# EC-2 Case Controller Installation and Programming Guide

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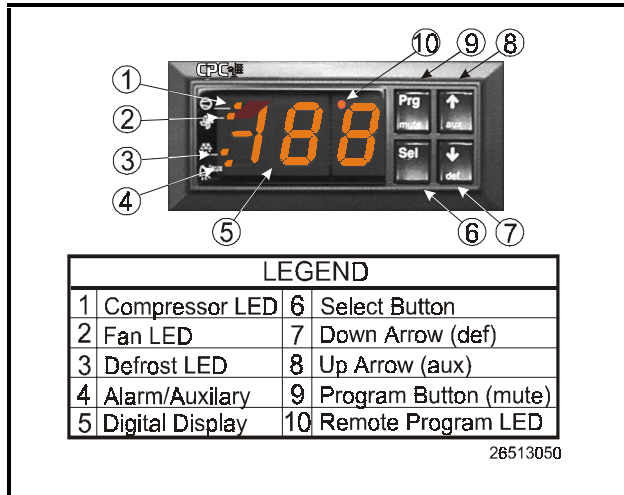
# 1    Hardware

## EC-2



**Figure 1-1** - *Front Panel Detail*

The EC-2 (*P/N 819-3600*) is an advanced refrigerated case controller that doubles as a temperature and case status indicator. During refrigeration and defrost, the EC-2 controls most typical case functions, including fans, defrost, and a pulse valve on the liquid side of the evaporator to regulate superheat. The EC-2 relies on a parent Einstein to handle logging, alarm control, defrost scheduling, and other case control functions.

The EC-2 is designed to be mounted on the front of a refrigerated case. The LED display shows the current case temperature with one-tenths of a degree's accuracy. The display can also show alarm codes to immediately notify floor managers of alarms and notices. Other lights on the display show the ON/OFF status of refrigeration, defrost, and fans.

The EC-2 can be easily programmed using either the four front-panel buttons or an optional infrared remote control. For security, the buttons can be disabled to prevent tampering.

## 1.1    Recommended Placement

Generally, the EC-2 should be mounted on the top canopy of a refrigerated case, within easy view from the retail floor. It should be postioned in an area that is flat, dry, out of the way of the discharge air stream, and has no risk of encountering condensation. You must insure that the rubber gasket behind the faceplate comes in contact all around to avoid any surface condensation from slipping into the unit.

After the unit is positioned correctly, but before the wiring is installed, push on the supplied bracket (see *Figure 1-2*). Once the bracket is pushed firmly onto the back of the EC-2 it will lock the unit into place. There is no need for further fastening. To remove the bracket from the EC-2, press the two flared ends that are towards the back of the unit inward, and carefully pull it away.

If an EC-2 must be installed in the field, its location should be based on the specific design of the case. *Figure 1-2* will help ensure proper installation.

### 1.1.1    Mounting

EC-2

The hole cut for the EC-2 should be about 2.8 inches long by 1.2 inches tall. This hole is slightly larger than the EC-2's body, but smaller than the face and gasket. Insure that the hole is very close to these dimensions. Also be sure that the unit will have ample room behind it for the wiring harness (see "Wiring Harness" on page 3).
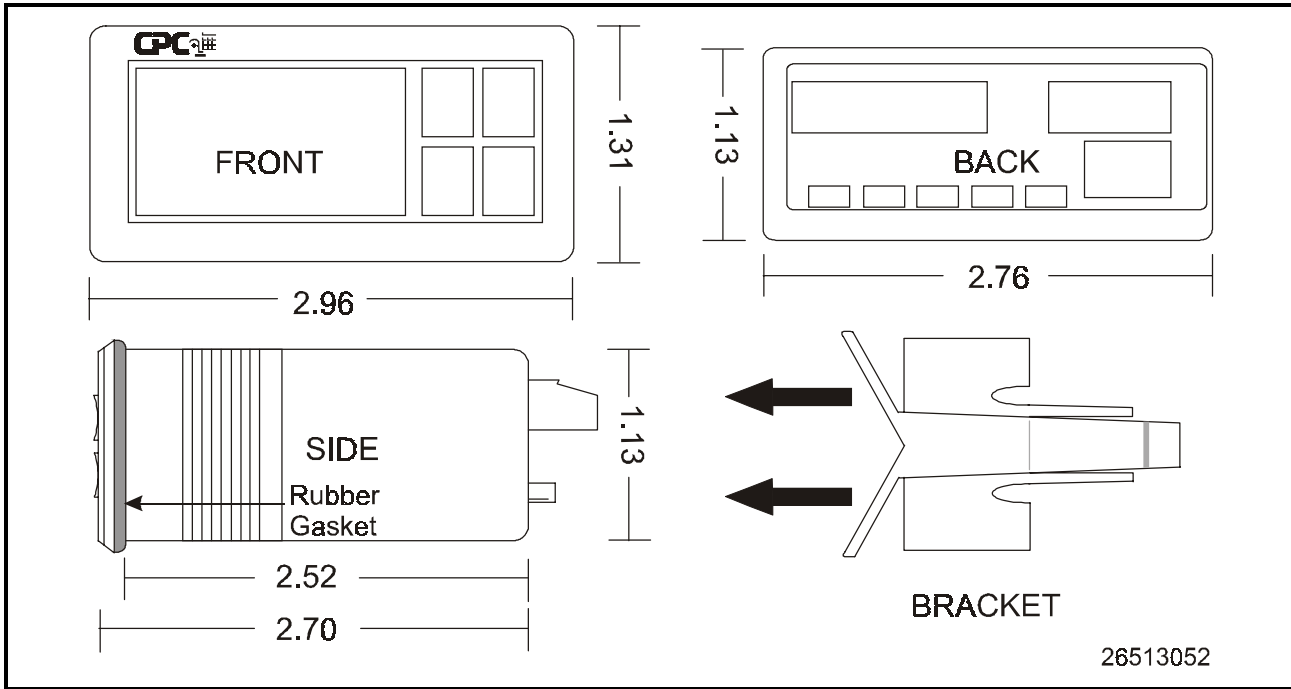
*Figure 1-2* - *EC-2 Dimensions*

### Power Module
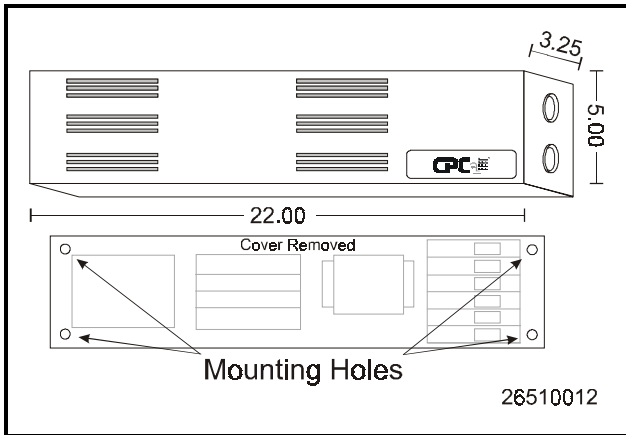


*Figure 1-3* - *Power Module Dimensions*

Power modules of this sort are traditionally mounted behind the lower front cover in a case. Insure that the power cables to it, the wiring harness from it, and all other wires are long enough before mounting the unit.

See *Figure 1-3* for the dimensions of the power module.

# 1.2    Wiring

> *Do not use the center tap of any transformer when powering the EC-2. Do not use a single transformer to power an EC-2 and another I/O board (16AI, 8RO, etc.).*

In most cases, the EC-2 must be connected to a power module (*P/N 816-4200* - Power Module supporting Fan and Defrost; *P/N 816-4201* Power Module supporting Fan only). This module not only powers the EC-2 Controller, but distributes incoming power to fans and electric defrost circuits (if equipped).

The EC-2's power module uses a pre-wired Class 2, 24 VAC (50 VA) transformer with no center tap to power the EC-2. Wiring the EC-2 to the power module is done through a wiring harness and is illustrated in *Figure 1-4*.

## 1.2.1    Wiring Harness
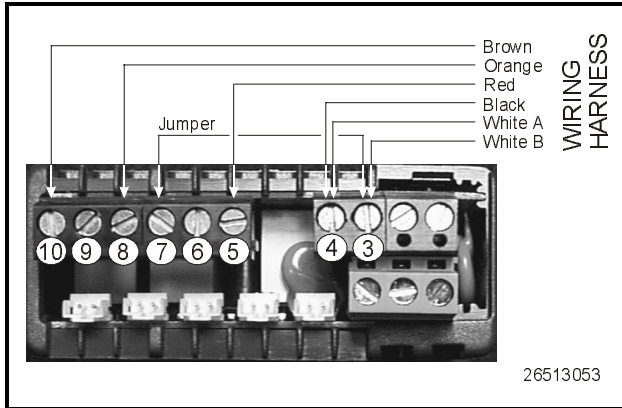


*Figure 1-4* - *EC-2 Wiring Harness Connnection*

The EC-2 has an optional wiring harness (P/N 335-3400) to connect the EC-2 to the power module. This harness not only supplies the EC-2 with power, but interfaces the EC-2 to the fans and electronic defrost circuit (if equipped).

The 20' harness is constructed with 18 AWG color-coded wire with a plug on one end that connects to the power module, while the other end has individual wires (a pigtail) that connect to the EC-2's screw terminals.

Note that in *Figure 1-4* , along with one of the AC connections to terminal #3, there is a jumper wire from this terminal to terminal #7. Also take note that terminal #4 has two wires connected to it. Follow the rest of the diagram to connect the wires from the harness to the EC-2's screw terminals.

## 1.2.2    Sensor and Network Wiring
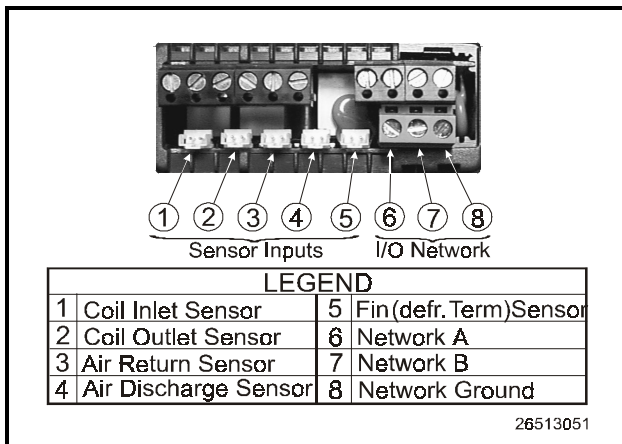


*Figure 1-5* - *Sensor Inputs and Network Wiring of EC-2*

The EC-2 has five sensor inputs for controlling various case functions. Each one of the sensor inputs must be used on order for the EC-2 to operate properly. The EC-2 only

can be equipped with specific sensors that use a special plug.

The part numbers for the sensors are as follows:

| Sensor Type | Part Number |
|---|---|
| Coil Inlet Sensor | 201-1142 |
| Coil Outlet Sensor | 201-1141 |
| Return Air Sensor | 201-1144 |
| Discharge Air Sensor | 201-1143 |
| Fin (defrost termination) Sensor | 201-1145 |

Follow the diagram in *Figure 1-5* to connect the sensors.

### Network Wiring

The EC-2 is designed to communicate with the Einstein RX or REFLECS controllers. The EC-2 sends temperature and alarm information over the Echelon network. Follow the diagram in *Figure 1-6* to connect these wires.

For more information on how to arrange and wire the Echelon network, consult *Einstein RX Refrigeration Controller User's Guide Revision 1 (P/N 026-1601)* or the *Router and Repeater* .
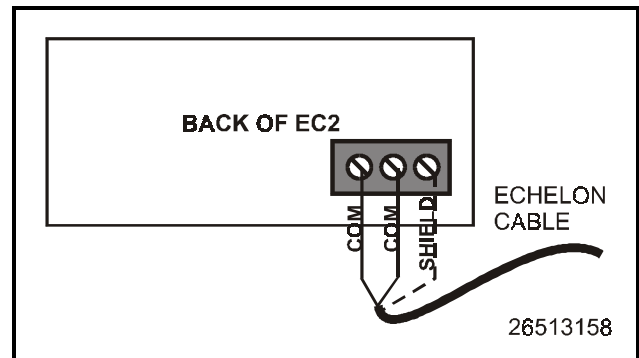


*Figure 1-6* - *EC-2 Echelon Network Wiring*

# 1.3    EC-2 Power Module
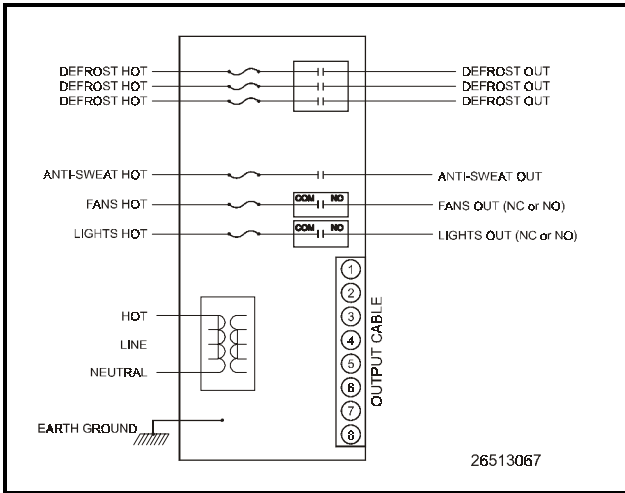


**Figure 1-7** - *EC-2 Power Module Wiring*

The EC-2 power module measures 16.25 inches long by 3 inches wide by approximately 3¼ inches deep. The base plate has one 0.218 inch mounting hole located at each corner.

### Power

The EC-2 power module should be connected to a 120 VAC single phase power source. Complete wiring of the case controller power module is diagrammed in *Figure 1-7*. Follow all local, NEC, and UL wiring practices.

### Size

| Power Module Output Ratings | | | | |
|---|---|---|---|---|
| Output | Volts | Normally Open | Normally Closed | Maximum Fuse |
| Fans | 120 V | ¾ hp | ¼ hp | 15 A |
| | 240 V | 1½ hp | ½ hp | |
| Defrost | 120 V | 30 A (1 or 2 pole) 25 A (3 pole) | | 30 A |
| | 240 V | 30 A (1 or 2 pole) 25 A (3 pole) | | |
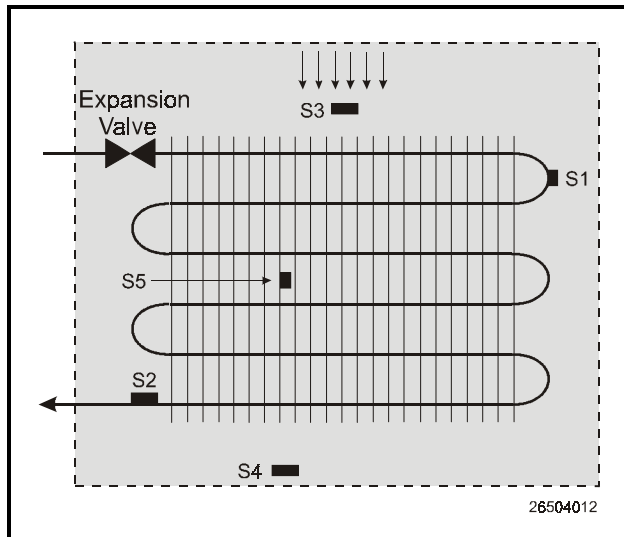
# 1.4    Sensor Location



*Figure 1-8* - *Sensor Locations*

## 1.4.1    Coil Inlet Sensor

Proper location of the coil inlet sensor is critical since valve control is dependent upon accurate measurement of changes to evaporator liquid temperature.  The coil inlet sensor should be located on either the first or second pass through the evaporator (See *Figure 1-8*, S1).  Preferably, the sensor should be placed six inches into the evaporator on the first pass.

Place the coil inlet sensor with the curved surface against the pipe and secure with the included Panduit low temperature cable tie number PLT2S-M120 or equivalent. The tie should be positioned in the groove on the top surface of the sensor. A second tie should be used to secure the lead to the pipe for additional support.

Sensors located on refrigerant tubing should be insulated to eliminate the influence of the surrounding air. A self-adhering insulation that will not absorb moisture is recommended to prevent ice accumulating at the sensor location. For orientation of the sensor on the coil, see *Figure 1-9*.

## 1.4.2    Coil Outlet Sensor

Proper location of the coil outlet sensor is critical since valve control is dependent upon accurate measurement of changes to evaporator discharge gas temperature. The coil outlet sensor should be located on a horizontal section of the suction line, near the evaporator outlet (See *Figure 1-8*, S2). Follow the mounting instructions listed for the coil inlet sensor. For orientation of the sensor on the coil, see *Figure 1-9*.
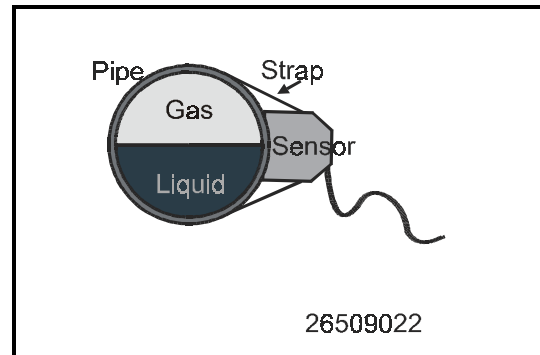


*Figure 1-9*- *Coil Sensor Orientation*

## 1.4.3    Return Air Sensor

The return air sensor measures the temperature of the air coming from the air duct. Position the sensor in the middle of the cabinet, as high as possible (see *Figure 1-8*, S3).

## 1.4.4    Discharge Air Sensor

In general, the discharge air sensor should be located in the air stream leaving the evaporator coil, but just before the air stream enters the food compartment of the refrigerated display case. Place as high as possible. See *Figure 1-8*, S4.

## 1.4.5    Fin Sensor

The fin sensor, or defrost termination sensor measures the amount of frost accumulated on the evaporator. This sensor is placed on the evaporator fins, on the expansion valve side. See *Figure 1-8*, S5.

# 2    EC-2/Einstein Setup

The previous section, EC-2 Hardware Setup, showed how to power up an EC-2 and connect it to the necessary sensors and Echelon network. This section shows how to set up the EC-2 to communicate with an Einstein RX.

## 2.1    Adding EC-2s to Einstein

The first step in making Einstein communicate with EC-2s is specifying the number of EC-2s that will be associated with the Einstein.

New EC-2s can be added to Einstein from the Network Setup screen. To access this screen:

1. Log in to Einstein.

2. Press **F8** followed by **Y** to navigate to the System Configuration menu.

3. Press **4** to select the Network Status/Setup menu.

4. Press **2** to select the Connected I/O Boards & Controllers option. The Network Setup screen should appear (*Figure 2-1*).

```
                    *** NETWORK SETUP ***
        Unit Number (Echelon Subnet) :  0
        Unit Name                     : THIS CTRL

        Boards on I/O Network:

                0    16 AI Boards
                0     8 RO Boards
                0     8 DO Boards
                0     4 AO Boards
                0    IRLDS Controllers

        Unit Controllers (Echelon):

                0    Liquid Controllers (CC100P/CC100LS)
                0    Suction Controllers (CC100H)
                0    Circuit Suction Controllers (CS100)
                0    ESR8-Line Up Boards
                0    TD3-Case Display
                0    EC2-Case Controllers
                0    Echelon 16 AI
                0    Echelon 8 RO

 Enter
 F1:          F2:          F3: DEFAULTS  F4:          F5:
 F6:          F7:          F8:           F9:          F10: NEXT
```

*Figure 2-1* - *Einstein Network Setup Screen*

This screen has several fields where you may specify the number of I/O boards and unit controllers associated with this Einstein. In the field labeled "EC2-Case Controllers," enter the number of EC-2 case controllers that will be associated with this Einstein.

## 2.2    Commissioning EC-2s

In order for any Echelon network device to communicate with Einstein, it must first be **commissioned**. Commissioning is the process of sending an Echelon ID number (unique to each EC-2) to the Einstein so that it can recognize and communicate with the EC-2.

To commission the EC-2:

1. Press **F8**, **Y**, **4**, then **1** to navigate to the Controller Network Configuration screen (*Figure 2-2*).

```
                 Controller Network Configuration

                                        Board#/
 Name        Model            Bus   Subnet Node   Revision  Neuron ID

 RX-300      RX300-Refrig     LON     1     1      1 30B 3   006502019418
 CL.01.002   CC100-Liquid     LON     1     2      0  0- 0
 CL.01.003   CC100-Liquid     LON     1     3      0  0- 0
 CL.01.004   CC100-Liquid     LON     1     4      0  0- 0
 CL.01.005   CC100-Liquid     LON     1     5      0  0- 0
 CL.01.006   CC100-Liquid     LON     1     6      0  0- 0
 CH.01.007   CC100-Suction    LON     1     7      0  0- 0
 CH.01.008   CC100-Suction    LON     1     8      0  0- 0
 CH.01.009   CC100-Suction    LON     1     9      0  0- 0
 CH.01.010   CC100-Suction    LON     1    10      0  0- 0
 CH.01.011   CC100-Suction    LON     1    11      0  0- 0
 CS.01.012   CS100-Ckt Suction LON    1    12      0  0- 0
 CS.01.013   CS100-Ckt Suction LON    1    13      0  0- 0
 CS.01.014   CS100-Ckt Suction LON    1    14      0  0- 0
 CS.01.015   CS100-Ckt Suction LON    1    15      0  0- 0
 CS.01.016   CS100-Ckt Suction LON    1    16      0  0- 0


 Enter Board/Controller : Controller Name
 F1: ADD CTRL    F2: DELETE RCRD F3: NET STATUS F4: NEW IO SCAN F5: CANCEL
 F6: SET ADDRESS F7:             F8: EXPD INFO  F9: HOME        F10: BACK
```

*Figure 2-2* - *Einstein Controller Network Configuration Screen*

The EC-2s you added to the Einstein configuration in **Section 2.1** will be listed somewhere on this screen (the Model field will read 'EC-2 Case Control'). If they are not visible, press the **PgDn** key several times until they are visible.

2. Using the arrow keys, move the cursor so that it highlights the EC-2 you wish to commission. If you wish to change the default name of the EC-2, press the **Del** key to erase the default name, and enter the desired name in the Name field.

3. With the cursor highlighting the name of the EC-2 you wish to commission, press **F6** : SET ADDRESS.

4. A pop-up menu will ask you to select a method for commissioning the EC-2. Select **1** : Pressing 'Service Pin' on controller.

5. A pop-up menu will ask you to enter a wait time period. Press **Enter** to choose the default wait time (one minute).

6. When Einstein prompts you to press the "Service Pin," press the ⬆aux button on the EC-2 and hold it for five seconds. While this button is pressed, the Service Pin LED on the EC-2 will be lit.

7. Verify the EC-2 was properly commissioned. If successful, the "Neuron ID" field for the module will show a number. If unsuccessful, an "ERROR - No controller responded during specified wait" error will be displayed. Check the wiring connections to the EC-2, and go back to **step 3** to try again.

8. Repeat **steps 1 through 7** for each EC-2 to be commissioned.

# 2.3 Associating EC-2s with Case Circuit Applications

EC-2 case controllers must be **associated** with Case Circuit applications in the parent Einstein. The process of association allows the EC-2 to use the Case Circuit's operating parameters, including the temperature set point and defrost schedule.

Before association can take place, the Einstein must have all its Case Circuit applications created and programmed. Refer to your Einstein RX User's Guide (*P/N 026-1601)* for Case Circuit setup instructions.

To associate EC-2s with Case Circuit applications:

1. Press F8 , xZ , and then 6 to navigate to the CC/CS100 <--> Circuit Association screen (*Figure 2-3*). This screen should list all the EC-2 case controllers in the Einstein configuration.



*Figure 2-3 - CS/CC-100 <--> Circuit Association*

2. Use the arrow keys to highlight the "Circuit" field of the EC-2 you wish to associate, and press F7 . From the Look-Up Table that appears, select the desired circuit, and press Enter .

3. Repeat this process for all unassociated EC-2s.

## 2.3.1 How Association Works
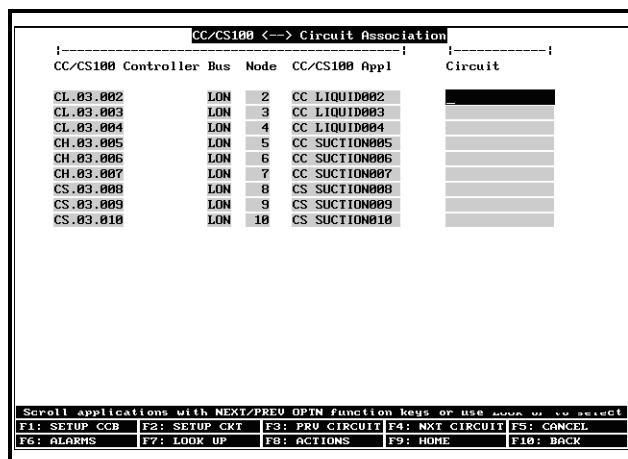
When the EC-2 is associated with a Case Circuit application, it will always use values from the Case Circuit application for the following case control parameters:

• Temperature set point and dead band

• Case temperature discharge-to-return-air mixture (i.e. the "virtual sensor" ratio)

• Defrost type, duration, and schedule

• Defrost termination type and termination set point

In addition, the EC-2 will automatically pass along the following input/output value information to the Case Circuit application:

• Case temperature

• Case state

In most cases, it will not be necessary to program the EC-2 directly either from the EC-2 front panel or through Einstein. Most configuration changes can be done on a circuit-wide level by changing the Case Circuit application.

# 3 EC-2 Operation

This section explains how an EC-2 operates during normal refrigeration and defrost control. It includes instructions on how to read the EC-2 display, how to initiate manual defrost, and how to change basic parameters such as the set point.

## 3.1 The EC-2 Display

The EC-2 display *(Figure 3-1)* consists of a numerical display and four LEDs that show the current status of fans, defrost, alarms, and (if present) the compressor. The numeric display shows temperatures during normal operation, and flashes error codes when alarms are active to notify store personnel of the problem.



| 1 | SERVICE PIN LED | 4 | DEFROST ON LED |
|---|---|---|---|
| 2 | COMPRESSOR ON LED | 5 | ALARM LED |
| 3 | FAN ON LED | 6 | NUMERIC DISPLAY |
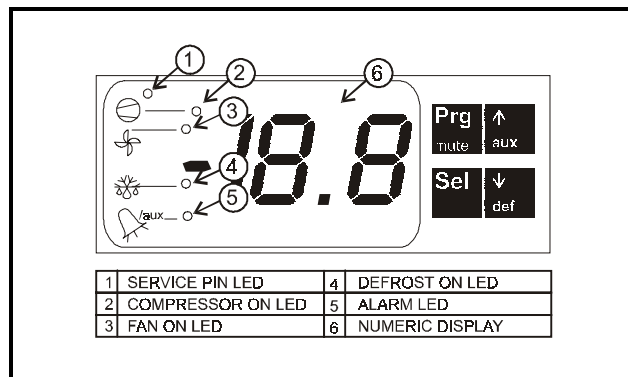
*Figure 3-1* - *The EC-2 Display*

### 3.1.1 Service Pin LED

This light will only be on when the EC-2 is sending its Echelon ID across the network, which only occurs when the ⬆aux key is being pressed.

### 3.1.2 Status LEDs

| COMPRESSOR LED STATE | Status |
|---|---|
| OFF | Compressor is OFF |
| ON | Compressor is ON |
| Blinking ON | Compressor cannot be activated or deactivated. Either the EC-2 is waiting for a compressor ON or OFF delay to elapse before activating or deactivating the compressor, or there is a system problem. |

| FAN ON LED STATE | Status |
|---|---|
| OFF | Fan is OFF |
| ON | Fan is ON |
| Blinking ON | Fan cannot be activated or deactivated. Either the EC-2 is waiting for a delay to elapse before activating or deactivating the fans, or there is a system problem. |

| DEFROST ON LED STATE | Status |
|---|---|
| OFF | Defrost is not active |
| ON | Defrost is active |
| Blinking ON | Defrost cannot be activated or deactivated. Either the EC-2 is in a pump down or drip delay, or there is a system problem. |

| ALARM LED STATE | Status |
|---|---|
| OFF | No alarms detected |
| ON | Alarms are active for this EC-2. You can get more information on these alarms by either observing the error codes flashing on the numeric display (see **Section 3.2,** *Alarms*) or checking the Einstein Alarm Advisory Log. |

### 3.1.3 Numeric Display

| NUMERIC DISPLAY | Status |
|---|---|
| A temperature value (positive or negative) | The EC-2 is in normal refrigeration control mode. The temperature shown is the combination of the discharge and return air temperature sensors, which the EC-2 recognizes as the **calculated case temperature.** |
| *DF* | The message 'dF' is displayed during defrost, both to signify active defrost and to hide the case temperature reading from customers. |
| Alternating temperature value and two-character alphanumeric code | There is an alarm condition on this EC-2. The error code will indicate the nature of the error - refer to **Section 3.2** for more information about error codes. |

# 3.2 Alarms

The table below lists all fifteen "error codes" that can appear in the numerical display of the EC-2. When an alarm is active, the EC-2 will alternate between showing the case temperature and the error code(s) for the active alarm(s).

| Alarm Code on Numerical Display | Error Description |
|---|---|
| *E0* | Evaporator inlet sensor failure. Either there is no sensor connected, or the cable has broken or short-circuited. |
| *E1* | Evaporator outlet sensor failure. Either there is no sensor connected, or the cable has broken or short-circuited. |
| *E2* | Discharge air sensor failure. Either there is no sensor connected, or the cable has broken or short-circuited. |
| *E3* | Return air sensor failure. Either there is no sensor connected, or the cable has broken or short-circuited. |
| *E4* | Defrost termination (fin sensor) failure. Either there is no sensor connected, or the cable has broken or short-circuited. |

| Alarm Code on Numerical Display | Error Description |
|---|---|
| *LO* | Low temperature alarm. The case temperature is currently lower than the low temperature set point. |
| *HI* | High temperature alarm. The case temperature is currently higher than the high temperature set point. |
| *MO* | The maximum saturation temperature (MOT) cannot be controlled anymore because the superheat set point is at its maximum (15 K). |
| *EC* | No cooling. The controller could not detect any refrigerant flow. This error should also be accompanied by blinking compressor and fan LEDs. The EC-2 will continue to try to start refrigeration every 10 minutes while this alarm is active. |
| *EH* | Hardware failure. Power the EC-2 off and then on. If failure still occurs, contact CPC to obtain a replacement unit. |
| *ED* | Defrost error. The EC-2 has been in defrost for longer than its maximum allowed time without terminating. Either the defrost termination set point is set too high, or defrost is inefficient. |
| *DF* | No error — defrost is active. |
| *CL* | No error — this is displayed when clearing alarm codes |
| *D1* | No error — this is displayed when a manual defrost is requested |
| *D0* | No error — this is displayed when a defrost is terminated manually. |

### 3.2.1 Clearing Alarm Codes

When the error condition(s) that caused an alarm to be generated are fixed, you can clear all active EC-2 alarms by pressing and holding both the [aux] and [def] keys simultaneously for 5 seconds. When cleared, the numeric display will briefly show the letters "cl".

If the condition that caused the alarm still exists, the EC-2 will display the alarm code again after a six second delay.

# 3.3 Manual Defrost

To begin a manual defrost on an EC-2 from the front

panel, press and hold the ⬇ key for 5 seconds until "d1" appears on the numerical display. A defrost cycle should begin immediately, after the applicable pump down delay has passed.

A manual defrost cycle is terminated like any other defrost cycle (i.e. by the defrost termination sensor). However, it may also be manually terminated at any time by pressing and holding the ⬇ key for 5 seconds. The message "d0" will appear on the display to signify the manual defrost was terminated successfully.

# 4    Software Setup

The EC-2 software performs three main functions:

- **Control Temperature -** The EC2 begins refrigeration when needed to keep the case temperature below its programmed set point. When not needed, EC2 turns off refrigeration.

- **Control Superheat -** During refrigeration, the EC2 varies the pulse valve's percentage in order to maintain the evaporator's **superheat set-point** (the difference between the coil in and coil out temperature sensors).

- **Control Defrost -** Once the Einstein commands the EC2 to start a defrost cycle, the EC2 handles all aspects of defrost control, including load and valve control, defrost termination, and pump down/drip delays.

## 4.1    Temperature Control

### 4.1.1    Determining Control Temperature

The EC-2 measures temperature in a case by mixing together the values of its discharge air and return air sensors into a single temperature value called the **control temperature.** By default, the control temperature is the average of the two sensors, but if you want one sensor value to "weigh" more than the other, you may do this by changing the EC2's mix percentage.

The calculated control temperature is considered throughout the EC-2 to be the official "case temperature." It is displayed on the EC-2's front panel during normal operation and used for alarm control and logging.

### 4.1.2    Temperature Control Modes

The EC-2 has three different modes of operation for controlling case temperature.

#### Dead Band Mode

In "Dead Band Mode," the EC-2 does not begin refrigeration immediately when the control temperature rises above the set point. The EC-2 waits until the control temperature is above the set point plus the dead band value before turning refrigeration on. Refrigeration will remain ON until the control temperature falls below the control set point.

For example, if a case with a 30°F set point has a dead band set point of 2.0°F, the zone of control will be from 30°-32°F. When the case temperature rises above 32°F, refrigeration will activate and remain ON until the tempera-

ture drops below the set point again (30°). At this temperature, refrigeration will turn OFF.

This control mode requires the user to supply the control set point and the dead band value to be used during refrigeration control.

#### No Regulation Mode

This mode is primarily designed for EC-2s that must operate without a central Einstein controller, and is therefore not required or recommended for use with EC-2s associated with Einsteins.

No Regulation Mode means the EC-2 itself does not control temperature for this case. Instead, it receives simple ON/OFF commands from a "master" EC-2 that acts as a circuit controller.

#### Adaptive Mode

Adaptive Mode temperature control is similar in function to the Dead Band mode described above. However, in Adaptive Mode, when the control temperature is close to the case temperature set point, the EC-2 will adjust the superheat set point in order to stabilize the system.

The superheat adaptation occurs when the control temperature reaches the control set point plus one-half the dead band value. When this temperature is reached, the EC-2 increases the superheat set point, which slows the rate of cooling in the case. The superheat set point will continue to be adjusted until the rate of case temperature change levels out and settles on a temperature somewhere within the set point dead band.

Adaptive temperature control mode only works if the superheat control is also set to "adaptive superheat control" as explained in **Section 4.2.1,** *Adaptive Superheat Control*.

### 4.1.3    Night Set Back

The EC-2 can be programmed to use an altered temperature control set point and dead band value when in unoccupied mode. The EC-2 relies on the Einstein to provide an OCCUPIED/UNOCCUPIED signal.

## 4.2    Superheat Control

Superheat, as it refers to evaporator control, is the difference between the temperature of the refrigerant leaving the evaporator (i.e. the **coil out temperature**) minus the temperature of the refrigerant entering the evaporator (i.e. the **coil in temperature**). The EC-2 measures these two temperature values by reading the coil in and coil out temperature sensors.

When Temperature Control calls for refrigeration to be ON, the EC-2 tries to keep the difference between the coil

out and coil in temperatures equal to the superheat set point. The EC-2 achieves this by varying the pulse valve percentage from 0% to 100%.

## 4.2.1 Adaptive Superheat Control

The EC-2 has a special mode of "smart" superheat control that analyzes the case evaporator's performance during refrigeration and "floats" the superheat set point to provide maximum efficiency. The EC-2 may vary the superheat set point anywhere from 3° - 15° during operation.

If desired, adaptive superheat may be turned OFF. This will cause the EC-2 to always control the superheat to the user-defined superheat set point (with no modification).

## 4.2.2 Saturation Temperature and the Maximum Operating Temperature Set Point

During refrigeration, the EC-2 can also monitor the saturation temperature of the refrigerant and vary the superheat set point to keep the saturation temperature from rising above a user-defined **maximum operating temperature** set point (also called the MOT set point)**.** When the saturation temperature approaches the MOT set point, the superheat set point will be increased to lower the saturation temperature.

If the saturation temperature exceeds the MOT set point while the superheat set point is at its maximum setting (15°), an alarm will be generated, since it is no longer possible to raise the superheat set point to control MOT.

Saturation temperature in the EC-2 is determined in either of two ways. It may be calculated based on the value of the coil inlet sensor temperature, or it may be calculated based on the value of a pressure transducer mounted on the coil outlet attached to an input point on the Einstein. If a pressure transducer is used, the EC-2 will not be able to perform MOT control if communications are lost with the Einstein.

# 4.3 Defrost Control

The EC-2 supports three different modes of defrost activation.

- **Off Cycle -** This defrost mode simply deactivates refrigeration for the duration of the defrost cycle.

- **Electric -** The Electric mode activates the defrost relay on the power module during defrost. This activates the case's electric heaters.

- **Hot Gas -** This mode turns on the defrost relay (which is typically used to activate a valve) AND opens the pulse valve to 100% for the duration of the defrost cycle.

## 4.3.1 Defrost Scheduling

The EC-2 relies on its parent Einstein and the Case Control Circuit it is associated with to schedule defrosts. When the Einstein determines it is time for the EC-2 to go into a scheduled defrost cycle, it sends a command to the EC-2 to begin defrost. From that point, the EC-2 handles all aspects of defrost control, including output control and defrost termination.

When an EC-2 has lost communications with its parent Einstein, it falls back on a user-programmable default defrost interval, which may be from 1-18 hours. Defrosts will occur at this interval until communications with the Einstein have been restored.

## 4.3.2 The Defrost Cycle

The defrost cycle has three phases.

<u>Pump Down</u>

The pump down delay period occurs only with electric and hot gas defrosts. When a defrost cycle first begins, the EC-2 will undergo a brief delay to allow refrigerant to be pumped out of the evaporator. During the pump down delay, the pulse valve will be closed (0%), and the defrost output will remain OFF.

The pump down delay is handled by Einstein, not the EC-2. Therefore, when the EC-2 is in stand-alone mode, pump down delay will not occur.

<u>Defrost Phase</u>

After the pump down delay, defrost will begin. During the defrost phase, the EC-2's outputs function as shown below in *Table 4-1*.

| Defrost Type | Defrost Output | Valve | Fans |
|---|---|---|---|
| Off Cycle | ON | CLOSED | (defined by user) |
| Electric | ON | CLOSED | (defined by user) |
| Hot Gas | ON | OPEN | (defined by user) |

*Table 4-1 - Output Behavior During Defrost Phases*

The Defrost phase ends when either the termination temperature is reached or when the defrost duration has elapsed. At the end of defrost, the defrost output will turn OFF and the valve will close (if not already closed).

<u>Drip Delay</u>

The drip delay period occurs only with electric and hot gas defrosts. During the drip delay, refrigeration is sus-

pended to allow moisture to drain off the evaporator coil. No defrost heat is applied during the drip delay.

The drip delay time is defined by the user and can be anywhere from 1-15 minutes. When complete, the case will resume refrigeration.

### 4.3.3    Defrost Termination

When an analog termination temperature sensor is present, the EC-2 will terminate defrost when the termination temperature goes above the case's termination temperature set point. If the termination temperature is reached during a defrost cycle, the EC-2 will start the drip delay phase, and afterwards resume refrigeration.

If the case has no dedicated termination temperature sensor, the EC-2 may be programmed to use the case temperature sensor for termination instead.

## 4.4    Valve Control

The EC-2 uses a pulse expansion valve mounted on the liquid side of the evaporator to regulate the flow of refrigerant through the evaporator.

During refrigeration, the EC-2's superheat control algorithm compares the current value of the superheat with the superheat set point. The result of this comparison is a percentage (from 0% - 100%) that corresponds to how much the valve should be open to achieve the superheat set point.

Since the pulse valve can only be either 0% open or 100% open, the EC-2 translates this percentage to an amount of time the valve should pulse ON during a specific time period.

# 5    Programming the EC-2

In most cases, it will not be necessary to program an individual EC-2, apart from programming the Case Circuit Control application. However, there may be some applications where the direct programming of an EC-2 is necessary.

To directly program an individual EC-2, it is recommended you use the Einstein front panel, because the Einstein interface is easier and quicker to use than the EC-2 front panel.

## 5.1    Navigating to the EC-2 Setup Editor Screens

1.  While logged into Einstein, press `F8` , `X Z`, and `6` to navigate to the Circuit Association screen.

2.  Use the arrow keys to move the cursor to the "Circuit" field of the EC-2 you wish to program.

3.  Press `F1` : SETUP CCB.

The "General" screen for the EC2 Case Control Setup Editor screens will be shown. Changes made to the parameters in these screens will be directly made to the EC-2 configuration. The sections below list all of the parameters that may be programmed in the EC-2.

*Note: If the EC-2 is associated with a Case Control Circuit application, many EC-2 configuration parameters listed in this section will not be available (specifically those functions not supported by Case Control Circuit applications, such as compressor control).*

## 5.2    Screen 1: General

### Name

**Default Value: CCB CELL**
**Visible when Mode = Always**

Enter a name for this EC2 cell in the Name field.

### Default Params

**Visible when Mode = Always**

The Einstein is pre-equipped with several sets of default set points and settings that apply to certain case types. If your case falls into one of these default categories, you can program all the set point and setup fields in this application with the defaults by choosing a case type in the Default Params field.

There are sixty-four case types to choose from. Select a case type by pressing F7 to call up the Look-Up Table, moving the cursor to the desired type, and pressing Enter. The appropriate set points and defrost parameters will be entered into the application.

### Update Rate

**Lo/Hi Limits:0:00:02 - 0:04:00**
**Default Value: 0:00:10**
**Visible when Mode = Full Opt**

The Update Rate is the rate at which the EC2 applicaiton receives updated temperature, output, and alarm information from the EC2. It is recommended the Update Rate remain at its default value unless otherwise instructed by CPC.

### Sat Source

**Visible when Mode = Always**

The Sat Source field allows you to choose one of two possible methods for calculating saturation temperature for the case evaporator. There are two options:

*Evap Inlet* - The saturation temperature will be based on the value of the EC2's coil inlet sensor.

*LON Pressure* - A pressure transducer on the evaporator's return will be converted to temperature by Einstein's EC2 application. This requires the EC2 application to be programmed with the correct refrigerant type AND for the RETURN TEMP input to be connected to a pressure transducer. Note that if this strategy is used, the EC2 will not be able to determine saturation temperature if communications are lost between the EC2 and the associated Einstein EC2 application.

This parameter corresponds to parameter /8 on the EC2 front panel.

### Location Lable

**Lo/Hi Limits:0 - 199**
**Default Value: 0**
**Visible when Mode = Full Opt**

The Location Label field is only necessary when the EC-2 is not being used as a part of the Einstein network. The Location Label field sets the node address for the EC-2 on the Echelon network.

## IR Password

**Lo/Hi Limits:0 - 199**
**Default Value: 0**
**Visible when Mode = Full Opt**

The IR Password field sets the access password for users logging in to the EC2 via the infrared remote. The password may be any number between 0 and 199.

This parameter corresponds to parameter H3 on the EC2 front panel.

## Display Decimal

**Visible when Mode = Full Opt**

The Display Decimal field selects whether you want the EC2 display to show temperatures to one-tenths of a degree of accuracy. If this field is set to Yes, temperatures will be shown to one-tenth of a degree (e.g. 16.6 degrees). If this field is set to No, temperatures will be shown to one degree (e.g. 16 degrees, not 16.6).

This parameter corresponds to parameter /6 on the EC2 front panel.

## Enable Remote

**Visible when Mode = Full Opt**

The Enable Remote field allows you to disable the EC2's infrared remote, the EC2's front panel buttons, or both. There are four options:

*Nothing Disabled* - The IR remote and front panel buttons will be enabled.

*Buttons disabled* - Only the EC2's front panel buttons will be disabled.

*IR Disabled* - Only the EC2's IR remote will be disabled.

*Both disabled* - Both the front panel buttons and the IR remote will be disabled, meaning the EC2 will only be accessible through Einstein.

This parameter is the same as parameter H2 on the EC2 front panel.

## UC Node

**Lo/Hi Limits:1 - 99**
**Default Value: 20**
**Visible when Mode = Full Cfg**

The UC Node field displays the Echelon network node number that has been assigned to the EC2 by the Einstein.

## UC Subnet

**Lo/Hi Limits:1 - 99**
**Default Value: 20**
**Visible when Mode = Full Cfg**

This field displays the subnet to which the EC2 belongs on the Echelon network.

# 5.3    Screen 2: Set Points

## CASE TEMP SP

**Lo/Hi Limits:-40 - 104**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Case Temp Setpoint is the temperature the EC2 will try to maintain in the case. The EC2 is programmed to automatically receive the case set point from the Case Control Circuit to which it is associated. Therefore, the Case Temp Setpoint field will be defined as an input that receives the ACTIVE SETPT output from the associated circuit.

## Night Delta SP

**Lo/Hi Limits:1.8 - 36**
**Default Value: 1.8**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Dual Temp SP is the case temperature set point the EC2 will use when operating in dual temp mode. When Einstein's EC2 application receives an ON signal from its Dual Temp input, the Einstein will command the EC2 to switch to using this set point for temperature control.

This parameter corresponds to parameter r6 on the EC2 front panel.

## SuperHeat SP

**Lo/Hi Limits:5.4 - 27**
**Default Value: 11**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The SuperHeat Setpoint parameter serves different functions, depending on whether the EC2 is using fixed or adaptive superheat mode. If the EC2 is operating in fixed superheat mode, the SuperHeat Setpoint is the temperature differential the EC2 will try to maintain when refrigeration is active. If the EC2 is

operating in adaptive superheat mode, the set point you enter in this field will be used by the EC2 when it first starts refrigerating, and over time the set point will be adjusted as deemed appropriate by the EC2.

This parameter corresponds to parameter u5 on the EC2 front panel.

## Case Circuit

**Visible when Mode = Always**

The Case Circuit field determines which case circuit the EC2 will be associated with. If the EC2 has been associated with a Case Control Circuit in the Case Circuit Association screen, the name of the Case Control Circuit will be visible in this field. If not, you may choose a circuit for association by pressing F7 in this field and selecting a circuit name from the Look-Up Table.

# 5.4    Screen 3: Inputs

## RACK FAIL IN

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Full Opt**

The Rack Fail Input informs the EC2 when its associated suction group has failed. An ON signal on this input will shut down refrigeration and defrost for the case until the signal returns to the OFF value. This input is automatically tied to a Case Control Circuit's RACK FAIL OUT output during circuit association.

## TERM WAIT

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

An ON signal received by this input will cause an EC2 operating in aWAIT state to cease waiting and resume refrigeration. This input is automatically connected to the Case Control Circuit's START DEFR OUT output when the EC2 is associated with the circuit.

## START DEFROST

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

An ON signal received by this input will command the EC2 to begin a defrost cycle. This input is automatically connected to the Case Control Circuit's START DEFR OUT output when the EC2 is associated with the circuit.

## DAY NIGHT

**Default Value: ACTIVE_INACTV**
**Engineering Units: ACTIVE_INACTV**
**Visible when Mode = Full Opt**

The Dual Temp Switch input toggles the EC2 between normal and dual temp mode so that the case can easily transition from one case type to another. When this input receives an ON signal, the EC2 will use the dual temp set points. When this input is OFF, the normal set points will be used. This input is typically tied to a physical switch or button.

## RETURN TEMP

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

If you set the Sat Source field to "LON Pressure" to use a pressure transducer on the return to check saturation temperature, the Return Temp field will appear. In this field, enter the board and point address of the pressure transducer.
Despite the name "Return Temp," this input accepts only pressure transducer values, not temperature values.

# 5.5    Screen 4: Outputs

## CASE STATE

**Visible when Mode = Always**

The Case State shows what mode the refrigerated case is operating in (I.e. if the case is in refrigeration, defrost, wash mode, off, etc.).

## ACTIVE SETPT

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Active Setpoint output is the case temperature set point currently being used by the EC2.

## SUPERHEAT SP

**Lo/Hi Limits:0.00 - 0.00**
**Default Value: 0.22**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Superheat SP output is equal to the current value of the EC2's superheat set point.

## CASE TEMP

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Case Temp output is an analog output equal to the temperature of the case. This is determined by mixing the discharge air and return air sensor values of the EC2. The Case Temp output is automatically tied to one of the Case Temp inputs of a Case Control Circuit application during circuit association.

## TERM TEMP

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Term Temp output is an analog output equal to the current value of the defrost termination temperature sensor of the EC2.

## VALVE OUT

**Default Value: 0.120000**
**Engineering Units: %**
**Visible when Mode = Always**

This analog output is equal to the current opening percentage of the EC2's evaporator valve (from 0 - 100%).

## CAL SUPER HEAT

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Calculated Superheat output's value is equal to the current calculated superheat of the EC2's evaporator. The superheat is calculated by subtracting the coil in temperature from the coil out temperature.

## COIL IN

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Coil In output is equal to the current value of the EC2's coil inlet temperature sensor.

## COIL OUT

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Coil Out output is equal to the current value of the EC2's coil outlet temperature sensor.

## RETURN AIR

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Return Air output is equal to the current value of the EC2's return air temperature sensor.

## DISCHARGE AIR

**Lo/Hi Limits:32 - 32**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Discharge Air output is equal to the current value of the EC2's discharge air temperature sensor.

## TSTAT OUT

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

## DEFROST STATE

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

The Defrost State output shows the current ON/OFF status of the EC2's defrost output.

## COMP OUT

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

The Compressor output shows the ON/OFF status of the compressor, if one is being controlled by the EC2.

## FAN STATE

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

The Fan State output shows the current ON/OFF status of the fan.

## CYCLE RATE

**Default Value: 0.000000**
**Visible when Mode = Full Opt**

The Cycle Rate output shows the rate at which the Tstat output has been cycling ON and OFF.

# 5.6    Screen 5: Case Params

### Min Temp SP

**Lo/Hi Limits:-40 - 104**
**Default Value: -40**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Minimum Temp SP is used when the EC2 is operating in adaptive case temperature control mode. The EC2 will not float the case temperature set point below the minimum limit specified in the Minimum Temp SP field. Enter the desired minimum set point limit in this field.

This parameter corresponds to parameter r2 on the EC2 front panel.

### Max Temp SP

**Lo/Hi Limits:-40 - 104**
**Default Value: 104**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Maximum Temp SP is used when the EC2 is operating in adaptive case temperature control mode. The EC2 will not float the case temperature set point above the maximum limit specified in the Maximum Temp SP field. Enter the desired maximum set point limit in this field.

This parameter corresponds to parameter r1 on the EC2 front panel.

### Night Delta DB

**Lo/Hi Limits:0.18 - 36**
**Default Value: 3.6**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Dual Temp DB is the dead band around the dual temp case air temperature set point (used when the Temp Mode is set to 'Dead Band') when the EC2 is operating in dual temp mode. The 'dead band' determines how far above the dual temp case temperature set point the temperature must be in order to start refrigeration, and how far below the dual temp case temperature set point the temperature must be to end refrigeration. Refrigeration will turn ON when the temperature is above the set point plus one-half the Temp DB value. Refrigeration will turn OFF when the temperature is below the set point minus one-half the Temp DB value.

This parameter corresponds to parameter rd on the EC2 front panel.

This parameter corresponds to parameter r7 on the EC2 front panel.

### Temp DB

**Lo/Hi Limits:0.18 - 36**
**Default Value: 3.6**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Temp DB is the dead band around the case air temperature set point (used when the Temp Mode is set to 'Dead Band'). The 'dead band' determines how far above the case temperature set point the temperature must be in order to start refrigeration, and how far below the case temperature set point the temperature must be to end refrigeration. Refrigeration will turn ON when the temperature is above the set point plus one-half the Temp DB value. Refrigeration will turn OFF when the temperature is below the set point minus one-half the Temp DB value.

This parameter corresponds to parameter rd on the EC2 front panel.

### Temp Mode

**Visible when Mode = Always**

The Temp Mode selects the strategy used by the EC2 during case air temperature control.

### SuperHeat Mode

**Visible when Mode = Always**

The SuperHeat Mode parameter allows you to choose whether you want the EC2's superheat set point to be fixed or adaptive. A fixed superheat set point will not vary from the value programmed by the user. An adaptive superheat set point adjusts itself as the EC2 operates, providing the most appropriate set point for the case evaporator. Choose either Adaptive or Fixed in this field.

This parameter corresponds to parameter u4 on the EC2 front panel.

## Enable MOT

**Visible when Mode = Full Opt**

The Enable MOT parameter enables or disables the EC2's Maximum Operating Temperature limitation mode. When MOT is enabled (Enable MOT = "Yes"), the EC2 will increase the EC2's superheat set point to keep the saturation temperature from reaching the MOT set point. When MOT is disabled (Enable MOT = "No"), the EC2 will make no adjustments to the superheat set point when the saturation temperature is high.

This parameter corresponds to parameter u2 on the EC2's front panel.

## Refrig Glide

**Lo/Hi Limits:-36 - 36**
**Default Value: 0.00**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Refrig Glide/Pressure Drop field is used to adjust the superheat parameters to accommodate for any refrigerant glide or pressure drop for this case. If there is a refrigerant glide factor for this refrigeration system, enter the factor in this field as a positive number. If a pressure drop is present for this case, enter the pressure drop factor in this field as a negative number (I.e. with a minus sign in front of the number).

## Clean Not Prior

**Lo/Hi Limits:0 - 99**
**Default Value: 50**
**Visible when Mode = Full Opt**

The Clean Notice Priority sets the priority level of the notice generated when the EC-2 enters Clean Mode. The default priority should be sufficient for most cases.

## Clean Notice

**Default Value: 0**
**Visible when Mode = Always**

When this field is set to "Yes," Einstein will write a low-priority notice to the Alarm Advisory Log every time a Clean Mode is initiated in the EC-2.

## Clean Failsafe

**Lo/Hi Limits:0:01 - 2:00**
**Default Value: 0:10**
**Visible when Mode = Full Opt**

The Clean Failsafe Time is the maximum amount of time an EC-2 will be allowed to stay in Clean Mode (or Wash Mode). If the EC-2 stays in Clean Mode longer than this time period, the EC-2 will end clean mode and resume normal refrigeration control.

# 5.7 Screen 6: Defrost

## Term Temp

**Lo/Hi Limits:-40 - 104**
**Default Value: 46**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Term Temp is the termination temperature set point the EC2 will use during defrost. If the termination temperature sensor (or discharge air sensor, if no termination sensor is being used) reads a temperature above the Term Temp set point, the defrost cycle is ended.

This parameter corresponds to parameter dt on the EC2 front panel.

## Defrost Type

**Visible when Mode = Always**

The Defrost Type field tells the EC2 what type of defrost heat the case uses. There are three options:
Off Cycle - No defrost heat is applied to the evaporator coil. During defrost, the EC2 closes the evaporator valve, and the case is allowed to thaw naturally.
Electric - Electric defrost heaters are present in the case. During defrost, the EC2 will activate its defrost relay and close the evaporator valve.
Hot Gas - Hot gas from the compressors will be run through the evaporator coil. During defrost, the EC2 opens the valve to 100% and closes its defrost relay to open the gas valve.

This parameter corresponds to parameter d0 on the EC2 front panel.

## Demand Defrost

**Visible when Mode = Always**

The Demand Defrost field enables demand defrost inhibit control for this case and sets the control strategy. There are three options to choose from:

*No* - demand defrost control is OFF.

*Yes* - demand defrost is ON, and will inhibit defrost cycles from occurring until the demand defrost sensor detects a sufficient build-up of frost.

*Yes + Timer* - same as the strategy explained in 'Yes' above, except the EC-2 will stop inhibiting defrost if a defrost cycle has not occurred after an amount of time equal to the Defrost Interval field (dl).

## Pump Down Delay

**Lo/Hi Limits:0 - 30**
**Default Value: 5**
**Visible when Mode = Always**

The Pump Down Delay is the amount of time the EC-2 will wait after a defrost cycle first begins before defrost heat is applied. This allows time for excess refrigerat to be pumped from the evaporator. Enter the desired number of minutes in this field.

## Defr Duration

**Lo/Hi Limits:1 - 199**
**Default Value: 30**
**Visible when Mode = Always**

The Defrost Duration is the maximum amount of time a defrost period will last (not including drip delays). If defrost is not terminated before the case has been in defrost for an amount of time equal to the Defrost Duration, defrost will be ended.

This parameter corresponds to parameter dP on the EC2 front panel.

## Drip Time

**Lo/Hi Limits:0 - 15**
**Default Value: 2**
**Visible when Mode = Always**

The Drip Time is an amount of time right after defrost is terminated where refrigeration will be delayed to allow excess moisture to drip off the evaporator. During the Drip Time, no defrost heat is active, and the valve remains closed. If you would like to program a drip time for the case, enter the number of minutes in this field.

## Defrost Display

**Visible when Mode = Full Opt**

The EC2 is programmed to hide the case temperature during defrost. The Defrost Display field allows you to choose what message you wish to show on the EC2 front panel screen when the EC2 is in defrost. There are three options:

*"df"* - The screen will display the message 'df' for the entire duration of the defrost cycle.

*"df" + Defr Temp* - The screen will alternate between 'df' and the current defrost termination temperature.

*"df" + Air Temp* - The screen will alternate between 'df' and the current calculated case temperature.

This parameter corresponds to the parameter d6 on the EC2 front panel.

## Defrost Sensor

**Visible when Mode = Always**

The Defrost Sensor field allows you to choose whether you want to use the defrost termination sensor (the sensor connected to input S5 on the EC2) or the discharge air temperature sensor (the sensor connected to input S4 on the EC2) to terminate defrost. Choose "Discharge Air" if you want to use sensor S4, or "Fin Sensor" if you want to use sensor S5.

This parameter corresponds to parameter /7 on the EC2 front panel.

## Fan During Defr

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Full Opt**

The EC2 can be configured to turns fans ON or OFF during a defrost cycle. To keep fans ON during defrost, enter "ON" in this field. To keep fans OFF during defrost, enter "OFF" in this field.

## Defr Alm Delay

**Lo/Hi Limits:0 - 180**
**Default Value: 10**
**Visible when Mode = Full Opt**

The Defr Alarm Delay is the amount of time after a defrost cycle ends when alarm checking is disabled in the refrigerated case. No case temperature alarms will be generated when the Defr Alarm Delay is active.

This parameter corresponds to parameter d8 on the EC2 front panel.

## Defr Fan Delay

**Lo/Hi Limits:0 - 15**
**Default Value: 1**
**Visible when Mode = Full Opt**

If you configured the fans to be OFF during defrost, you may specify an amount of time after defrost ends for the fans to remain OFF (thus keeping moisture from being blown into the case). If a fan delay is desired, enter the number of minutes in this field.

This parameter corresponds to parameter Fd on the EC2 front panel.

### Fan On Temp

**Lo/Hi Limits:-40 - 104**
**Default Value: 32**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Fan On Temperature is the case temperature set point that determines when the fans will be OFF or ON in the case. If the case temperature falls below this set point, fans will be OFF. If the case temperature rises above this set point, fans will be ON.

This parameter corresponds to parameter Ft on the EC2 front panel.

### Max Wait Time

**Lo/Hi Limits:0:00 - 1:00**
**Default Value: 0:10**
**Visible when Mode = Always**

The Maximum Wait Time is the maximum number of minutes the EC-2 will be allowed to sit in a WAIT state. If the EC-2 is in a WAIT state longer than this time, it will exit and try to resume refrigeration.

The Maximum Wait Time ensures that an abnormal network or system condition that keeps Einstein from sending the "Terminate Wait" signal to the EC-2 does not result in product loss. Be sure to choose a Wait Time period larger than the defrost cycle duration.

### Defr St Delay

**Lo/Hi Limits:0 - 199**
**Default Value: 0**
**Visible when Mode = Full Opt**

If you have configured the EC2 to defrost after power-up (I.e. the Defrost on PwrU field (parameter d4) was set to 'Yes'), enter the number of hours the EC2 will wait after power-up before starting defrost in this field.

### Defrost On PwrU

**Default Value: 0**
**Visible when Mode = Full Opt**

When this field is set to Yes, the EC2 will begin a defrost cycle right after power up of the EC2 unit. The duration of the wait after power-up is determined by the "defrost delay after power-up" (parameter d5 on the EC2 front panel). When this field is set to "No," defrost will occur at the scheduled times regardless of whether the EC2 has just been powered up.

This parameter corresponds to parameter d4 on the EC2 front panel.

### Defr Interval

**Lo/Hi Limits:0 - 18**
**Default Value: 18**
**Visible when Mode = Full Opt**

The Defrost Interval is the amount of time in between two defrost cycles when the EC2 is operating by itself without interaction with an Einstein. Normally, an EC2 that has been associated with a case control circuit will follow the circuit's defrost schedule. If the EC2 cannot communicate with a Case Control Circuit application, then the EC2 will use the Defrost Interval to schedule defrosts.

This parameter corresponds to parameter dl on the EC2 front panel.

## 5.8 Screen 8: Alarms

### Case Alm Hi

**Lo/Hi Limits:-40 - 99**
**Default Value: NONE**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Case Alarm Hi set point is the alarm set point for high case temperature. If the calculated case temperature rises above this value, an alarm will be generated.

### Case Alm Lo

**Lo/Hi Limits:-40 - 99**
**Default Value: NONE**
**Engineering Units: Deg F**
**Visible when Mode = Always**

The Case Alarm Lo set point is the alarm set point for low case temperature. If the calculated case temperature falls below this value, an alarm will be generated.

### Case Alm Delay

**Lo/Hi Limits:0:00 - 8:00**
**Default Value: 0:30**
**Visible when Mode = Always**

The Case Alarm Delay is the amount of time the combined case temperature must remain above the Case Alarm High set point or below the Case Alarm Low set point before an alarm may be generated.

### Case Alm Hyst

**Lo/Hi Limits:0.00 - 36**
**Default Value: 2.0**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Case Alarm Hysteresis is the number of degrees the temperature must fall below the high alarm set point in order for a high case temperature alarm to be considered "returned to normal." Likewise, the temperature must rise above the low alarm set point a number of degrees equal to the Case Alarm Hysteresis before a low case temperature alarm returns to normal.

### Case Alm Prior

**Lo/Hi Limits:0 - 99**
**Default Value: 30**
**Visible when Mode = Always**

The Case Alarm Priority is the priority level of the high and low case temperature alarms. Enter the desired priority number in this field.

### Defr Temp Fail

**Lo/Hi Limits:0 - 99**
**Default Value: 20**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when the defrost termination sensor fails.

### Coil In Fail

**Lo/Hi Limits:0 - 99**
**Default Value: 20**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when the coil inlet sensor fails.

### Coil Out Fail

**Lo/Hi Limits:0 - 99**
**Default Value: 20**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when the coil outlet sensor fails.

### Return Fail

**Lo/Hi Limits:0 - 99**
**Default Value: 20**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when the return airsensor fails.

### No Ref Flow

**Lo/Hi Limits:0 - 99**
**Default Value: 30**
**Visible when Mode = Full Opt**

### MOT Alarm

**Lo/Hi Limits:0 - 99**
**Default Value: 30**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when the refrigerant's saturation temperature rises above the EC-2's Maximum Operating Temperature (MOT) set point, AND the EC-2 has already increased its superheat to the maximum level (meaning it can take no more further action to reduce saturation temperature).

### End Defr Alarm

**Lo/Hi Limits:0 - 99**
**Default Value: 0**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when a defrost cycle in an EC-2 lasts for the full defrost interval without terminating. By default, this alarm priority is set to zero, which means an alarm will not be generated when this condition occurs. If you want an alarm to occur when the full defrost interval is reached, enter a priority number from 1 to 99.

### Discharge Fail

**Lo/Hi Limits:0 - 99**
**Default Value: 20**
**Visible when Mode = Full Opt**

This field sets the priority level of the alarm generated when the discharge air sensor fails.

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### Temp Offset

**Lo/Hi Limits:-36 - 36**
**Default Value: 0.00**
**Engineering Units: Deg F**
**Visible when Mode = Full Opt**

The Temp Offset alters the control temperature value to make up for sensor inaccuracies. The value of the Temp Offset field is added to the calculated case air temperature (the mixture of the discharge and return air temperature sensor values). Enter the desired number of degrees to offset the control temperature (from -20 to 20) in this field.

This parameter corresponds to parameter /C on the EC2 front panel.

## Temp Factor

**Lo/Hi Limits:0 - 100**
**Default Value: 50**
**Engineering Units: %**
**Visible when Mode = Always**

The Temp Factor determines how the discharge air and return air temperature sensors mix their values to form the control case air temperature. The formula used for determining case temperature is (discharge temperature * Temp Factor %) + (return temperature * (100% - Temp Factor%)) = case temperature. A Temp Factor of 50% means discharge and return are weighted equally in the calculation. If you want discharge air to weigh more in the case temperature calculation, choose aTemp Factor above 50%. Otherwise, if you want return air to weigh more, choose aTemp Factor below 50%.

This parameter corresponds to parameter /4 on the EC2 front panel.

## SELFTEST STATUS

**Default Value: 0.000000**
**Visible when Mode = Full Opt**

The Selftest Status field shows the results of any self-tests you are performing from the Einstein front panel (I.e. by altering the "Self Test" parameter in the EC2 application.

## SELF TEST

**Visible when Mode = Full Opt**

The Self Test field allows you to remotely perform self-test functions on the EC2. The EC2 has 23 different self-tests, all of which can be performed by pressing F7 and selecting a test from the Look-Up Table. When finished testing, press F7 again and change the value of this field back to NONE.

## VALVE IN

**Default Value: NONE**
**Engineering Units: %**
**Visible when Mode = Full Opt**

The Valve In input is an override input for the EC2's valve percentage. When this input is any analog value other than NONE, the EC2's pulse valve will be overridden to the percentage value received in the Valve In input.

## THERMOSTAT IN

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

The Thermostat In input is only required if the EC-2 is being controlled by a "master" EC-2 instead of a Case Circuit Control application in Einstein. If the EC-2 is being controlled by a "master," this input must be filled in with the address of the TSTAT OUT output from the master EC-2.

## ALARM OUT

**Default Value: ON_OFF**
**Engineering Units: ON_OFF**
**Visible when Mode = Always**

The Alarm Out output turns ON to signify an alarm is active in the EC2. This output may be tied to an I/O control input or a annunciator device for extended alarm control purposes.

## RETRY TIMER

**Default Value: 0.000000**
**Visible when Mode = Full Opt**

The Retry Timer output is used by service personnel for troubleshooting.

## WAIT TIMER

**Default Value: 0.000000**
**Visible when Mode = Full Opt**

The Wait Timer is used by service personnel for troubleshooting.

## CELL STATUS

**Visible when Mode = Full Opt**

The Cell Status output is used for service personnel for troubleshooting.

## BIND SUB STATE

**Visible when Mode = Full Opt**

The Binding Sub State is used by service personnel for troubleshooting.

## BINDING STATE

**Visible when Mode = Full Opt**

The Binding State output is a status-only field that shows the current status of the network connection between the Einstein and the EC2. Once an EC2 has been added to the network and successfully commissioned, this field should read "Online & Bound" on the EC2 Status Screen.

## ALG STATUS

**Visible when Mode = Full Opt**

The Algorithm Status shows the current operating status of the EC2 control algorithm in the Einstein. This output is used by service personnel for troubleshooting.

## ALARM STATUS

**Default Value: 0.000000**
**Visible when Mode = Full Cfg**

This status field shows the current alarm state of the EC-2 Case Controller.

## CONT STATUS

**Default Value: 0.000000**
**Visible when Mode = Full Cfg**

This status field shows the current operating state of the EC-2 Case Controller.