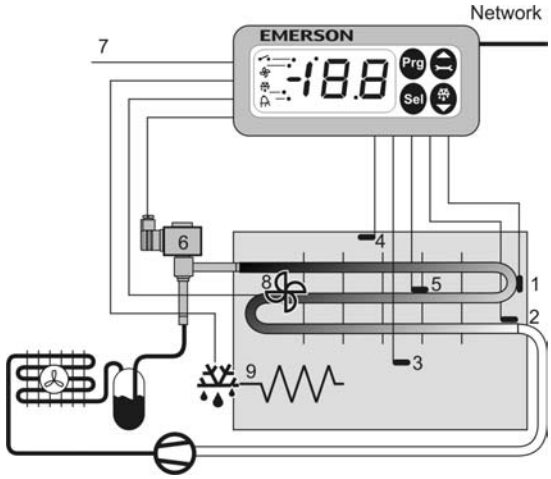
EC2-391 Display Case and Coldroom Controller

Operating Instructions

GB

Note: This document contains short form instructions for experienced users. Use last column in List of Parameters to document your individual settings. More detailed information can be found in the User Manual.

The EC2-391 is a dedicated refrigeration controller with superheat and a driver for an Alco Controls Electric Control Valve EX2. In addition the EC2-391 controls air temperature and manages defrost and fan(s).



Two ECN-Pxx pipe temperature sensors (1) and (2) measure suction gas temperatures at the evaporator inlet / outlet and feed the signals into the superheat control loop. The superheat controller output modulates the opening of the EX2 pulse width modulated Electrical Control Valve (6) thus optimising the refrigerant mass flow through the evaporator. The air temperature sensors (3) and (4) measure air-in and out temperature of the evaporator and feed signals into the air temperature thermostat. The ECN-Fxx fin sensor (5) is used for defrost termination. The controller has 3 relay outputs to control the defrost heater (9), the evaporator fan (8) and an optional output (7). Please consult the technical data (right) for input and output ratings.
In case of power loss, due to the positive shut-off characteristics of the EX2 Electrical Control Valves, a liquid line solenoid valve is not needed to prevent flooding of the compressor.

⚠ 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.**
- **Ensure electrical ratings per technical data are not exceeded.**
- **Disconnect all voltages from system before installation.**
- **Keep temperatures within nominal limits.**
- **Comply with local electrical regulations when wiring**

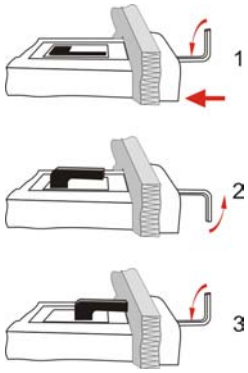
Technical Data

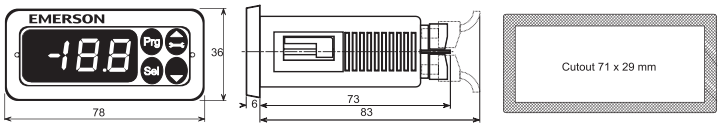
EC2 Series Controller

Power supply	24VAC ±10%; 50/60Hz; Class II
Power consumption	20VA max including EX2
Communication	LonWorks® Interface, FTT10, RJ45 connector
Plug-in connector size	Removable screw terminals wire size 0.14 … 1.5mm^2
Temperature storage operating	 -20 … +65°C 0 … +60°C
Humidity	0…80% r.h. non condensing
Protection class	IP65 (front protection with gasket)
Pressure transmitter input	24VDC, 4...20mA
Output relays (3)	SPDT contacts, AgCdO Inductive (AC15) 250V/2A Resistive (AC1) 250V/8A; 12A total return current
Triac output for EX2 Electrical Control Valve Coil (ASC 24V only)	24V AC, 0.1 … 1A
Marking	PCT AB28

Mounting

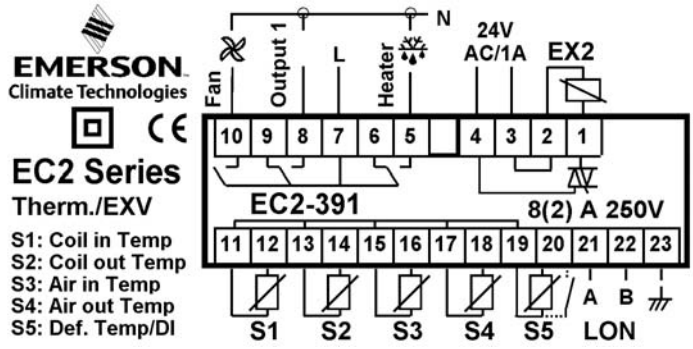
The EC2-391 can be mounted in panels with a 71 x 29 mm cutout. See dimensional drawing below for space requirements including rear connectors.
Push controller into panel cutout.(1)
Make sure that mounting lugs are flush with outside of controller housing
Insert allen key into front panel holes and turn 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 controller is secured. Do not over tighten as mounting lugs will break easily.





Electrical Installation

Refer to the electrical wiring diagram (below) for electrical connections. A copy of this diagram is labeled on the controller. Use connection wires/cables suitable for 90°C operation (EN 60730-1).



EC2 analog inputs are for dedicated sensors only and should not be connected to any other devices. **Important:** Keep controller and sensor wiring well separated from mains wiring. Minimum recommended distance 30mm.
Warning: Use a class II category transformer for 24VAC power supply (EN 60742). Do not ground the 24VAC lines. We recommend to use one transformer per EC2 controller and to use separate transformers for 3rd party controllers, to avoid possible interference or grounding problems in the power supply. Connecting any EC2 inputs to mains voltage will permanently damage the EC2.

Recommended Sensor Positions in Detail:

(1) ECN-Pxx coil-in temperature sensor: Position on the first return bend of the evaporator.

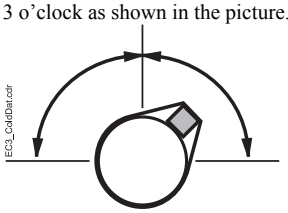
(2) ECN-Pxx coil-out temperature sensor: Position directly after the evaporator on the common suction line.

(3) ECN-Pxx air-in temperature sensor: Position in the middle of the cabinet as high as possible.

(4) ECN-Pxx air-out temperature sensor: Position asymmetric closer to the expansion valve as high as possible.

(5) ECN-Fxx fin temperature sensor: Position on the evaporator, asymmetric closer to the expansion valve.

Recommendations for mounting the pipe sensor: Insure proper thermal contact by using a metallic pipe clamp or temperature resistant plastic straps. Do not use standard plastic tie wraps (as used for electrical wiring) as they may become loose over time, which could result in faulty temperature measurements and poor superheat control performance. It is recommended to insulate the pipe temperature sensor with ARMAFLEX™ or equivalent. The recommended position of the pipe sensors is between 9 and 3 o'clock as shown in the picture.



Both air temperature sensors should be mounted on spacers in the air duct so that there is airflow around.

Caution: The sensor cables can be extended if necessary. The connection must be protected against water and dust.

The evaporator outlet temperature sensor should be mounted on the common suction header of the evaporator.

A calibration correction can be made using the parameter u1 (see procedure below).

Setup and Parameter Modification Using the Keypad

For convenience, an infrared receiver for the optional **IR remote control unit** is build-in, enabling quick and easy modification of the system parameters when a computer interface is not available.

Alternatively, 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

The first modifiable parameter code is displayed (/1).

To modify parameters see Parameters modification below.

Parameter Modification: Procedure

- 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 parameter:

- Do not press any button for at least 60 seconds (TIME OUT).
- Press "**ESC**" on IR remote control.

Defrost Activation:

A defrost cycle can be activated locally from the keypad:

- Press the ▼ button for more than 5 seconds, a flashing "0" is displayed
- Press ▲ or ▼ until "12" is displayed (password)
- Press **SEL** to confirm password

The defrost cycle is activated.

Special Functions:

The Special Functions can be activated by:

- Press ▲ and ▼ together for more than 5 seconds, a flashing "0" is displayed.
- Press ▲ or ▼ until the password is displayed (default = 12). If password was changed, select the new password.
- Press **SEL** to confirm password, a "0" is displayed and the Special Function mode is activated.
- Press ▲ or ▼ to select the function. The number of special functions is dynamic and controller dependent. See list below.
- Press **SEL** to activate the function without leaving the special function mode.
- Press **PRG** to activate the function and leave the special function mode.

Most of the Special Functions work in a toggle mode, the first call activates the function, and the second call deactivates the function.

The indication of the function can only be displayed after exiting the special function mode.

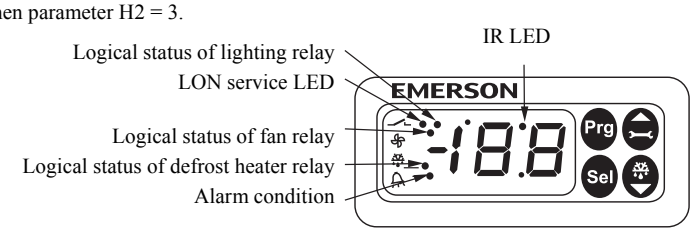
- 0: Display test function
- 1: Clear alarm messages
- 2: Cleaning mode. The cleaning mode is effectively a manual defrost with the option of the fans on/off. The cleaning mode should not be used in order to isolate the application for maintenance purposes.
- 3: Fans only
- 4: Set the electronic control valve to 100% open
- 5: Resets all parameters to the factory default setting. The controller will indicate "oF" during the reset and the valve will close.

Display of Data:

The data to be shown on the display can be selected by the user. In case of an alarm, the alarm code is displayed alternately with the selected data. The user can inhibit the alarm code. Press the **SEL** button to scroll through all possible displayable data.

The display will show for one second the numerical identifier of the data and then the selected data. After two minutes the display will return to the by parameter /1 selected data.

It is possible to temporarily display the values of the different sensors. This is a useful feature when initially setting-up the system without the aid of the WebPages. Press the **SEL** sequentially. The value displayed on the screen corresponds to the number corresponding to the /1 parameter. Action only valid when parameter H2 = 3.



List of Parameters

		Min	Max	Unit	Def.	Custom
/	**DISPLAY PARAMETERS**					
/1	Value to show 0 = Thermostat control temperature with Temp. alignment °C 1 = Air-in temperature °C 2 = Air-out temperature °C 3 = Alarm temperature °C 4 = Defrost termination temperature °C 5 = Coil-in temperature °C 6 = Coil-out temperature °C 7 = Calculated superheat °K 8 = Valve opening in % 9 = Displays defrost status	0	9	-	0	
/2	Alarm suppression 0 = off, 1 = on	0	1	-	0	
/5	Temperature Unit 0 = °C, 1 = °F	0	1	-	0	
/6	Decimal point 0 = yes, 1 = no	0	1	-	0	
/7	Display during defrost 0 = dF (= defrost mode); 1 = dF + defrost termination temp. 2 = dF + control temperature	0	2	-	0	
/C	Temperature alignment for /1=0	-20	20	K / °F	0.0	
A	**ALARM-PARAMETERS**					
A0	Mean factor alarm temperature	0	100	%	100	
A1	Low temp alarm delay	0	180	min	5	
A2	High temp alarm delay	0	180	min	5	
A3	Alarm delay after defrost	0	180	min	10	
AH	High temp alarm limit	AL	70	°C / K	40	
AL	Low temp alarm limit	-55	AH	°C / K	-50	
At	Alarm limit type 0=absolute temperatures °C; 1= relative temperatures K to setpoint	0	1	-	0	
r	**THERMOSTAT-PARAMETERS**					
r1	Min setpoint	-50	r2	°C	-50	
r2	Setpoint max	r1	60	°C	40	
r3	Day/night control 0 = off, 1 = on	0	1	-	1	
r4	Thermostat mode 0 = off, no thermostat function, continues cooling air in sensor monitoring off, no temp. alarms generated 1 = cooling, deadband control: cut in = set-point + difference; cut out = set-point 2 = cooling, modulating thermostat: cut in = set-point; cut out = set-point – difference /2 3 = heating, deadband control: cut in = set-point – difference; cut out = set-point 4 = on, external control using nvi Valve via SNMP. Air in and air out sensor monitoring off. Temp. alarms will be generated	0	4	-	1	
r6	Setpoint night	r1	r2	°C	4.0	
r7	Differential night	0.1	20.0	K	2.0	
r8	Mean factor, day operation	0	100	%	100	
r9	Mean factor, night operation	0	100	%	50	
rd	Differential day	0.1	20.0	K	2.0	
St	Setpoint day	r1	r2	°C	2.0	
d	**DEFROST PARAMETERS**					
d0	Defrost mode 0 = natural defrost, defrost heater not activated pulsed defrost not possible 1 = forced defrost, defrost heater activated, pulsed defrost possible 2 = forced defrost, defrost heater activated, pulsed defrost possible, defrost termination using nviStartUp via SNMP	0	2	-	1	
d1	Termination by: 0 = termination by temperature, termination by time will generate an alarm 1 = termination by time, termination by temperature will generate an alarm 2 = first, what ever comes first time or temperature, no alarm 3 = last, by time and temperature, no alarm	0	3	-	0	
d2	Defrost termination sensor 0 = Dedicated defrost sensor must be installed 1 = Air-out sensor used for defrost termination	0	1	-	1	
d3	Pulsed defrost 0 = off, no pulsed defrost, heaters switched off at defrost termination temperature dt or max. time dP whatever is selected 1 = on, pulsed defrost, dd and dH in use, heaters are switched off at dH and switched on again at dH – dd	0	1	-	0	
d4	Defrost at startup 0 = no, 1 = yes	0	1	-	0	
d5	Delay power up defrost	0	180	min	0	
d6	Pump down delay Compressor will run during pump down delay while valve is closed	0	180	sec	0	
d7	Drain delay	0	15	min	2	
d8	Injection delay Valve is open during injection delay while compressor is not running	0	180	sec	0	
d9	Demand defrost mode 0 = off, 1 = on, 2 = on together with timed defrost	0	2	-	0	
dd	Pulsed defrost differential	1	20	K	2	
dH	Pulsed defrost setpoint	-40	dt	°C	5	
dt	Defrost termination temperature	-40	90	°C	8	
dP	Max defrost duration	0	180	min	30	
dI	Defrost interval	0	192	h	8	
du	Start up delay after synch	0	180	min	30	
F	**FAN-PARAMETERS**					
F1	Fan startup by: 0 = on 1 = delayed by time Fd, error on temperature 2 = by temperature Ft, error on time 3 = first, whatever comes first time or temperature, no alarm 4 = last, time and temperature must come, no alarm	0	4	-	0	
F2	During no cooling 0 = on; 1 = off; 2 = delayed by F4; 3 = off, when door open	0	3	-	0	
F3	During defrost 0 = on, 1 = off	0	1	-	0	
F4	Stop delay time	0	30	min	0	
F5	During cleaning 0 = off, 1 = on	0	1	-	0	
Fd	Fan delay after defrost	0	30	min	0	
Ft	On temp after defrost	-40	40	°C	0	
u	**SUPERHEAT PARAMETERS**					
u0	Refrigerant 0 = R22 1 = R134a 2 = R507 3 = R404A 4 = R407C 5 = R410A 6 = R124 7 = R744A	0	7	-	3	
u1	Correction glide / dp Glide = positive values Pressure drop = negative values	-20.0	20.0	K	0.0	
u2	MOP control 0 = MOP off, 1 = MOP on	0	1	-	0	
u3	MOP temperature	-40	40	°C	0	
u4	Superheat mode 0 = off 1 = fixed superheat 2 = adaptive superheat	0	2	-	1	
u5	Superheat init setpoint	u6	u7	K	6	
u6	Superheat setpoint min.	3	u7	K	3	
u7	Superheat setpoint max.	u6	20	K	15	
uu	Start opening	25	75	%	30	
	DIGITAL INPUT PARAMETERS					
i0	S5 input 1 = inverse function	0	1	-	0	
∩0	Functions for S5 0 = normal input 1 = cleaning 5 = day / night switch 2 = only fan 6 = compressor safety chain 3 = door contact 7 = defrost request 4 = permanent cooling 8 = defrost inhibited	0	8	-	0	
	DIGITAL OUTPUT PARAMETERS					
o0	Output 1 = inverse function	0	1	-	0	
n0	Functions for output 1 = alarm	0	1	-	0	
H	**OTHER PARAMETERS**					
H2	Display access 0 = all disabled (Caution: access to controller only via LON network possible) 1 = Keyboard enabled 2 = IR remote control enabled 3 = Keyboard and IR remote control; Temporary data display and manual defrost enabled. 4 = Keyboard and IR remote control; Temporary data display disabled. Control setpoint with **SEL** key and manual defrost enabled.	0	4	-	3	
H3	IR access code	0	199	-	0	
H5	Password	0	199	-	12	

Formula for Mean Factors A0, r8, r9

Temperature calculation by the following formula:

Temperature = Air_{in} * (1 - Mean Factor / 100) + Air_{out} * Mean Factor / 100

Examples:

Mean factor = 0 , Temperature = Air in
Mean factor = 100, Temperature = Air out
Mean factor = 50 , Temperature = Average between Air-in and Air-out

Alarm Codes

E0 **Coil in sensor alarm**
E1 **Coil out sensor alarm**
E2 **Air-in sensor alarm** This Alarm Code is inhibited if no air-in sensor used (A0, r8 and r9 = 100)
E3 **Air-out sensor alarm** This Alarm Code is inhibited if no air-out sensor used (A0, r8 and r9 = 0) and fin sensor installed (d2 = 1)
E4 **Fin sensor alarm** This Alarm Code is inhibited if no fin sensor used (d2 = 0)

Explanations for **E0 … E4 Alarms**: No sensor connected, or the sensor and/or the sensor cable is broken or short-circuited.

Er **Data error display - out of range**
Data send to the display is out of range.
AH **High temperature alarm**
AL **Low temperature alarm**
AE **Thermostat emergency operation**
Air sensor failure, system is in continuous cooling mode
AF **Valve Status**
Valve closed due to compressor safety loop active
Ao **Superheat, emergency operation**
Sensor(s) failure
Ar **No refrigerant flow detected**
No refrigerant flow was detected
Au **Valve open 100% for more than 10 minutes**
dt **Forced defrost termination (time or temperature)**
Ft **Forced fan startup (time or temperature)**

Messages

--- **No data to display**
The display will show an "---" at node start up and when no data is send to the display.
In **Reset to default values activated**
The display will show an "In" when the factory default configuration data set is initialized.
Id **Wink request received**
The display will show a flashing "Id" when the wink request was received. The flashing "Id" will be shown on the display until the service button will be pressed, or a 30 min delay timer will expire or a second wink request is received.
OF **Node is offline**
The node is offline and no application is running. This is the result of a network management command and will happen for example during node installation.
dS **Defrost standby**
dP **Pump down**
dF **Defrost cycle**
dd **Defrost drain delay**
dI **Defrost injection delay**
du **Defrost start-up delay**
Cn **Cleaning**
CL **Alarms are cleared**

Visualising Data: LON Monitoring Server

The **EC2-391** has a LON communication interface enabling the controller to be directly connected to a Monitoring Server. It can be connected by using the optional cable assembly to a LON network (ECC-014, Order No. 804 381, with RJ45 to open, cable length 3m).

Neuron ID / Service PIN:

The service pin is available on the display. It is used to identify the controller in a LON network. Press the ⏏ button for app. 1 second to send the Neuron ID. The LED in the left upper corner will indicate the transmission of the Neuron ID.
The default settings may be modified remotely from the Monitoring Server via the LON network. Consult the Monitoring Server user manual for more information.
It is also possible to display live graphical data on the server or to log data containing the control temperature at defined intervals.

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