restart to occur, all term sensors must fall below the defrost restart temperature in the defrost period.

RACK SETPOINTS

Alarm Delay: The period that must pass after an alarm condition has been met before an alarm will be logged.

Alarm Relay: The relay assignment that will be activated upon an alarm condition logged by the RC-2000 (use N/C contacts). The suction and head columns may operate with independent alarm relay or with the same alarm relay.

Ambient Sensor: The analog input temperature sensor that will be used for monitoring the outdoor ambient temperature. It will be used only if Temperature Differential for head pressure control or split condenser control are configured in the Rack Setpoints screen. You may assign either high or low temperature sensors in this field unless the TD Head Pressure Control is configured for WET B. When the TD Head Pressure Control is configured for WET B, the ambient sensor is restricted to high temperature only.

Analog Liquid Level Sensor: Only available when the Refrigerant Liquid Level is configured for analog. There are two types of inputs that are accepted for this sensor, 1-6V and 0-10VDC. (Refer to the sensor specifications and the *RC-2000 Installation Manual,* Form No. 4464402700, Version 4.32 for hardware hookup procedures.) If using a 0-10V input type, ensure that the board channel setup is set to 0-10V type prior to programming this assignment.

Aux Cut in/Aux Cut out: Setpoints that are used when the Auxiliary Enable Digital Input Contacts are CLOSED. Compressor and Condenser Control each contain an Aux Cut in and Aux Cut out setting. Each of the Aux Cut in and Aux Cut out setpoints has only one Aux Enable Input. If the setpoints are left in the default 000p state, the Aux setpoint will not enable for that control type.

Aux Enable Input: The digital input that when closed, will activate the **Aux cut in** and **Aux cut out** setpoints. The RC-2000 will immediately react to the new setpoints. When this input is active, a reverse video 'A' will appear next to the setpoints field on the Rack Status Screen.

Capacity Values: These values (HP, BTU, or a percent) should be proportional for all the compressors used. For example: if three compressors at 7.5hp are used, use 75 for all three since 7.5 cannot be entered as a Capacity value. Further, if a Variable Speed compressor is used at a capacity of 10 hp, use 100 as its capacity for compatibility with the fixed compressor capacities. Generally, higher numbers for Variable Speed Capacity, (multiply actual capacity by 10), provide finer control of the Variable Speed Compressor.

Compressor Relay Assignments (1-8): Compressor Relay Assignments (1-8) are available. If [SEQUENTIAL] operation is selected, they should be entered in the order in which they are expected to operate. When using variable speed compressors, sometimes the first assignment is skipped so that it is easier to interpret the status screen. However, if any other places are skipped, the compressor operation will stop at the last valid entry.

Condensing Pressure Sensor: Only available when TD Head Pressure Control is set for [PRES]. A high pressure transducer senses discharge pressure, converts it to a temperature, then uses it to determine the TD in relation to the ambient temperature.

Condensing Temp Sensor: Only available when the TD Head Pressure Control is set for [TEMP]. A high temperature sensor will sense the temperature of the drop leg or condensing sensor and then will be used to determine the TD in relation to the ambient temperature.

Control Gain: Regulates the response of the RC-2000 to changes in suction and head pressures. Typical starting values are [10] for suction and [100] for head. The higher the gain, the faster the RC-2000 will respond and calculate capacities. A Control Gain value must be set in order for the system to operate. For optimum performance, ECI recommends that these values be tailored to suit the particular compressor installation. The **minimum value** is [000] and the **maximum value** is [255].

NOTE

If TD head pressure control is being used, the recommended Control Gain on the head side is [25]. This will be used when the temperature is in control. Should the need arise to control with the pressure setpoints, the Control Gain will be four times higher (i.e., 100).

Controller Address: Consists of eight assignments. The assignments are a communication address value for an Echelon interface with the Encore ESC-200/Bitzer Screw Compressor Control Module. Each individual compressor (i.e., 1-8) relay assignment is in direct order with its controller address assignment. These devices are assigned here and then will be installed via the LonNetwork utility accessed through the Main Menu of the RC-2000.

Once these devices are assigned, the Rack Status Screen will indicate it by displaying a dash on the ESC Units Line for each assigned module directly beneath the corresponding compressor. If there is an alarm condition on the module, it will be indicated there by an [A] symbol and the appropriate alarm will be logged.

The Rack Status Screen will display a [_] below the associated compressor unit, noting that an ESC-200 is assigned to it. If this module is in alarm, it will display an [A] in the place of the dash indicator for that compressor/module and enter the alarm into the alarm log.

The ESC-200 alarm interface does not honor any alarm time delays if the module is in alarm it will be entered into the log immediately. The RC-2000 has a dial out capability for each of these alarms and the alarm relay assigned to the suction alarm will de-energize if an ESC-200 is in alarm.

The Compressor/Module number that is in alarm condition will be indicated by a C# prior to the following descriptions in the alarm or event log.

The alarms received from the ESC-200 will be as follows:

MOTOVR	Motor Overload
OIL FLW	Oil Flow
OIL LVL	Oil Level
GAS TMP	Discharge Gas Temperature
PHASE	Phase Failure
ROTATE	Rotation Failure
RUN PRF	Run Proof

Cut in & Cut out: The **Cut in** and **Cut out** fields set the general operating pressures of the rack. They are a PSI value. The **Cut in** value must be higher than or equal to the **Cut out** value.

Defrost Sense Input: Only available when Defrost Sense Input is configured for [EXTERNAL]. If this input contact is CLOSED, the RC-2000 will lock on the compressor with the smallest capacity to ensure that ample pressure is available for Hot Gas Defrost operation. If Defrost Sense Input is configured for [INTERNAL], the RC-2000 will lock on the smallest compressor stage when any hot gas circuit is in the defrost cycle.

Derivative Gain: A setting through which the RC-2000 senses the direction and magnitude of pressure changes. It is useful when the unit experiences sharp rises and falls of pressure. Typical values should start at four times the Control Gain. The higher the Derivative Gain, the faster the RC-2000 will respond and calculate additional capacities. For optimum performance, it can be tailored to suit the particular compressor installation. This feature is optional. If you do not want to set a Derivative Gain, set the fields to [000] and the maximum value to [255].

Head Override: This setpoint sets a high pressure point that, if exceeded, starts an orderly shutdown of the compressors. As this setpoint is exceeded, the suction percentage required decreases, allowing the compressors to shutdown. The higher the compressors are above this setpoint, the faster they will shutdown. When the head pressure drops below the head override setpoint, the compressors will be allowed to return to normal operation.

High Alarm & Low Alarm: These setpoints are values that when exceeded, will cause an alarm in the RC-2000. These alarms will honor the alarm time delay.

HR Override Delay: A time setting. The liquid level must be below the HR override level for the period of this setting before an HR override action occurs.

HR Override Difference: A liquid level percentage. The liquid level must exceed it (HR override level + HR override diff) before the HR override relay is returned to normal operation.

HR Override Level: A percent value that the liquid level must be below for the specified time for the HR override relay to de-energize, placing the system into an effective heat reclaim bypass.

HR Override Relay: The relay that will be de-energized when the liquid level in the receiver falls below the HR Override Level. The HR Override Delay will be active before the relay is de-energized. The relay will energize when the liquid level returns above the HR Override Level plus the HR Override Diff.

Follow these guidelines to set up the HR Override Relay:

- Use **NO contacts** for **valves** that are **energized** for **heat reclaim**.
- Use **NC contacts** for valves that are **de-energized** for **heat reclaim**.
- **Hook it up in series** with the device operating the heat reclaim, (i.e., the EC-1000 relay output).

Ignore Temperature Below: Only available when the RC-2000 is configured for a minimum of one case control. If a pressure value is entered in this field, the RC-2000 will not send a suction temperature update to the Case Controllers when the actual suction pressure is less than the setpoint.

Liquid Level: This input is only available when the Refrigerant Liquid Level is configured for digital. This assignment is used only when the liquid level sensor is a dry contact digital type sensor. If the contacts are closed, an alarm will be generated by the RC-2000 and a reverse video block with a Small Capital T will be visible in the status screen to the right of the suction pressure reading.

Liquid Level Alarm: A percent value. When the analog liquid level sensor falls below it, an alarm will be generated.

Max Cut in: A value is used to determine a maximum pressure for the system to operate under when floating setpoints are used. See the *Rack Configuration* section for a control method description.

Min Ambient Temp: This setpoint is available when the TD Head Pressure Control is set for TD or Press. This setpoint is the minimum value that will be used in the TD equation for ambient temperature.
[(Condensing Temp) – (Ambient Temp) = TD].

Minimum on & Minimum off times: Time settings that supply time delays for short cycle protection of the compressors and condenser fans. The default settings are thirty seconds [30s] for compressors and zero seconds [0s] for condenser fans.

Minimum Wet Bulb Temp: A temperature setting, available when the TD Head Pressure Control is set for [WETB]. This setpoint is the minimum value that will be used in the TD equation for the calculated Wet Bulb Temperature. [(Sump Temp) – (Wet Bulb Temp) = TD].

Minimum Difference Oil Pressure [Min diff oil pres]: The value used to alarm on a low oil condition. The RC-2000 calculates the difference of the [(Oil Pressure) and (the Sump Pressure or Suction Pressure)], see above. If that value is less than the [Min diff oil pres], an alarm is generated.

Oil Failure Input: A digital input used to monitor rack oil pressure. This is a monitor only input, no action will occur on rack components. An alarm will be logged upon opening the contacts. All oil fail contacts should be connected in series such that any failure will open the digital input. When the contacts are closed, the alarm condition will clear.

Oil Pressure [Oil pres]: Inputs that are used for analog input from pressure transducers monitoring the compressor oil pressure. They range from 0 to 100 lbs. using the SA-100 transducers.

Percent Increase: A percent setting. It is only available when the TD Head Pressure Control is set for [WETB]. It is used as an anticipator for the water-cooled condenser control strategy. If the discharge pressure is greater than the Variable Speed Pressure Override setpoint, the actual capacity will increase by the amount of this setpoint, anticipating a load increase on the water-cooled condenser. Generally, it is recommended to set this at ten percent, but it is adjustable, as the user deems necessary.

Phase Loss Input: A digital input. When it is opened, it will shut down all compressors and associated circuits as defined by the **Circuit Setpoint Screen**. Ensure that this input is closed when all phases are present for operation.

Positive Derivative Gain: Available when the TD Head Pressure Ctrl is set to Wet B. This is the active derivative gain setpoint when the TD is increasing in this mode.

Pressure Sensor: A PSI value. The analog input the pressure sensors are connected to on the termination boards govern the value assigned. Suction pressure is used with a 100 psi transducer; head pressure is used with a 500 psi transducer.

Pressure Control: A pressure setting. It is only available when TD Head Pressure Control is set for [WETB]. This setpoint determines the manner that the eight discharge pressure inputs are used in the water-cooled strategy. The default is [AVG], which will average up to eight discharge pressure inputs for control. The other option is [MAX], which will take the maximum pressure of the eight pressure inputs to use for control.

Refrigerant Type: A setpoint used with temperature differential condensing control and case control electronic expansion valve control. It enables you to select the refrigerant look up table that will be used to determine the discharge pressure temperature for the control strategies listed above. The default setting is [R-22].

RH Sensor: An I/O assignment. It is available when the TD Head Pressure Control is set for [WETB]. The RH Sensor is an ambient sensor that is connected to one 0-10V input. The setpoint value is used in conjunction with the ambient temperature to calculate the Wet Bulb temperature.

Run Input [Run Inpt]: Used for digital proof of run contacts for each compressor. The RC-2000 expects closed contacts when the compressor runs and opened contacts when the compressor turns off. There is a five minute delay incorporated for this input. If the compressor is called to be on for five minutes without sensing a Run Input Closure, an alarm will be generated. The alarm log will indicate a C# prior to the description to indicate the compressor number in alarm. The alarm will not clear from the log until the compressor is being called for and the Run Input is closed.

Shutdown: Allows shutdown of all compressors on the rack if the suction pressure falls below it. Normal operation will resume when the pressure rises above the shutdown value. The compressors must honor the min off time before restarting. The minimum value for proper operation is [001 PSI]. To disable this feature, set the shutdown value to [000 PSI].

Split Cut in Temp: A temperature setting. It is only available when the system is configured for Split Condenser. If the ambient temperature is less than this setpoint, the split condenser control becomes the active control. The Split Cut in Temp default setting is [50°F].

Split Cut out Temp: A temperature setting. It is only available when the system is configured for Split Condenser. If the ambient temperature is greater than this setpoint, the split condenser control becomes inactive. The default setting is [55°F].

Split Minimum Off Time: A time setting. It is only available when the system is configured for Split Condenser. If the condenser control changes from the split mode to the full condensing mode, it will remain in the full condensing mode for the minimum time set via this setpoint.

Split Override Pressure: A pressure setting. It is only available when configured for split condenser. If the discharge pressure is greater than this

setpoint, the split condenser control will be overridden, thus putting the condenser back to the full condensing mode of operation.

Sump Pressure [Sump pres]: Inputs that are for analog input from pressure transducers monitoring the compressor sump oil pressure. They range from (0 to 100 lbs.) using the SA-100 transducers. If no sump transducer is assigned, the oil pressure will be calculated using the suction pressure transducer.

Sump Temp Sensor: Only available when TD Head Pressure Control is set for [WETB]. It is a high temperature sensor that will sense the temperature of the sump in a water cooled condenser, which then will be used to determine the TD in relation to the calculated ambient wet bulb temperature.

Temperature Differential Cut in & Temperature Differential Cut out: A temperature setting. It reflects the desired maximum difference of the condensing temperature minus the ambient temperature. If the difference in temperatures is greater than this setpoint, the condenser fans will begin to calculate percent required and stage on. When the temperature difference is less than this setpoint minus the Temp Differential Cut out, the condenser fans will stage off. The Temp Differential Cut out can be set to [00] to allow a single setpoint control strategy.

The Cut in and Cut out setpoints for standard head pressure control should be set as outside boundaries when using TD Diff Cut in and TD Diff Cut out setpoints. If the discharge pressure value goes beyond the standard Cut in and Cut out pressures, the TD Diff Setpoints control will be replaced by the standard pressure setpoints and the standard discharge pressure value.

Unit Combinations: The method of sequencing compressors and condenser fans on the RC-2000. They are set as Sequential [SEQ] or Alternating [ALT]. Sequential Mode brings the stages on from left to right, and brings them off from right to left. In Alternate Mode, the RC-2000 alternates stages based on run times and required capacity.

Unloaders: The number of **unloaders** provided for the compressor assigned directly above it. The RC-2000 then assumes that the next Unloaders number of compressors is actually Unloaders. For example, Compressor 1 (10hp total) has four unloaders (each has 1/5 total capacity) relay assignments 1-1 through 1-5, Compressor 3 (15hp) and 4 (15hp) have no unloaders, relay assignments 1-6 and 1-7. The assignments would be:

Compr	1	2	3	4	5	6	7	8
Relay	1-1	1-2	1-3	1-4	1-5	1-6	1-7	0-0
Capacity	020	020	020	020	020	150	150	000
Unload-ers	4	0	0	0	0	0	0	0

The RC-2000 will not allow a programmed unloader to come on without its master compressor on first.

Variable Speed Pressure Override: A pressure setting. It is available when the TD Head Pressure Control is set for [WETB]. If the discharge pressure exceeds the value of this setpoint, the Variable Speed Condenser will override to one hundred percent (100%) of full speed.

Wet Bulb Pressure Sensors: An option in the control software that consists of eight pressure transducer assignments. They are only available when the TD Head Pressure Control is set for [WETB]. These discharge pressure inputs will be used as the pressure reference for the Wet Bulb/Water Cooled Condenser control strategy. The pressure inputs used for reference will be either the highest or the average, as determined by the Pressure Control Setpoint.

VARIABLE SPEED COMPRESSOR SETPOINTS

Analog Output: The output assignment for the 0-10VDC analog output card that is connected to the inverter. This output is used for speed reference and is proportionally outputted in relation to the maximum and minimum RPM settings. This assignment is not available if the Inverter Address setpoint is assigned.

Compressor Inverter Capacity: The Compressor Inverter Capacity for Variable Speed Control uses the same capacity setup as that for fixed compressors. The higher the capacity, the more defined increments for the V.S. output.

For example:

Cap = 10	Max RPM = 1750
V.S. steps 175 RPM	
Cap = 100	Max. RPM = 1750
V.S. steps 17.5 RPM	

Control Relay: Used to control the main power contactor for the inverter. The control relay is energized whenever the analog output is active (use N/C contacts). This control is generally routed through the switchover relay to allow for switchback if there is an inverter failure.

Current Sensor: Used for an external monitor of the operating current of the V.S. compressor. The signal should be 0-10VDC. This assignment is not available if the Inverter Address setpoint is assigned.

Fan Relays Main Bank/Bank A: Six fan relays that are always available for assignment. The functionality of these six relays is the same in all condenser configurations. The six fan relays will cycle on and off according to the required capacity for the condenser control. These relays will cycle on and off in the same manner during full condensing and split condensing mode of operation.

Fan Relays Split Bank/Bank B: Six fan relays. They are only available for assignment when configured for twelve fan operation. These relays will always cycle in unison with the corresponding relay in the Main Bank/Bank A. This type of cycling allows the user to control each fan with an individual relay but still uses the fan bank control method. During Split Condenser mode of operation, this bank of fans will not cycle on.

Fault Input: The Fault Input accepts a digital fault signal from the inverter. If the contacts are closed, the RC-2000 will attempt to reset the inverter using the reset relay. This assignment is not available if the Inverter Address setpoint is assigned.

Frequency Sensor: Used to externally monitor the operating frequency of the inverter. The signal should be 0-10VDC. This assignment is not available if the Inverter Address setpoint is assigned.
Inverter Controller Address: This address is set up in the same manner as listed before for the Compressor Controller Address for the ESC-200/Bitzer Screw Compressor Module. When the address is assigned to this setpoint, the alarms will be referenced as Comp Inverter alarms in the log instead of a compressor number.

Maximum RPM: The maximum value of RPM for the compressor under Variable Speed Control. This corresponds to the maximum output of the analog out card (10VDC). The maximum value allowed is 5000 RPM.

Minimum RPM: The minimum value of RPM for the compressor under Variable Speed Control. The compressor will never operate below this RPM. The Variable Speed (V.S.) compressor will shut down only when the required capacity is at zero percent.

Reset Relay: Used to send a reset signal to the inverter. If a fault is detected from the inverter, the reset relay will pulse three times in twenty seconds and attempt to get the inverter running properly. If after three resets the inverter is still in a fault condition, the inverter will go into switchover mode. This assignment is not available if the Inverter Address setpoint is assigned.

Run Input: A digital input that is used for proof of run verification of the V.S. inverter. If the contacts are closed, the compressor is assumed to be running. If the run input does not match the actual run condition of the compressor, an alarm is generated. This assignment is not available if the Inverter Address setpoint is assigned.

Run Input A: Six inputs that are the Run Proof Inputs for the six fan relays from the Main Bank/Bank A. The Run Proof will alarm if the fan is being called to be on and the input for the proof is not closed for five minutes. The alarm will log as a [F# Verify] in the alarm log with the # representing the number of the fan bank.

Run Input B: Six inputs that are the Run Proof Inputs for the six fan relays from the Split Bank/Bank B. These inputs are only available when configured for Run Verification and twelve fan operation.

Split Control Relays: Two are available only when the system is configured for Split Condenser Control. They will become energized when the RC-2000 calls for split condenser control. One of these relays is generally used to bypass condenser piping and the other is used to electrically bypass the fan control for the split bank when using the six fan relay condenser control. If using the twelve fan control method, the second split relay will not be needed for the electrical bypass.

Switchover Relay: Used to bypass the inverter control and run the inverter as an on/off compressor. If the inverter has a fault and does not recover, the switchover relay will be set on and the external bypass relay will control the

compressor. This relay can be connected either N/O or N/C as configured in the rack configuration.

Variable Speed Condenser Fan

Setpoints that are available for a system that is configured for Variable Speed Condenser control. They have the same functionality as the Variable Speed Compressor Control. However, the Variable Speed Condenser Control does not support all of the functionality of the Variable Speed Compressor Control. The following list supplies the setpoints available for Variable Speed Condenser Control. Please refer to the Variable Speed Compressor control descriptions printed earlier in this section.

Inverter Address	Control Relay
Max RPM	Reset Relay
Min RPM	Switchover Relay
Analog Output	Fault Input

Power Sensor: A 0-10VDC input from a kW watt transducer that is generally installed in the rack to monitor power usage.

Max Power: This field is a scale factor that is used to calculate instantaneous kW usage. The Max Power setpoint will vary according to the model and voltages of the kW transducer and the CTs that are installed. The table below provides a list of the transducers, the *RC-2000 Installation Manual*, Form No. 4464402700, Version 4.32 provides detailed hook up procedures.

Transducer Model Number	Rating	Maximum kW
CC/20106400	208V, 3 Phase, 3 Wire	.36 x (CT size)
CC/20106401	480V, 3 Phase, 3 Wire	.83 x (CT size)
CC/20106402	208V, 3 Phase, 4 Wire	.36 x (CT size)
CC/20106403	480V, 3 Phase, 4 Wire	.83 x (CT size)

Associated Low Temperature Rack: This rack interlocks the rack to another for lock out purposes. It is intended for two stage systems. If the medium temperature rack compressors are not running, the low temperature rack will be locked out (all compressors off). This number should be set on the medium temperature rack. On the associated low temperature rack, this field will show [N/A].

TRADEMARK INFORMATION

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