

User Manual

(Version V1.1)

EVDCool

Uni-polar electronic expansion valve controller



Introduction

EVDCool is a controller for single pole stepper motor which manages one electronic expansion valve. It is designed for DIN rail assembly and is fitted with removable screw terminals. EVDCool controls refrigerant superheat and optimizes the efficiency of the refrigerant circuit, guaranteeing maximum flexibility, being compatible with various types of refrigerants and valves (Danfoss, Sporlan, Emerson, CAREL, SANHUA). It features low superheat (LowSH), high evaporation pressure (MOP), and low evaporation pressure (LOP) protection, and can manage, as an alternative to superheat control, special functions such as the hot gas bypass, evaporator pressure regulation (EPR) and control of the valve downstream of the gas cooler in transcritical CO₂ circuits. The controller can drive an electronic expansion valve in a refrigerant circuit with Digital Scroll compressor, if integrated with a specific UX* controller via Modbus RTU.

As regards network connectivity, the controller can be connected to either of the following:

- a UX* controller via RS485/Modbus;
- a supervisor or IOT platform via RS485/Modbus.

In this case, On/Off control is performed via digital input 1, if suitably configured. As well as regulation start/stop, digital inputs 1 can be configured for the following:

- valve regulation optimization after defrosts;
- valve forced open (at 100%);
- regulation backup;
- regulation security.

Another possibility involves operation as a simple positioner with 4 to 20 mA or 0 to 10 Vdc analogue input signal.

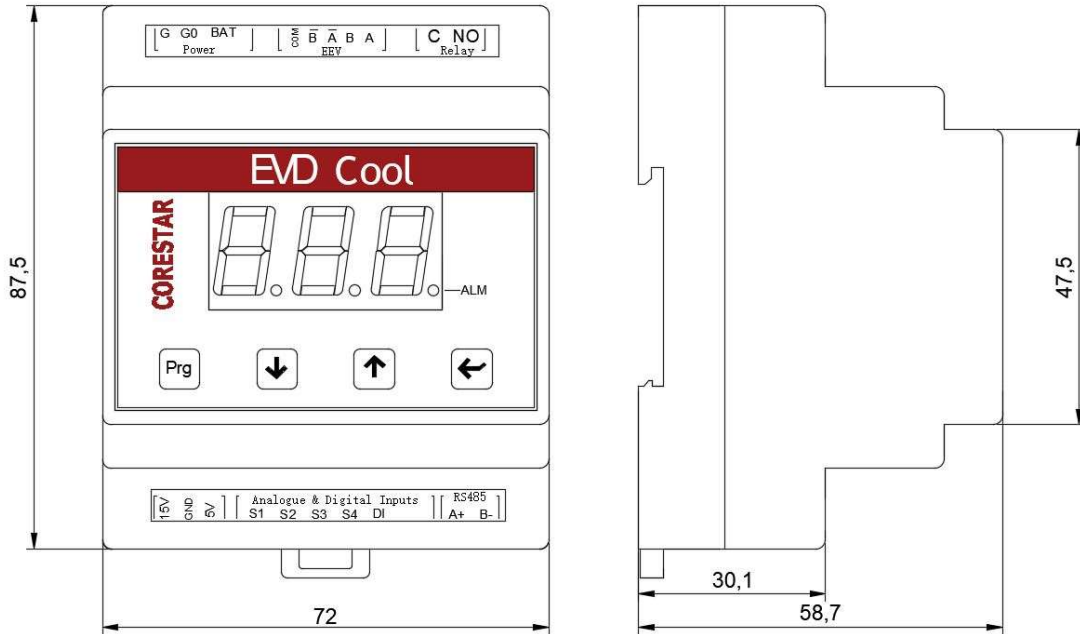
EVDCool has one build-in LED display and one keypad with four keys, so that the user can change/configure parameters easily. normally, the user just needs 4 parameters to start basic regulation:

- refrigerant
- Valve
- Pressure sensor
- main regulation

Main Features

- electrical connections by removable screw terminals;
- RS485 bus with standard Modbus RTU;
- compatibility with various types of valves;
- superheat control with protection functions for low superheat LowSH, MOP, LOP;
- build-in LED display and keypad, easy to check/change/config parameters;
- parameters protected with password;
- supports both 0.5V~4.5V and 4~20 mA pressure transducer;
- supports both NTC and PT1000 temperature probes
- 4~20 mA or 0~10 Vdc input to use the controller as a positioner controlled by an external signal;
- management of power failures with valve closing (both 24Vac and 24Vdc);
- pre-position time settable by parameter;
- 4 to 20 mA pressure transducer can be shared between up to 5 drivers;

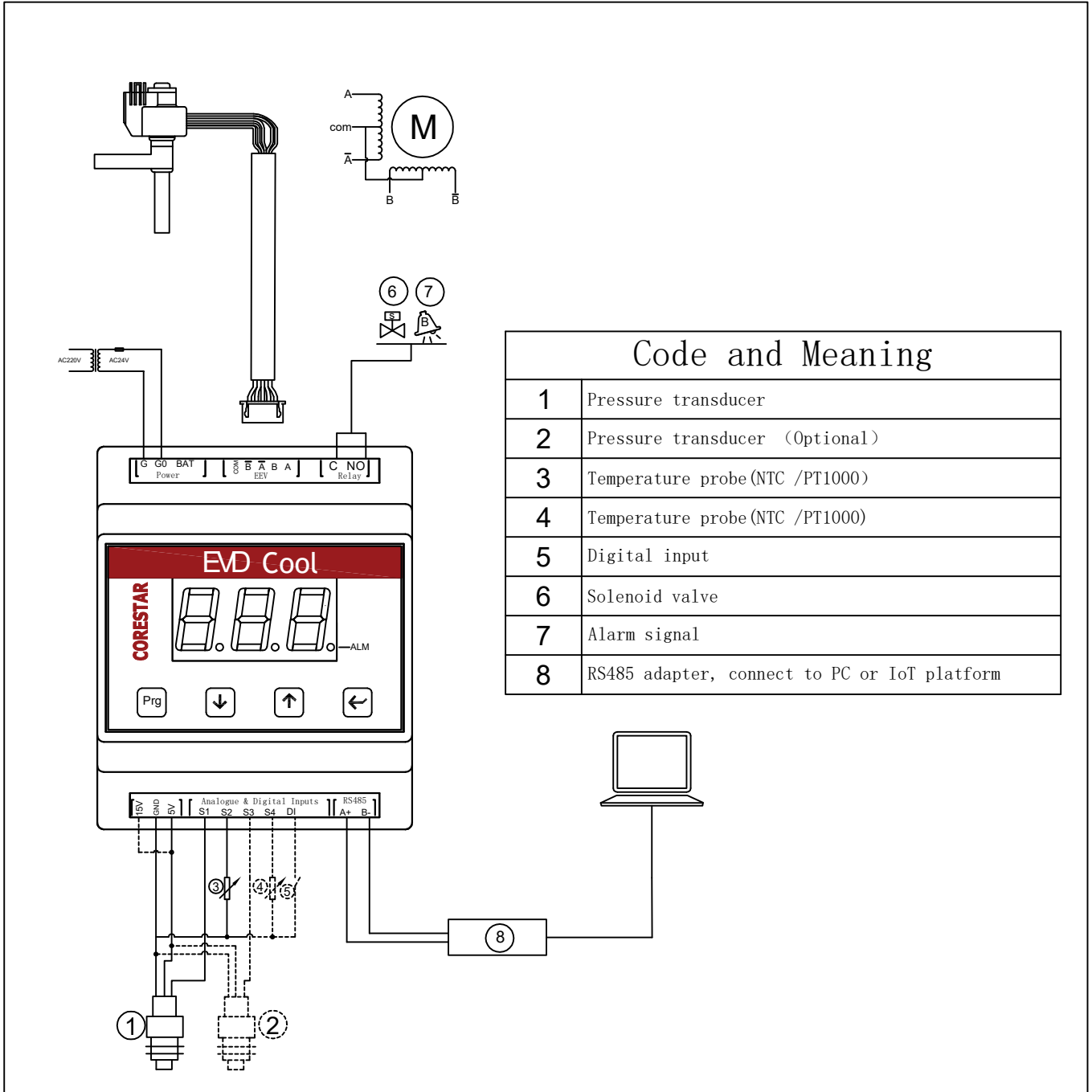
DIN assembly and dimensions (unit: mm)



Description of the terminals

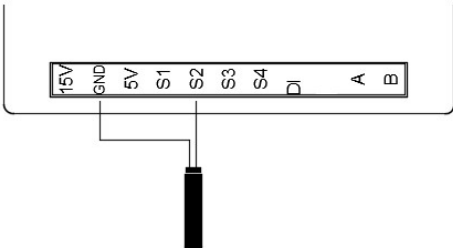
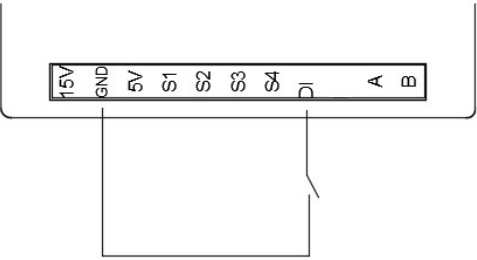
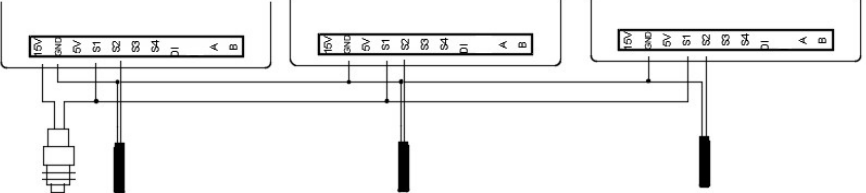
G GO	24VAC or 24VDC power supply, when using DC switching power supply, G=V+, GO=V-
VBAT	Backup battery
$\begin{bmatrix} \text{COM} \\ \text{B} \\ \text{A} \\ \text{B} \\ \text{A} \end{bmatrix}$ EEV	EEV stepper motor power supply
COM, NO	Alarm relay output (COM: common point, NO: normally open)
15V, 5V	Power supply to active probes (15V and 5V cannot be shorted)
GND	Signal ground
S1	Probe 1 (4~20mA or 0.5~4.5V type pressure transducer) or external 4~20mA signal, related to C09
S2	Probe 2 (NTC or PT1000) or external 0~10V signal, related to C10
S3	Probe 3 (4~20mA or 0.5~4.5V type pressure transducer) or external 4~20mA signal
S4	Probe 4 (NTC)
DI1	Digital input 1, related to C07
A	RS485 A or Tx/Rx+
B	RS485 B or Tx/Rx-

General Connection diagram

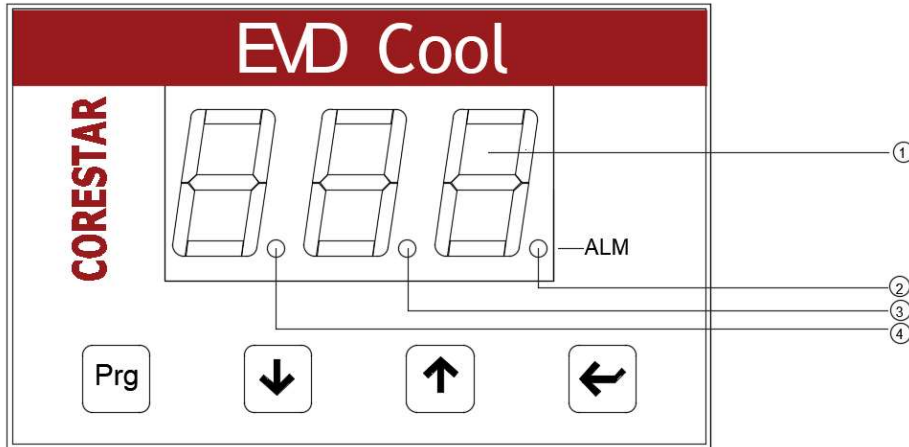


Wiring diagram

Pressure transducer	4-20mA 2-wires	
	4-20mA 3-wires	
	0.5-4.5V 3-wires	
positioner	4-20mA	
	0-10V	

<p>Temperature</p>	<p>NTC NTC-HT PT1000</p>	
<p>Digital inputs</p>	<p>Start/Stop signal</p>	
<p>Shared Pressure transducer</p>	<ul style="list-style-type: none"> ● Max 5 ● Only 4~20mA 	






LED display icons and keys definition



Indicator	Normal	Alarming
①	Segments to show menu and value	Show value alternatively with alarm code
②	OFF	Blinking
③	Lights on when the value to be displayed is a decimal	Lights on when the value to be displayed is a decimal
④	Lights on when the displayed value is bigger than 999, otherwise off, representing 10 times the displayed value, for example: 1.23 means 1230	Lights on when the displayed value is bigger than 999, otherwise off, representing 10 times the displayed value, for example: 1.23 means 1230
Key	Short press	Long (3 seconds) press
	--Parameters setup (password 22) --back to menu	Same to short press
	-- Menu down -- Value decrease	--Value fast decrease
	--Menu up --Value increase	--Value fast increase
	--Save changes to RAM, will lose if reboot --show value --back to parameters' code	Save changes to EEPROM, will NOT lose even if reboot

Parameters list

(Note: A: Analogue data, D: Digital data, I: integer data, R: Readable, W: Writable)

Code	Description	Default	Min	Max	Unit	Type	Access	Modbus register
<p>DO NOT NEED a password to access below parameters, please operate as below steps:</p> <p>Not in edit status and press  → Display shows SH code → press  or  to switch the code → press  to check the value of code → press  back to the code level</p>								
PS	Password entering	22						
OPn	Valve Opening	0	0	100	%	A	R	16
StP	Valve Steps	0	0	9999	步	I	R	131
Ucc	Unit capacity	0	0	100	%	I	R/W	134
SH	Super heat	0	-40	180	K	A	R	9
Sut	Suction temperature	0	-60	200	°C	A	R	4
Eut	Evaporation temperature	0	-60	200	°C	A	R	5
Eup	Evaporation pressure	0	-20	200	bar	A	R	6
Cdt	Condensing temperature	0	-20	200	°C	A	R	10
CdP	Condensing pressure	0	-60	200	bar	A	R	11
P1	Probe S1 reading	0	-20	200	bar/mA	A	R	0
P2	Probe S2 reading	0	-60	200	°C	A	R	1
P3	Probe S3 reading	-20	200	A	bar/mA	R	0	2
P4	Probe S4 reading	0	-20	200	°C	A	R	3
RNP	4 to 20 mA input value (S1)	4	4	20	mA	A	R	18
UOL	0 to 10 V input value (S2)	0	0	10	V	A	R	19

d I	Digital input status (DI 1)	0	0	1	-	D	R	13
r L P	Alarm relay output status	0	0	1	-	D	R	8

NEED input correct password to query or modify below parameters, please operate as below steps:

Not in edit status and press → display shows **P S** code → press , display will show value **0** → press or to increase or decrease the value until it is equal to the correct password → press , display will show **C O I** code if password is correct → Press or to switch the code → press to query the value of code → press back to the code level

NOTE:

- ◆ Short press of , will keep all changes to RAM of controller, all changes will lose if reboot. if you want to keep the changes even reboot, please press at least 3 seconds
- ◆ If you want to change more than one parameters, you can save them to RAM firstly by short press, and have a long press (3s) at last one, so that you can save all changes to EEPROM

C O I	Modbus network address	1	1	207	-	I	R/W	138			
C O 2	Modbus connection configuration	2	0	30	-	I	R/W	201			
	Value								Baud rate	Stop bit	Parity
	0								4800	2	none
	1								9600	2	None
	2								19200	2	None
	4								4800	1	None
	5								9600	1	None
	6								19200	1	none
	16								4800	2	even
	17								9600	2	Even
	18								19200	2	Even
	20								4800	1	Even
	21								9600	1	Even
	22								19200	1	Even
	24								4800	2	odd
	25								9600	2	Odd
	26								19200	2	Odd
28	4800	1	Odd								
29	9600	1	Odd								
30	19200	1	Odd								
C O 3	Valve: 1= ExV uni-polar, 500stps	1	0	1	-	I	R/W	141			

C 0 4	Refrigerant: 1=R22 2=R134a 3=R404A 4= R407C 5= R410A 6=R507A 7=R290 8=R600 9=R600a 10= R717 11=R744 12=R728 13=R1270 14=R417A 15=R422D 16=R413A 17=R422A 18=R423A 19=R407A 20=R427A 21= R245FA 22=R407F 23=R32 24=HTR01 25=HTR02 26=R23	3	1	26	-	I	R/W	140
C 0 5	Main regulation: 0= user defined; 1= Multiplexed showcase/cold room 2= Showcase/cold room with compressor on board 3= "Perturbed" showcase/cold room 4= Showcase/cold room with sub-critical CO2 5= R404A condenser for sub-critical CO2 6= Air-conditioner/chiller with plate heat exchanger 7= Air-conditioner/chiller with tube bundle heat exchanger 8= Air-conditioner/chiller with finned coil heat exchanger 9= Air-conditioner/chiller with variable cooling capacity 10= "Perturbed" air-conditioner/chiller 11= EPR back pressure 12= Hot gas bypass by pressure 13= Hot gas bypass by temperature 14= Transcritical CO2 gas cooler 15= Analogue positioner (4 to 20 mA) 16= Analogue positioner (0 to 10 V) 17= Air-conditioner/chiller or showcase/cold room with adaptive control 18= Air-conditioner/chiller with Digital Scroll compressor	1	1	18	-	I	R/W	142
C 0 6	Relay function: 1= Disabled 2= Alarm relay (open when alarm active) 3= Solenoid valve relay (open in standby) 4= Valve + alarm relay (open in standby and control alarms) 5= Reversed alarm relay (closed in case of alarm) 6= Valve status relay (open if valve is closed) 7= Direct command 8= Faulty closure alarm relay (opened if alarm) 9= Reverse faulty closure alarm relay (closed if alarm)	2	1	9	-	I	R/W	139
C 0 7	DI 1 function: 1= Disabled 2= Valve regulation optimization after defrost 3= Discharged battery alarm management 4= Valve forced open (at 100%) 5= Regulation start/stop 6= Regulation backup 7= Regulation security	5	1	7	-	I	R/W	212
C 0 9	Probe S1: Ratiometric (0.5 ~4. 5 V) Current (4 ~ 20 mA) 1= -1...4,2 bar 8= -0,5...7 bar 2= -0,4...9,3 bar 9= 0...10 bar 3= -1...9,3 bar 10= 0...18,2 bar 4= 0...17,3 bar 11= 0...25 bar 5= 0,85...34,2 bar 12= 0...30 bar 6= 0...34,5 bar 13= 0...44,8 bar 7= 0...45 bar 14=shared-0,5...7 bar 21= -1 ~ 12,8 bar 15= shared 0...10 bar 22= 0 ~ 20,7 bar 16= shared 0...18,2 bar 23= 1.86 ~ 43.0 bar 17= shared 0...25 bar 24= liquid level 18= shared 0...30 bar 25=0...60,0bar 19= shared 0...44,8 bar 26=0...90,0bar 20=signal 4~20mA 27=signal 0~5V 28=0...20bar 29=0...25bar	3	-1	29	-	I	R/W	143
C 1 0	Probe S2: 0=user defined 1= NTC normal 2= NTC high temperature 3= combined NTC 4=0 ~ 10 V signal 5=NTC low temperature 6=PT1000	1	-1	6	-	I	R/W	144
C 1 1	Probe S3: Ratiometric (0.5 ~4. 5 V) Current (4 ~ 20 mA) 1= -1...4,2 bar 8= -0,5...7 bar 2= -0,4...9,3 bar 9= 0...10 bar 3= -1...9,3 bar 10= 0...18,2 bar 4= 0...17,3 bar 11= 0...25 bar 5= 0,85...34,2 bar 12= 0...30 bar 6= 0...34,5 bar 13= 0...44,8 bar 7= 0...45 bar 14=shared-0,5...7 bar 21= -1 ~ 12,8 bar 15= shared 0...10 bar 22= 0 ~ 20,7 bar 16= shared 0...18,2 bar 23= 1.86 ~ 43.0 bar 17= shared 0...25 bar 24= liquid level 18= shared 0...30 bar	3	-1	29	-	I	R/W	146

	25=0...60,0bar 26=0...90,0bar 27=signal 0~5V 28=0...20bar 29=0...25bar	19= shared 0...44,8 bar 20=signal 4~20mA							
C 12	Probe S4: 0=user defined 2=NTC high temperature 4=----- 6=PT1000	1= NTC normal 3= combined NTC 5=NTC low temperature	1	-1	6	-	I	R/W	147
C 13	Probe S1 alarm management: 1= No action 2= Forced valve closing 3= Valve in fixed position 4= Use backup probe S3 (*) (*) CANNOT BE SELECTED		3	1	4	-	I	R/W	151
C 14	Probe S2 alarm management: 1= No action 2= Forced valve closing 3= Valve in fixed position 4= Use backup probe S4 (*) (*) CANNOT BE SELECTED		3	1	4	-	I	R/W	152
C 15	Probe S3 alarm management: 1= No action 2= Forced valve closing 3= Valve in fixed position		1	1	3	-	I	R/W	153
C 16	Probe S4 alarm management: 1= No action 2= Forced valve closing 3= Valve in fixed position		1	1	3	-	I	R/W	154
P 0 1	S1: calibration offset		0	-60 , -60	60 , 60	bar mA	A	R/W	33
P 0 2	S1: calibration gain, 4 to 20 mA		1	-20	20	-	A	R/W	35
P 0 3	Pressure S1: Minimum value		-1	-20	S1: Max	bar	A	R/W	31
P 0 4	Pressure S1: Maximum value		9,3	S1: Min	200	bar	A	R/W	29
P 0 5	Pressure S1: Minimum alarm value		-1	-20 (-290)	S1: Max alarm value	bar	A	R/W	38
P 0 6	Pressure S1: Maximum alarm value		9,3	S1: Min alarm value	200	bar	A	R/W	36
P 0 7	S2: calibration offset		0	-20 , -20	20 , 20	° C , V	A	R/W	40
P 0 8	S2: calibration gain,0 ~ 10 V		1	-20	20	-	A	R/W	42
P 0 9	Pressure S2: Minimum alarm value		-50	-60	S2: Max alarm value	° C	A	R/W	45
P 1 0	Pressure S2: Maximum alarm value		105	S2: Min alarm value	200	° C	A	R/W	43
P 1 1	S3: calibration offset		0	-60	60	Bar	A	R/W	34
P 1 2	S3: calibration gain, 4 ~ 20 mA		1	-20	20	-	A	R/W	81
P 1 3	Pressure S3: Minimum value		-1	-20	S3: Max	bar	A	R/W	32

P 14	Pressure S3: Maximum value	9,3	S3: Min	200	bar	A	R/W	30
P 15	Pressure S3: Minimum alarm value	-1	-20	S3: Max alarm value	bar	A	R/W	39
P 16	Pressure S3: Maximum alarm value	9,3	S3: Min alarm value	200	bar	A	R/W	37
P 17	S4: calibration offset	0	-20	20	° C	A	R/W	41
P 18	Pressure S4: Minimum alarm value	-50	-60	S4: Max alarm value	° C	A	R/W	46
P 19	Pressure S4: Maximum alarm value	105	S4: Min alarm value	200	° C	A	R/W	44
r 01	Superheat set point	11	LowSH: threshold	180	K	A	R/W	49
r 02	start-up delay after defrost	10	0	60	minute	I	R/W	167
r 03	Hot gas bypass temperature set point	10	-60	200	° C	A	R/W	27
r 04	Hot gas bypass pressure set point	3	-20	200	bar	A	R/W	61
r 05	EPR pressure set point	3,5	-20	200	bar	A	R/W	28
r 06	PID: proportional gain	15	0	800	-	A	R/W	47
r 07	PID: integral time	150	0	1000	s	I	R/W	165
r 08	PID: derivative time	5	0	800	s	A	R/W	48
R 01	LowSH protection: threshold	5	-40	Superheat set point	K	A	R/W	55
R 02	LowSH protection: integral time	15	0	800	s	A	R/W	54
R 03	LOP protection: threshold	-50	-60 (-76)	MOP protection threshold	° C	A	R/W	51
R 04	LOP protection: integral time	0	0	800	s	A	R/W	50
R 05	MOP protection: threshold	50	LOP protection threshold	200	° C	A	R/W	53
R 06	MOP protection: integral time	20	0	800	s	A	R/W	52
R 07	MOP: suction temperature threshold (S2)	30	-85	200	° C	A	R/W	101

R 0 8	Low superheat alarm delay (LowSH) (0= alarm disabled)	300	0	18000	s	I	R/W	170
R 0 9	Low evaporation temperature alarm delay (LOP) (0= alarm disabled)	300	0	18000	s	I	R/W	168
R 1 0	High evaporation temperature alarm delay (MOP) (0= alarm disabled)	600	0	18000	s	I	R/W	169
R 1 1	Low suction temperature alarm threshold	-50	-60	200	° C	A	R/W	25
R 1 2	Low suction temperature alarm delay (0= alarm disabled)	300	0	18000	s	I	R/W	136
F 0 1	EEV minimum steps	50	0	9999	step	I	R/W	157
F 0 2	EEV maximum steps	480	0	9999	step	I	R/W	158
F 0 3	EEV closing steps	500	0	9999	step	I	R/W	163
F 0 4	Valve opening at start-up	50	0	100	%	I	R/W	164
F 0 5	Valve open in standby (0= disabled= valve closed; 1=enabled = valve open according to parameter F 0 6)	0	0	1	-	D	R/W	22
F 0 6	Valve position in stand-by 0 = 25% 1...100% = % opening	0	0	100	%	I	R/W	218
F 0 7	enable manual valve positioning	0	0	1	-	D	R/W	23
F 0 8	Manual valve position	0	0	9999	step	I	R/W	166
F 0 9	Power supply type 0= 24 Vac; 1= 24 Vdc	1	0	1	-	D		46
F 1 0	Pre-position time	6	0	18000	s	I	R/W	217

Technical Specifications

Power supply		24 Vac (+10/-15%) 50/60 Hz, to be protected by external 2 A type T fuse 24 Vdc (+10/-15%) , to be protected by external 2 A type T fuse. (need to change F09 value accordingly)
Max power consumption		10.0 W
Backup power supply		22 Vdc+/-5%
Valve connection cable		5 or 6-wire shielded cable AWG 18/22, Max length is 10m or AWG14, Max length 50m
Digital input		Digital input to be activated from voltage-free contact or transistor to GND. Closing current 5 mA; Max length 30 m
Probes (Max length: 10m)	S1	Ratiometric pressure probe (0.5 to 4..5V): <ul style="list-style-type: none"> • resolution 0.1 % fs; • measurement error: 2% fs maximum; 1% typical Current type pressure probe (4 to 20 mA): <ul style="list-style-type: none"> • resolution 0.5 % fs; • measurement error: 8% fs maximum; 7% typical Shared current type pressure probe (4 to 20mA). Maximum number of drivers connected=5
	S2	Low temperature NTC: <ul style="list-style-type: none"> • 10 KΩ at 25° C, -50T90 ° C; • measurement error: 1° C in range -50T50 ° C; 3° C in range +50T90 ° C High temperature NTC: <ul style="list-style-type: none"> • 50 KΩ at 25° C, -40T150 ° C; • measurement error: 1.5 ° C in range -20T115 ° C, 4 ° C in range outside of -20T115 ° C Combined NTC: <ul style="list-style-type: none"> • 10 KΩ at 25 ° C, -40T120 ° C; • measurement error: 1 ° C in range -40T50 ° C; 3° C in range +50T90 ° C PT1000: <ul style="list-style-type: none"> • support class A and Class B; measurement range: -85 T 100° C 0 to 10 V input (max 12 V): <ul style="list-style-type: none"> • resolution 0.1 % fs; • measurement error: 9% fs maximum; 8% typical
	S3	Ratiometric pressure probe (0.5 to 4..5V): <ul style="list-style-type: none"> • resolution 0.1 % fs; • measurement error: 2% fs maximum; 1% typical current pressure probe (4 to 20 mA): <ul style="list-style-type: none"> • resolution 0.5 % fs; • measurement error: 8% fs maximum; 7% typical Shared current type pressure probe (4 to 20mA). Maximum number of drivers connected=5
	S4	Low temperature NTC: <ul style="list-style-type: none"> • 10 KΩ at 25° C, -50T90 ° C; • measurement error: 1° C in range -50T50 ° C; 3° C in range +50T90 ° C High temperature NTC: <ul style="list-style-type: none"> • 50 KΩ at 25° C, -40T150 ° C; • measurement error: 1.5 ° C in range -20T115 ° C, 4 ° C in range outside of -20T115 ° C Combined NTC: <ul style="list-style-type: none"> • 10 KΩ at 25 ° C, -40T120 ° C; • measurement error: 1 ° C in range -40T50 ° C; 3° C in range +50T90 ° C
Relay output		SPST, normally open contact; 5A, 250 Vac resistive load; 2 A, 250 Vac inductive load
Active pressure probe power supply		+5 Vdc+/-2% or 15 Vdc+/-10%
RS485 serial connection		Max length 1000m with shielded cable
Assembly		DIN
Connectors		removable, pitch 5.0mm, cable size 0.5 to 2.5 mm ² (12 to 20 AWG)
Dimensions (mm)		LxHxW=72x87.5x58.7
Operating conditions		-25 to 60° C <90% RH, non-condensing
Storage conditions		-35 to 60° C <90% RH, non-condensing
Index of protector		IP20
Conformity		Electrical safety: EN 60730-1, EN 61010-1, UL873, VDE 0631-1 EMC: EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4; EN61000-3-2, EN55014-1, EN55014-2, EN61000-3-3.

Alarms

Alarm type	Possible reasons	Alarm code	Relay	Reset	Effects on control	Check/solutions
Probe S1	Probe S1 faulty or exceeded set alarm range	<i>P 1</i>	Depends on Configuration	Automatic	Depends on parameter <i>C 13</i>	Check the probe connections. Check the "Probe S1 alarm management", & "Pressure S1: Minimum & Maximum alarm value" parameters
Probe S2	Probe S2 faulty or exceeded set alarm range	<i>P 2</i>	Depends on Configuration	Automatic	Depends on parameter <i>C 14</i>	Check the probe connections. Check the "Probe S2 alarm management", & "Temperature S2: Minimum & Maximum alarm value" parameters
Probe S3	Probe S3 faulty or exceeded set alarm range	<i>P 3</i>	Depends on configuration	Automatic	Depends on parameter <i>C 15</i>	Check the probe connections. Check the "Probe S3 alarm management", & "Pressure S3: Minimum & Maximum alarm value" parameters
Probe S4	Probe S4 faulty or exceeded set alarm range	<i>P 4</i>	Depends on configuration	Automatic	Depends on parameter <i>C 16</i>	Check the probe connections. Check the "Probe S4 alarm management", & "Temperature S4: Minimum & Maximum alarm value" parameters
LowSH (low superheat)	LowSH protection activated	<i>L S H</i>	Depends on configuration	Automatic	Protection action activated	Check the "LowSH protection: threshold & alarm delay" parameters
LOP (low evaporation temperature)	LOP protection activated	<i>L O P</i>	Depends on configuration	Automatic	Protection action Activated	Check the "LOP protection: threshold & alarm delay" parameters
MOP (high evaporation temperature)	MOP protection activated	<i>M O P</i>	Depends on configuration	Automatic	Protection action Activated	Check the "MOP protection: threshold & alarm delay" parameters
Low suction temperature	Threshold and delay time exceeded	<i>L S u</i>	Depends on configuration	Automatic	No effect	Check the threshold and delay parameters
EEPROM damaged	EEPROM for operating and/or unit parameters damaged	<i>E E P</i>	Depends on configuration	Replace controller/contact service	Totally shutdown	Replace controller/ contact service
EEV motor error	Valve motor fault	<i>E E U</i>	Depends on configuration	Automatic	interruption	Check the connections and the condition of the motor. Switch controller off and on again
Wrong power supply mode	Power supply mode not correct (<i>F 0 9</i>) Main power failure	<i>b P r</i>	Depends on configuration	Automatic	Totally shutdown	Check if F09 parameter is correct. If using a backup battery, this alarm will be activated
Network error	RS485 network communication error	<i>n E t</i>	No change	Automatic	No effect	Check serial cable connections <i>C07</i> parameter wrongly configured, if controller work in alone, no network connection, <i>C07</i> should equal to 5