



cooling
technologies

REFRIGERATION CYCLE CONTROLLER FP-MC-23EM

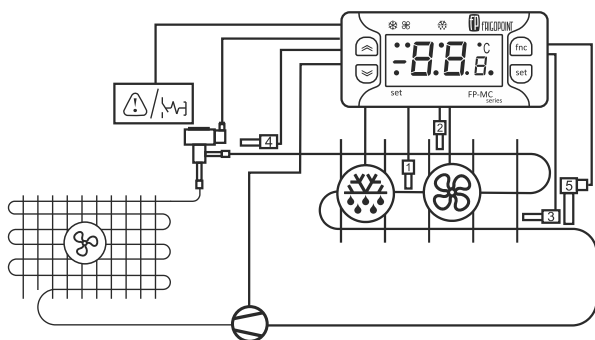
Operation instruction

Safety instruction

- Carefully read the following instruction. Ignoring this instruction may lead to failure of controller and to personnel injuries.
- Operation of controller should be done by qualified personnel which has all the necessary knowledge and skills.
- Please follow the sequence of connections, power polarity and safety rules.
- Follow instruction for connection and controller configuration. Ignoring instruction for connection and controller configuration may lead to it's failure.
- Follow requirements for temperature and humidity of working environment.

General data

Controller designed for superheat maintenance, temperature maintenance in a cooling space and defrost cycle management.



Technical data

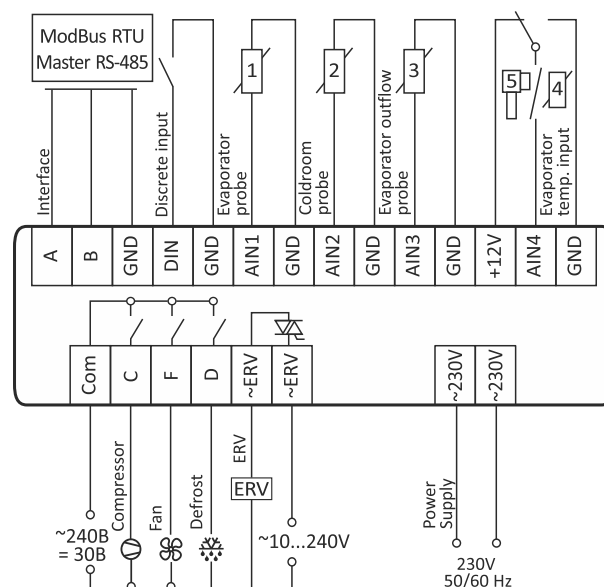
Power supply	~230V ±10%; 50/60 Hz
Power consumption	3VA
Sizes	Installation hole 71x29 mm Panel 77x35.5 mm Dimension 77x35.5x79(65,5) mm
Serial port	RS485 Modbus RTU
Environment	-5...+55 °C, relative humidity 10...90%
Protection class	IP 65 front panel, IP 20 case
Analogue input	FP-TSN(PX3-42H) range -45...110 °C - 4 pcs. 4...20mA - 1 pcs.
Discrete input	Clean contact, configured
Relay output	Ind.load (AC15) 250B/3A, (DC13) 30B/3A Resistive load (AC1) 250B/8A, (DC1) 30B/8A
ERV output	Triac (AC15) 10...230B/1A
Connections	Screws up to 1.5 mm ² with pitch 3.5mm

Installation

Controller is installed into panel with a notch 71x29mm. Fixation of controller is made with a help of clamps supplied together with controller.

Electrical connections

Connections are made according to the layout shown further in this instruction as well as on controller. Connection of probe to analog input AIN4 is realized according to a type of probe set in SPt parameter (pressure probe or temperature probe). In order to avoid effect of electromagnetic field of power signals on analog signals coming from probes make sure that minimum distance between power and probe wires is 30 mm. Analog inputs of controller are made for connecting probes of appropriate types only. It is allowed to connect coils of electronic expansion valves of set nominal voltage and power only.



Installation of probes

AIN1(1) – evaporator temperature probe – place between blades, closer to upper point of evaporator.

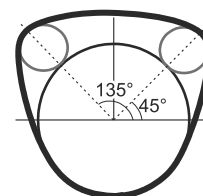
AIN2 (1) – coldroom temperature probe – place at the center of evaporator.

AIN3 (3) – temperature probe at outflow of evaporator – place on outcome horizontal tube.

AIN4 (4)² – temperature probe at inflow of evaporator – place on horizontal part of second turn of evaporator tube

AIN4 (5)³ – evaporation pressure probe – place on suction tube close to temperature probe at outflow of evaporator.

During installation of probes recommended to use metal crimps or thermostable cable ties. Installation of probes on a tube must be done under 45 and 135 degrees. It is recommended to make isolation of probes installed on a tube with a help of thermoinsulation.



Indications

In “off” state display should show in rotation current selected parameter dIS and sign OFF. In alarm mode display shows in rotation alarm message and current parameter dIS. When door is opened display shows in rotation sign dOr and current parameter dIS.

When changing parameters before indication of parameter display shows it's symbol: tCH – coldroom temperature, tEP – evaporator temperature, tIn – temperature on inflow of evaporator, tOu – temperature on outflow of evaporator, tOH – evaporator superheat temperature, Eru - on-off ratio of electronic expansion valve, Pln – evaporation pressure. In nominal mode indication of working components shown on display as dots (on, off, blinking).

	●	Compressor “on”		◐	Dripping time
	◐	Compress. run delay, vacuum		○	Defrost “off”
	○	Compressor “on”		●	Fan “on”
	●	Defrost “on”		○	Fan “off”

Menu and keyboard

Interface with display and 4 key is used to control state of a system and to set parameters in system menu as well as to turn programming functions. To turn special functions press and hold a key from the main screen for 3 seconds. System has three levels of access. Modification of setpoint parameters is made from quick menu. Access to setpoint menu is done by pushing “set” up to 3 seconds. Access to first and second level is done by entering password of first or second level in appropriate window of menu. If password is incorrect display shows PAS and returns to the main screen.

But.	Main function	Secondary func.
	Increase value	On/Off
	Decrease value	Normal/Eco mode
	Escape (Esc)	Defrost
	Entrance. Set.	Menu
		Block

Alarms

A1 – disconnection or short circuit of evaporator probe wires during 10 seconds. System continues working. Defrost is done on schedule and function fan to work depending on evaporator temperature is not working.

A2, A3, A4 – disconnection or short circuit of coldroom probe wires, inflow or outflow of evaporator during 10 seconds. System stops. If probe indication recovers system come back to work.

A5, A6 – superheat is higher AHO or lower ALO during time AOt. System continues working.

A7, A8 – coldroom temperature is higher then setpoint on AHS or lower on ALS during time AdS. System continues working.

A9 – system in nominal mode cannot reach setpoint during time Ast. System continues working.

A10 – pressure is lower then APL during Apt using pressure probes. System stops. If pressure is higher APL system come back to work.

A11 – digital inlet dIn state is inverse to dCC during time dIt. System stops. If inlet comes to normal state dCC, system come back to work.

List of parameters

Par	Description	Un	min	max	default	L
SYSTEM						
Sys	Working mode 0-stop, 1-always “on”, 2-“on”/ “off” key		0	2	0	1
Set	Regulation setpoint	°C	5LS	5HS	2.0	0
SH	Regulation differential	°C	0.1	20.0	2.0	1
SEC	Economy mode 0-nom mode, 1-eco mode, 2-“on”/ “off” key		0	2	0	1
SES	Economy mode setpoint	°C	5LS	5HS	4.0	1
SEH	Economy mode differential	°C	0.1	20.0	4.0	1
SHS	Maximum volume setpoint	°C	5LS	60.0	60.0	1
SLS	Minimum volume setpoint	°C	-60.0	5HS	-60.0	1
SPr	Filling time	sec	0	180	3	1
Sur	Vacuum time	sec	0	180	10	1
SP	Vacuum pressure ³	bar	-1.0	8	1.0	1
SH	Refrigerant superheat setpoint	K	1.0	20.0	6.0	1
SP	Koefficient P		0.0	99.9	5.0	2
SI	Koefficient I		0	999	30	2
dIn	Configuration of digital input DIN 0-no, 1-“on”/“off”, 2-nom/eco mode, 3-door, 4-defrost, 5-alarm		0	5	0	2
dCC	Configuration of digital input DIN 0-normal open (open - off/close - on 1-normal close (close - off/ open - on)		0	1	0	2
dIt	Time of response on signal digital input	sec	0	360	0	2
Adr	ModBus adress		1	255	1	2
SPd	ModBus speed (8 bit, parity - no, 1 stopbit) 1- 1200, 2- 2400, 3- 4800, 4- 9600, 5- 19200, 6- 28800, 7- 38400, 8- 43000, 9- 56000, 10- 57600, 11- 115200, 12- 128000	bit/ sec	1	12	5	2
dIS	Display 0-manual, 1-room temperature, 2-evaporator temperature, 3-input evap. temperature 4-output evap. temperature, 5-superheat, 6-on-off ratio ERV, 7-setpoint, (8-evaporating pressure)*		0	7(8*)	0	1
SE1	Calibration of temperature probe on evaporator	°C	-10.0	10.0	0.0	1
SE2	Calibration of temperature probe in coldroom	°C	-10.0	10.0	0.0	1
SE3	Calibration of outflow temperature probe	°C	-10.0	10.0	0.0	1
SE4	Calibration of inflow temperature	°C	-10.0	10.0	0.0	1
SP4	(Calibration of pressure sensor) ³	bar	-2.0	2.0	0.0	1
SPt	Input probe type AIN4 1-temp.sensor FP-TS-N, 2-pressure sensor FP-PT-12 3- pressure sensor (customize)		1	3	2	2

Par	Description	Un	min	max	default	L
SPL	Lower measurement limit of pressure probe (SPt=3)	bar	-1.0	5.0	0.0	2
SPH	Upper measurement limit of pressure sensor (SPt=3)	bar	0.0	50.0	0.0	2
SPF	Refrigerant type 0-R22, 1-R134a, 2-R404A, 3-R407C, 4-R410A, 5-R507A		0	5	0	2
Fnc	Programming «fnc» 0-нет, 1-оттайка		0	1	0	2
LOC	Key lock 0-“on”, 1- “off”		0	1	1	2
COMPRESSOR						
CFS	First start delay	sec	0	999	10	2
COH	Minimum working time	sec	0	999	30	2
COF	Minimum stop time	sec	0	999	0	2
CCO	Ciclicity of switching	sec	0	999	600	2
FAN						
FOC	Work together with ERV 0-always “on”, 1-work together with ERV		0	1	0	1
FCT	Evaporator temperature control 0- “off”, 1- “on”		0	1	0	1
FOH	Off temperaure	°C	-50.0	30.0	0.0	1
FFH	Off differential	°C	0.1	30.0	5.0	1
ERV						
EPH	Period	c	3	16	6	2
ELL	Minimum on-off ratio of ERV	%	0	EHL	10	2
EHL	Maximum on-off ratio ERV	%	ELL	100	100	2
ESL	Initial state	%	ELL	EHL	75	2
DEFROST						
dOH	First defrost offset	min	0	999	0	1
dPr	Defrost interval	10 min	0	999	18	1
dDr	Defrost duration	min	0	180	30	1
dEt	End defrost temperature	°C	-30.0	50.0	10.0	1
dnc	Defrost mode 0-free defrost, 1-Electric		0	1	1	2
dCC	Start from defrost (switching “on”) 0- “off”, 1- “on”.		0	1	0	2
dDf	Fan delay time	sec	0	999	20	1
dD	Drip-off time delay	min	0	30	10	1
dFt	Evaporator probe defrost AIN1 0- “off”, 1- “on”		0	1	1	2
dFd	Fan working mode during defrost 0-“off”, 1 “on”-		0	1	0	2
dId	Display mode during defrost 0-room temperature, 1 temperature before defrost, 2-DEF		0	2	1	2
ACCESS						
Pr1	First level access password		0	999	000	2
Pr2	Second level access password		0	999	0 10	2
rSt	Default settings (YES, no)		no	YES	no	2
ALARMS						
AHS	Exceed temperature above setpoint	°C	2	30	30	2
ALS	Decrease temperature under setpoint	°C	2	30	30	2
AdS	Exceed/decrease waiting time ⁴	min	0	360	0	2
ASt	Setpoint waiting time ⁴	hour	0.0	99.0	0.0	2
ALO	Minimum superheat	K	0.0	AHO	0.0	2
AHO	Maximum superheat	K	ALO	50.0	50.0	2
AOE	Superheat waiting time ⁴	min	0	999	0	2
APn	Minimum waiting time ³	bar	-1.0	10.0	0.0	2
APt	Minimum pressure waiting time ³⁽⁴⁾	c	0	999	10	2

¹- this instruction is a description of functions for experienced users.

²- as evaporation probe it is recommended to use pressure probe due to

it's lower persistence in comparison to temperature probe;

³- manufacturer is not responsible for correct operation of controller if non original temperature (FP-TSN) and pressure (FP-PT) probes are used;

*- parameters available if configuration with pressure probe is used;

** - setting 0 for temporary parameters turns off alarm running.