

## EC3-X33 Superheat Controller and ECD-002 Keypad/Display Unit

### Description

**EC3-X33** is a universal superheat controller used in conjunction with Emerson Electrical Control Valves EX4...EX8.



### Safety Instructions

- Read installation instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.
- The product is intended for use by persons having the appropriate knowledge and skills.
- Disconnect all voltages from system before installation.
- Do not operate system before all cable connections are completed.
- Comply with local electrical regulations when wiring.

**Note:** The EC3-X33 series contains a lead, acid gel rechargeable battery. The battery must NOT be disposed of with other commercial waste. Instead, it is the user's responsibility to pass it to a designated collection point for the safe recycling of batteries (harmonized directive 98/101/EEC). For further information contact your local environmental recycling center.

### Technical data

Power supply	24VAC ±10%; 50/60Hz; 1A
Power consumption	25VA max. including EX4 ... EX8
Plug-in connector	Removable screw terminals wire size 12-20 AWG
Grounding	1/4 in spade earth connector
Protection class	IP20
Connection to ECD-002	ECC-Nxx or CAT5 cable with RJ45 connectors
Digital Inputs	0/24VAC/DC for stop/start function
NTC input	Emerson temperature sensor ECN-N60
4-20 mA Analog input	Emerson PT4-07M / PT4-18M / PT4-30M
4-20 mA Analog output	For connection to any 3 <sup>rd</sup> party controller with 12/24VDC power supply and appropriate burden
Output alarm relay	SPDT contacts 24V AC/DC, 2 Amp inductive load
Activated:	During normal operation (no alarm condition)
Deactivated:	During alarm condition or power supply is OFF
Stepper motor output for EX4...EX8	Maximum current 0.8A with nominal 24VDC operating voltage

### Mounting

The EC3-X33 is designed to be mounted onto a standard DIN rail.

Digital input status is dependant to operation of compressor/thermostat

Commander	Operating condition	Digital input
Compressor	Compressor starts	Closed / 24V (Start)
	Compressor stops	Open / 0V (Stop)
Thermostat	Demand (compressor must be ON)	Closed / 24V (Start)
	No demand	Open / 0V (Stop)

### Electrical Installation

- Refer to the electrical wiring diagram for electrical connections.
- Do not apply voltage to the controller before completion of wiring.
- Ground the metal housing with a 1/4 in spade connector.
- **Important:** Keep controller and sensor wiring well separated from mains wiring. Minimum recommended distance 1.2 in.

**Warning:** Use a class II category transformer for 24VAC power supply. Do not ground the 24VAC lines. We recommend to use individual transformers for EC3 controller(s) and for 3<sup>rd</sup> party controllers to avoid possible interference or grounding problems in the power supply. Connecting any EC3 inputs to mains voltage

### Preparation for Start-up

- Evacuate the entire refrigeration circuit.
- **Warning:** Emerson Electrical Control Valves EX4...EX8 are delivered at half open position. Do not charge system before closure of valve.
- Apply supply voltage 24V to EC3 while the digital input is 0V. The valve will be driven to close position.
- After closure of valve, start to charge the system with refrigerant.
- **Warning:** EC3 needs to be setup prior to start-up. Do not apply 24V digital input to EC3 before completion of main parameters setting.
- Connect ECD-002 to EC3 as shown in wiring diagram with ECC-Nxx cable or with any standard straight Cat5 cable with two RJ45 plugs.

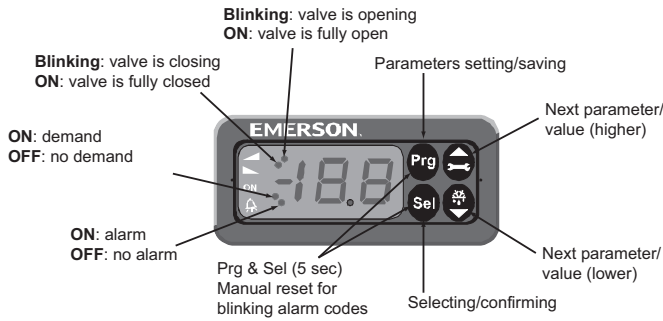
### Setup of main parameters (need to be checked/modified before start-up) using ECD-002

- Make sure that digital input is 0V (open). Turn the power supply ON.
- **Important:** Three main parameters i.e. refrigerant type (u0), pressure sensor type (uP) and valve type (ut) can be set only when digital input is open (0V) while the power supply is ON (24V). This feature is for added safety to prevent accidental damage of compressors and other system components.
- For easy setting of main parameters, follow the pictorial procedure of "Quick start-up" on the attached individual paper.
- **Once the main parameters have been selected/saved the EC3 is ready for startup. All other parameters can be modified at any time during operation or standby if it is necessary.**

### Start-up

Start the system and check the superheat and operating conditions. The EC3-X33 is fully functional without keypad/display unit. ECD-002 may be removed or connected at any time.

## ECD-002 Display/Keypad Unit (LEDs and Button Functions)



### Procedure for parameters modification using ECD-002

The parameters can be accessed via the 4-button keypad. The configuration parameters are protected by a numerical password. The default password is "12". To select the parameter configuration:

- Press the **PRG** button for more than 5 seconds, a flashing "0" is displayed.
- Press ▲ or ▼ until "12" is displayed (password).
- Press **SEL** to confirm password.
- Press ▲ or ▼ to show the code of the parameter that has to be changed.
- Press **SEL** to display the selected parameter value.
- Press ▲ or ▼ to increase or decrease the value.
- Press **SEL** to temporarily confirm the new value and display its code.

Repeat the procedure from the beginning "press ▲ or ▼ to show..."

#### To exit and save the new settings:

- Press **PRG** to confirm the new values and exit the parameters modification procedure.

#### To exit without modifying any parameters:

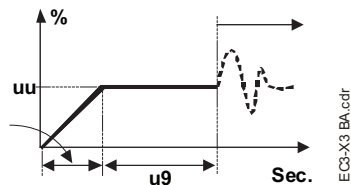
- Do not press any button for at least 60 seconds (TIME OUT).

#### Reset all parameters to factory setting:

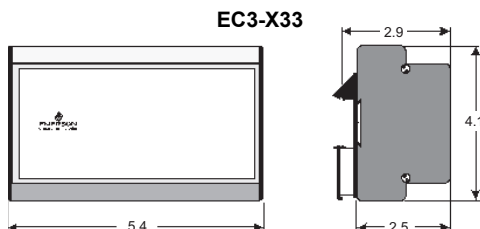
- Make sure that digital input is 0V (open).
- Press ▲ or ▼ together for more than 5 seconds, a flashing "0" is displayed.
- Press ▲ or ▼ until the password is displayed (Factory setting = "12").
- If password was changed, select the new password.
- Press **SEL** to confirm password. "0" is displayed.
- Press **SEL** to reset all parameters to factory setting.
- Press **PRG** to activate the function and leave the special function mode.

### Control (valve) start-up behavior (Parameter uu and u9)

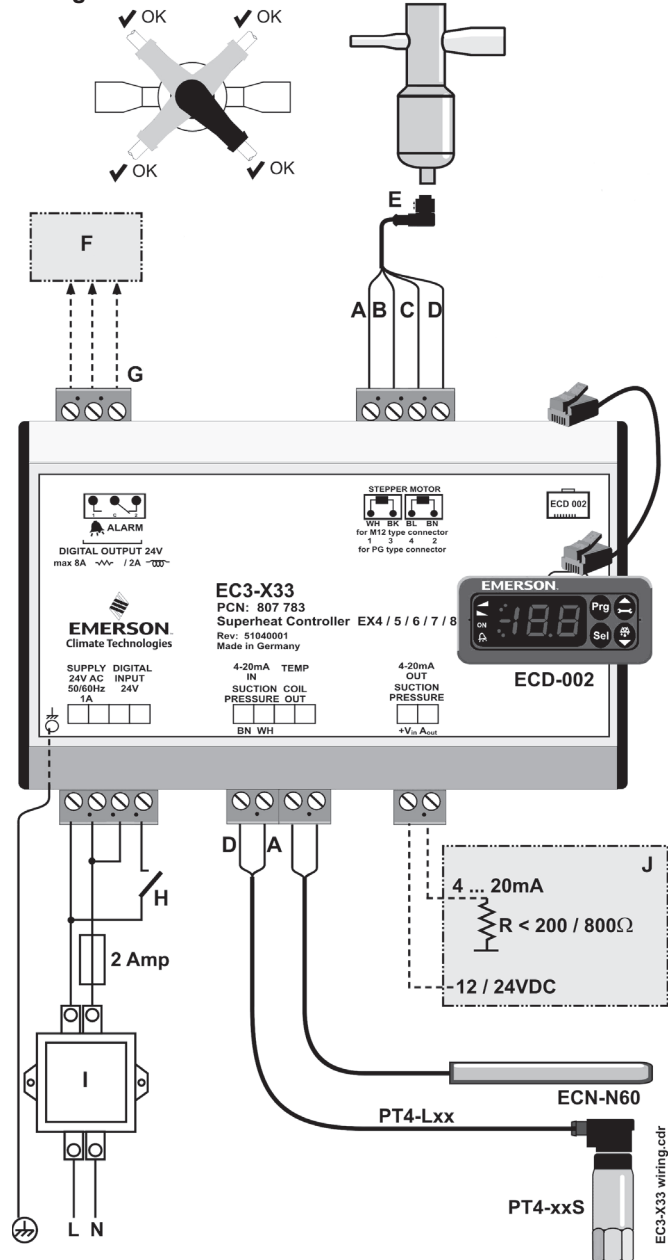
- EX4/5/6 ≤ 1.5 seconds
- EX7 ≤ 3.2 seconds
- EX8 ≤ 5.2 seconds



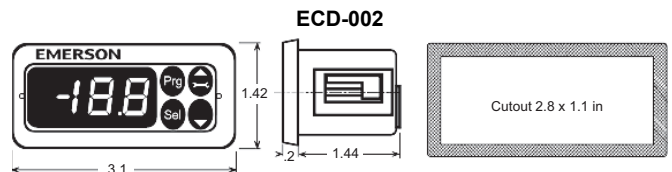
### Dimensions



### Wiring



- A:** White wire    **B:** Black wire    **C:** Blue wire    **D:** Brown wire
- E:** Plug cable assembly EX5-Nxx for connection to EX4/EX5/EX6/EX7/EX8
- F:** Remote control panel, system controller
- G:** Alarm relay, dry contact. Relay coil is not energized at Alarm or power off
- H:** Digital input (0V/open = Stop; 24V/closed = Start)
- I:** Transformer Class II, 24VAC secondary / 25VA
- J:** Third party controller (can use the analog output signal from EC3)



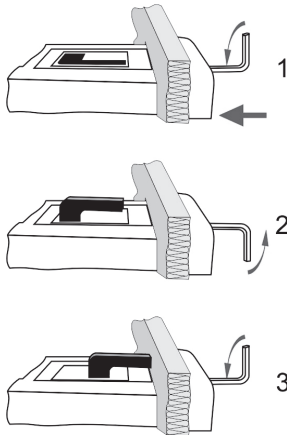
### Main parameters (must be checked and modified if necessary)

Code	Parameter description & choices	Min	Max	Factory Setting	Field Setting
H5	Password	1	199	12	
u0	System Refrigerant 0 = R22; 1 = R134a; 2 = R507; 3 = R404A; 4 = R407C; 5 = R410A; 6 = R124; 7 = R744 (subcritical application)	0	7	1	
uP	Installed pressure sensor type 0 = PT4-07M (for R22/R134a/R507/R404A/R407C/R124) 1 = PT4-18M (for R410A) 2 = PT4-30M (for R744, subcritical)	0	1	0	
ut	Installed valve type 1 = EX4; 2 = EX5; 3 = EX6; 4 = EX7; 5 = EX8	1	5	5	

### Mounting of ECD-002

ECD-002 can be installed at any time also during operation.

- ECD-002 can be mounted in panels with 2.8x1.1 in cutout
- Push controller into panel cut-out.(1)
- Make sure that mounting lugs are flush with outside of controller housing
- Insert allen key into front panel holes and turn clockwise. Mounting lugs will turn and gradually move towards panel (2)
- Turn allen key until mounting lug barely touches panel. Then move other mounting lug to the same position (3)
- Tighten both sides very carefully until keypad is secured. Do not over tighten as mounting lugs will break easily.



### Optional parameters

(recommended factory setting for majority of applications)

Code	Parameter description & choices	Min	Max	Factory Setting	Field Setting																									
uu	Start valve opening (%)	10	100	50																										
u9	Start opening duration (second)	1	30	5																										
uL	Low superheat alarm function 0 = disable (for flooded evaporator) 1 = enable auto reset 2 = enable manual reset Cut-out at 1°F (if it maintains 1 min.); Cut-in immediately at 6°F	0	2	1																										
u5	Superheat set-point (°F) If uL enabled (auto or manual) If uL disabled	5.4 0.9	54 54	10.8 10.8																										
u2	MOP function 0 = disable 1 = enable	0	1	1																										
u3	MOP set-point (°F) saturation temperature Factory setting is according to selected refrigerant (u0): +55°F for R22 +59°F for R134a +45°F for R507 +45°F for R404A +59°F for R407C +59°F for R410A +122°F for R124 +23°F for R744	*	*	X																										
□ 5	Units conversion (only for u3, u5, □ 1) 0 = °C, K, bar 1 = °F, R, psig (Psig values are divided by 10. Example: Display 12.5 is 125 psig)	0	1	0																										
□ 1	Value to show 0 = Measured superheat (F) 1 = Measured evaporator pressure (psi) 2 = Valve opening (%) 3 = Measured coil-out temp. (°F) 4 = calculated evaporating temperature (°F) from the pressure	0	4	0																										
b1	Battery error management, when battery is defective (EC3-X33 only), see below:	0	3	2																										
	<table border="1"> <thead> <tr> <th>Value</th> <th>Alarm Display</th> <th>Alarm Relay</th> <th>Valve</th> <th>Reset possibility after recovery/replacement</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>-</td> <td>-</td> <td>Regulating</td> <td>-</td> </tr> <tr> <td>1</td> <td>Ab</td> <td>-</td> <td>Regulating</td> <td>-</td> </tr> <tr> <td>2</td> <td>Ab</td> <td>Signalling</td> <td>Fully close</td> <td>Auto</td> </tr> <tr> <td>3</td> <td>Ab (blinking)</td> <td>Signalling</td> <td>Fully close</td> <td>Manual</td> </tr> </tbody> </table>	Value	Alarm Display	Alarm Relay	Valve	Reset possibility after recovery/replacement	0	-	-	Regulating	-	1	Ab	-	Regulating	-	2	Ab	Signalling	Fully close	Auto	3	Ab (blinking)	Signalling	Fully close	Manual				
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\* Min. and Max. setting values are dependant to selected type of refrigerant.

### Error/Alarm Handling

Alarm code	Description	Related parameter	Alarm relay	Valve	What to do?	Requires manual reset after resolving alarm
E0	Pressure transmitter error	-	Signalling	Fully close	Check wiring connection and measure the signal 4 to 20 mA	No
E1	Temperature sensor error	-	Signalling	Fully close	Check wiring connection and measure the resistance of sensor	No
A□	EX4...EX8 electrical connection error	-	Signalling	-	Check wiring connection and measure the resistance of winding	No
AL	Low superheat (<1°F)	uL: 1	Signalling	Fully close	Check wiring connection and operation of valve	No
AL blinking		uL: 2	Signalling	Fully close		Yes
Ab	Battery error	b1: 1	-	Regulating	Battery potentially does not have enough charge to close valve in case of main power supply interruption. May occur temporarily with new controllers or after long storage but should disappear when battery is charged sufficiently. If Ab remains active even when battery is charged, battery may be defective and should be replaced.	-
Ab		b1: 2	Signalling	Fully close		Yes
Ab blinking		b1: 3	Signalling	Fully close		Yes
Er	Data error display – out of range	-	-	-	Data send to the display is out of range. Check temperature and pressure sensor.	No

**Note:** When multiple alarms occur, the highest priority alarm is displayed until being cleared, then the next highest alarm is displayed until all alarms are cleared. Only then will parameters be shown again.

### Message

— No data to display

The display will show an “—” at start up and when no data is sent to ECD-002

### Checking system operating conditions

The data to be permanently shown on the display can be selected by the user (parameter □ 1). It is possible to temporarily display these values. However, this function is not available in an alarm condition. The display will show for

one second the numerical identifier of the data (see □ 1 parameter) and then the selected data. After 5 minutes, the display will return to the value selected by parameter □ 1.

### Service/Troubleshooting

Symptom	Cause	Action
Operating superheat is several degrees higher or lower than set-point	Incorrect signal from pressure or temperature sensors	1- Check the sensors 2- Make sure ECN-N60 temperature sensor is used 3- For optimum accuracy, please use: PT4-07M for R22/R134a/R507/R404A/R407C/R124 PT4-18M for R410A PT4-30M for R744 4- Make sure the sensor cables are not installed along with other high voltage cables
Operating superheat is too low i.e. compressor wet running	1- Incorrect wiring of ECVs 2- Defective sensors	1- Check the wiring 2- Check the sensor
Valve is not fully closed	1- The digital input is ON (24V) 2- Wrong setting of parameter ut.	1- Valve is shut off only when the digital input is turned off (0V) 2- Check the setting of parameter ut
Instable superheat (hunting)	Evaporator is designed to operate at higher superheat	Increase the superheat set-point
Valve opens when EC3 commands to close and vice versa	Wrong wiring between EC3-X33 and valve	Correct the wiring
EX8 is not able to open at high differential pressure	Wrong setting of parameter ut	Check the parameter ut. (Larger valve requires higher torque and higher current)
Superheat set-point is shifting after several months of uninterrupted operation or permanent jumper of 24V digital input	Stepper motor driven valves require synchronization	Do not apply permanent 24V digital input. Interrupt digital input once every week for 5 seconds if compressor never stops.

## Quick Start Up EC3-X33 & ECD-002

**0**

24 V AC

**1**

5 sec.

**1a**

12x

**1b**

**1c**

**1d**

1-199

**1e**

**2**

**2a**

**2b**

0 = R22  
 1 = R134a  
 2 = R507  
 3 = R404A  
 4 = R407C  
 5 = **R410A**  
 6 = R124  
 7 = R744

**2**

**3**

**3a**

**3b**

0 = PT4-07S  
 (R22/R134a/R507/R404A/R407C/R124)  
 1 = **PT4-18S (R410A)**  
 2 = PT4-30S (R744)

**3c**

**4**

**4a**

**4b**

1 = EX4  
 2 = EX5  
 3 = EX6  
 4 = **EX7**  
 5 = EX8

**4c**

**4d**

**4e**

24 V AC

### Display of Data:

SH =  $T_s - T_o$  (K)      Po (barg)      Vo (%)      Ts (°C)      To (°C)

EX4, EX5      EX6, EX7      EX8

Po => To  
 Ts  
 R22