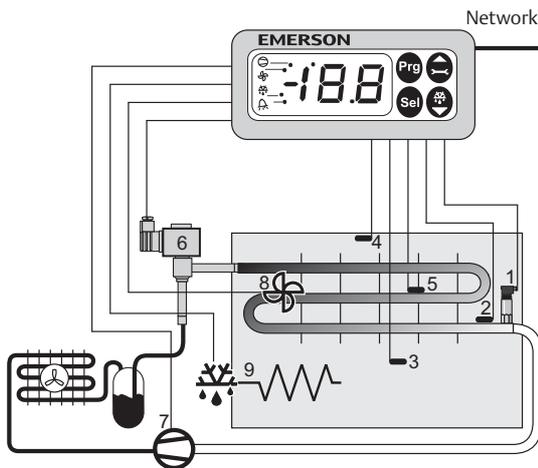


**Note:** This document contains short form instructions for experienced users. Use last column in List of Parameters to document your individual settings. More detailed information can be found in the User Manual.



The EC2-352 is a dedicated refrigeration controller with superheat and a driver for an Alco Controls Electric Control Valve EX2. In addition the EC2-352 controls air temperature and manages defrost and fan(s).



A PT5 pressure transmitter (1) and an ECN-Pxx pipe temperature sensor (2) measure saturated suction gas pressure and suction gas temperature at the evaporator 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 optimizing the refrigerant mass flow through the evaporator. The ECN-Sxx 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 compressor (7), defrost heater (9) and evaporator fan (8). 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	TCP/IP Ethernet 10MBit/s
Plug-in connector size	Removable screw terminals wire size 0.14 ... 1.5 mm <sup>2</sup>
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	

### Mounting

The EC2-352 can be mounted in panels with a 71 x 29 mm cutout. See dimensional drawing below for space requirements including rear connectors.

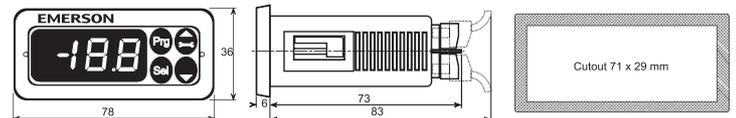
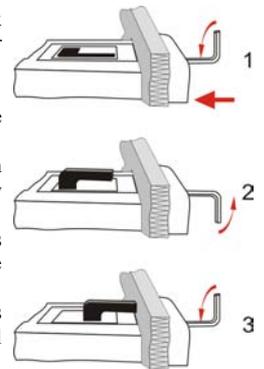
Push controller into panel cutout. (1)

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)

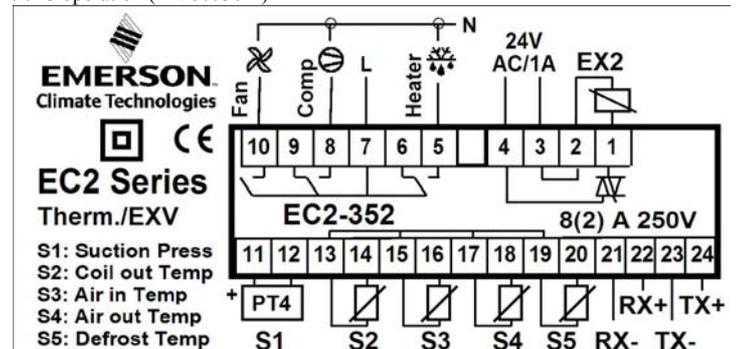
Turn allen key until mounting lug barely touches panel. Then move other mounting lug to the same position (3)

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. Connecting any EC2 inputs to mains voltage will permanently damage the EC2.

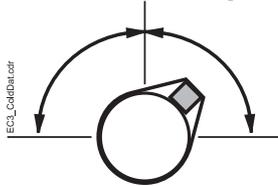
**Important:** Keep controller and sensor wiring well separated from mains wiring. Minimum recommended distance 30mm.

**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 3<sup>rd</sup> 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:

- (2) ECN-Pxx coil-out temperature sensor: Position directly after the evaporator on the common suction line.
- (3) ECN-Sxx air-in temperature sensor: Position in the middle of the cabinet as high as possible.
- (4) ECN-Sxx 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.



- (1) PT5-07M suction pressure transmitter: Position on the common suction line close to coil-out temperature sensor (2)

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:

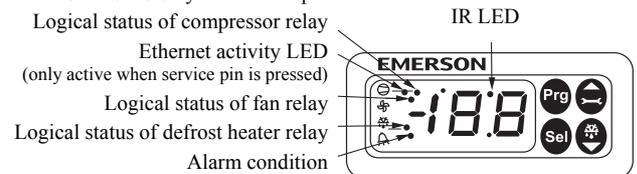
- Press **▲** and **▼** together for more than 5 seconds, a flashing "0" is displayed.
  - Press **▲** or **▼** until the password is displayed (default = 12). If password was changed, select the new password.
  - Press **SEL** to confirm password, a "0" is displayed and the Special Function mode is 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: Displays the current TCP/IP address
- 6: Set the controller's TCP/IP address to 192.168.1.101 (default value). This change is only temporary. A power down will reset the previous address.
- 7: 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 permanently shown on the display can be selected by the user (parameter /1). In case of an alarm, the alarm code is displayed alternately with the selected data. The user can inhibit the alarm code.

It is possible to temporarily display these values. This is a useful feature when initially setting-up the system without the aid of the WebPages. Press the **SEL** button to scroll through all possible displayable data.. The display will show for one second the numerical identifier of the data (see /1 parameter) and then the selected data. After two minutes the display will return to the by parameter /1 selected data. This action is only valid when parameter H2 = 3.



### List Of Parameters

/	DISPLAY PARAMETERS	Min	Max	Unit	Def.	Custom
/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 calculated from the pressure 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	

		Min	Max	Unit	Def.	Custom
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	2	-	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	

C COMPRESSOR PARAMETERS						
C0	Delay first start after power up	0	15	min	0	
C1	Cycle time	0	15	min	0	
C2	Min. stop time	0	15	min	0	
C3	Min. run time	0	15	min	0	

u SUPERHEAT PARAMETERS						
u0	Refrigerant 0 = R22 1 = R134a 2 = R507 3 = R404A 4 = R407C 5 = R410A 6 = R124 7 = R744	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	

P ANALOG SENSOR PARAMETERS						
P1	Pressure sensor type selection 0 = PT5-07M; 1 = PT5-18M; 2 = PT5-30M	0	2	-	0	

H OTHER PARAMETERS						
H2	Display access 0 = all disabled (Caution, access to controller only via the TCP/IP Ethernet 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:

$$\text{Temperature} = \text{Air}_{\text{in}} * (1 - \text{Mean Factor} / 100) + \text{Air}_{\text{out}} * \text{Mean Factor} / 100$$

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 Pressure 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. This function is action only when using SNMP protocol
- 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**
- dl** **Defrost injection delay**
- du** **Defrost start-up delay**
- Cn** **Cleaning**
- CL** **Alarms are cleared**

### Visualising Data : WebPages

A **TCP/IP Controller-Readme** file is available on the [www.emersonclimate.eu](http://www.emersonclimate.eu) website to provide detailed information about TCP/IP Ethernet connectivity. Please refer to this file if you need information beyond the contents of this instruction sheet.

The **EC2-352** has a TCP/IP Ethernet communication interface enabling the controller to be directly connected to a PC or network via the standard Ethernet port. The **EC2-352** controller has embedded WebPages to enable the user to easily visualise the parameter lists using real text labels.

No special software or hardware is required.

Connect the **EC2-352** using the optional EX-N60 cable assembly to a network or hub that enables the controller to receive a dynamic TCP/IP address. If a DHCP server is not available, the controller can be connected to a computer using a crossover cable plugged directly into the Ethernet port. In this case, the TCP/IP address of the computer must be manually modified to be compatible with the default address of the controller. Refer to the **TCP/IP Controller-Readme** file for more details.

Open the Internet browser program on the computer and enter the default TCP/IP address of the controller into the address line of the Internet browser: **192.168.1.101** or the dynamic address from the DHCP server. Refer to the **TCP/IP Controller-Readme** file if a specific port is required.

After a few moments, the default monitoring page should be displayed. If the browser does not open the default page or display active data, the user should check the Internet browser “Option” configuration. Refer to the **TCP/IP Controller-Readme** file.



The Monitoring and Alarm WebPages are read only and therefore it is not necessary to enter a username or password. A username and password will be requested upon the initial request to any of the other WebPages. The factory default settings are:

**Username: EmersonID**

**Password: 12**

The default settings may be modified in the Display configuration page. Press the tabs at the top of the Monitoring page with a left click of the mouse button to enter the respective Webpage.

The parameters will be visualised in real text together with the program code as defined in the parameter list below.

After the parameters have been modified, the complete list of settings can be saved to the memory of the computer and used later to upload into another controller. This can save a considerable amount of time when using multiple controllers and over a period of time, a library can be created containing the parameter lists for equipment for different applications.

It is also possible to display live graphical data from the controller. In addition, a permanent 30 days log file containing the control temperature at 15 minutes intervals is stored in the non-volatile memory to be later transferred using FTP to the computer. The log file can be imported into a standard spreadsheet program such as Excel. Refer to the **TCP/IP Controller-Readme** file for a complete description of the features available for the TCP/IP series of controllers.

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This document replaces all former versions