User Manual

（Version V1.3）

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.

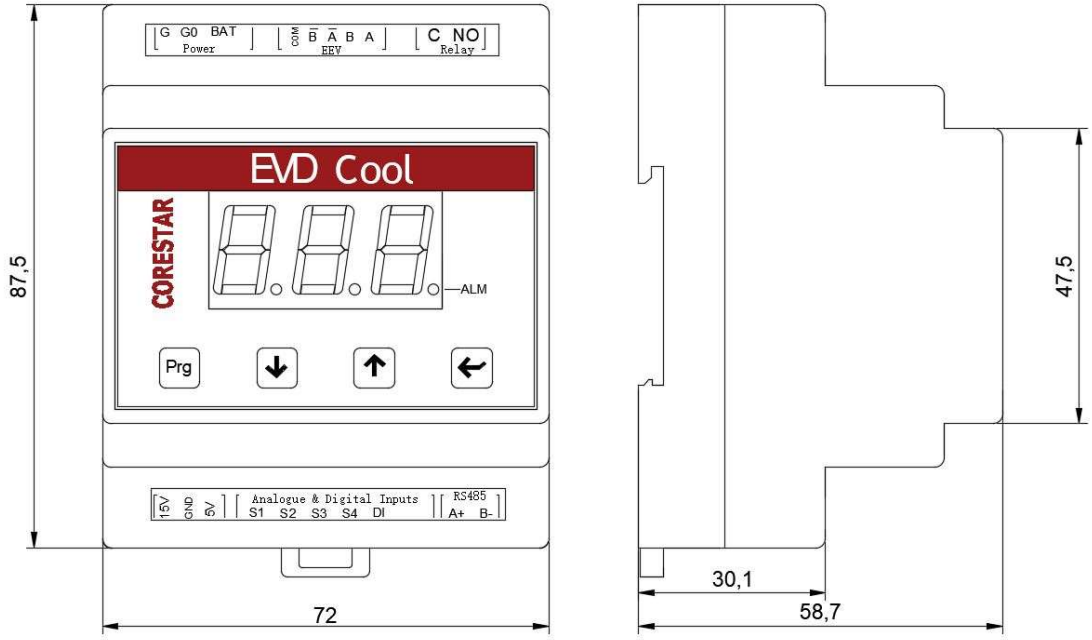
EVDCool has one build-in LED display and one keypad with four keys, so that the user can change/configure parameters easily. normally, the user just needs 4 parameters to start basic regulation:

- 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;

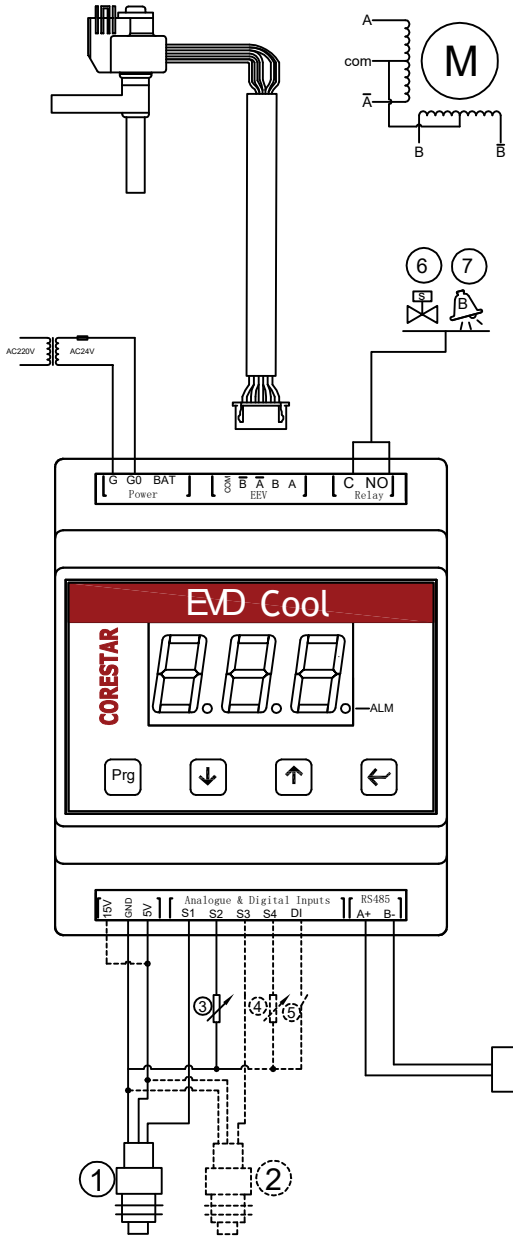
DIN assembly and dimensions (unit： mm)



Description of the terminals

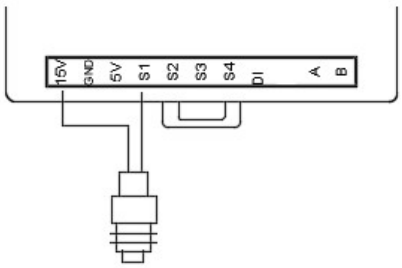
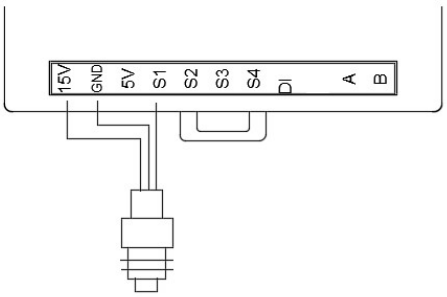
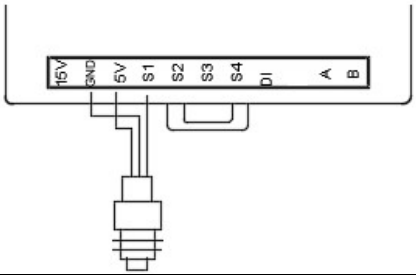
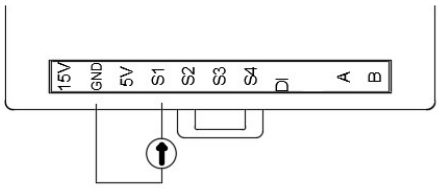
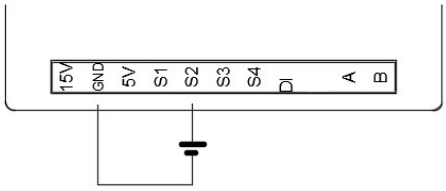
G GO	24VAC or 24VDC power supply, when using DC switching power supply, G=V+, GO=V-
VBAT	Backup battery
COM B A B A EEV	EEV stepper motor power supply
COM、NO	Alarm relay output (COM: common point, NO: normally open)
15V、5V	Power supply to active probes (15V and 5V cannot be shorted)
GND	Signal ground
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-

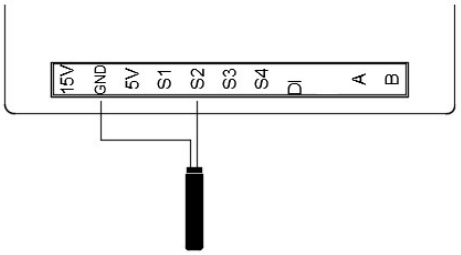
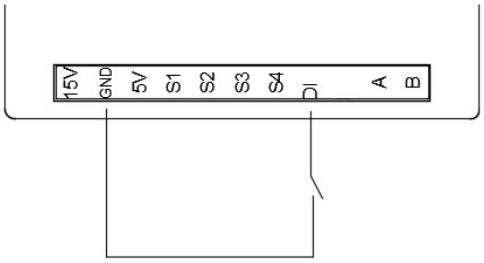
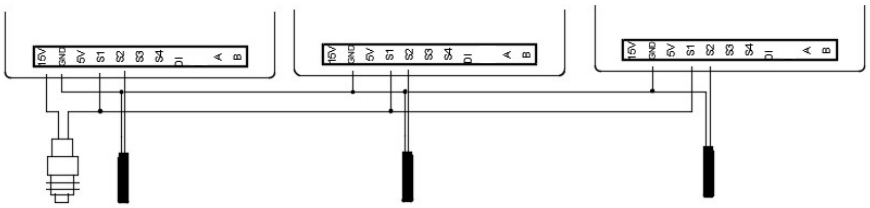
General Connection diagram



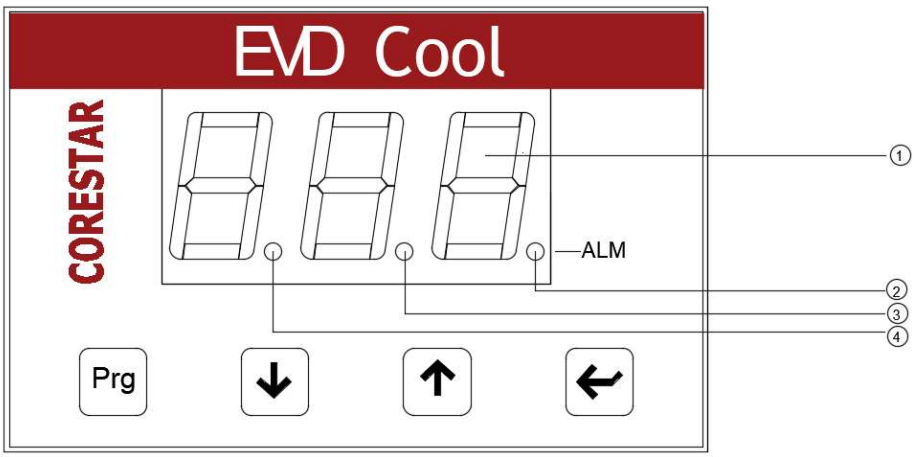
Code and Meaning	
1	Pressure transducer
2	Pressure transducer （Optional）
3	Temperature probe(NTC /PT1000)
4	Temperature probe(NTC /PT1000)
5	Digital input
6	Solenoid valve
7	Alarm signal
8	RS485 adapter, connect to PC or IoT platform

Wiring diagram

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

Temperature	NTC NTC-HT PT1000	
Digital inputs	Start/Stop signal	
Shared Pressure transducer	• 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**
Prg	--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
DO NOT NEED a password to access below parameters, please operate as below steps: 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								
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	℃	A	R	4
Eut	Evaporation temperature	0	-60	200	℃	A	R	5
EuP	Evaporation pressure	0	-20	200	bar	A	R	6
Cdt	Condensing temperature	0	-20	200	℃	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	℃	A	R	1
P3	Probe S3 reading	-20	200	A	bar/mA	R	0	2
P4	Probe S4 reading	0	-20	200	℃	A	R	3
AnP	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

d1	Digital input status (DI 1)	0	0	1	-	D	R	13
rLY	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 [Prg] →display shows PS 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 C01 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

C01	Modbus network address	1	1	207	-	I	R/W	138
C02	Modbus connection configuration	2	0	30	-	I	R/W	201
C03	Valve type: 0= ExV customized 1= ExV uni-polar, 500stps 2= ball valve, uni-polar, 2800stps	1	0	2	-	I	R/W	141

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

C04	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 27= R1234yf 28=R1234ze 29=R455A 30=R170 31=R442A 32 = R447A 33=R448A 34=R449A 35=R450A 36=R452A 37 = R508B 38=R452B 39=R513A 40=R454B 41=R458A 42 =R515B 43=R1233zd(E)	3	1	43	-	I	R/W	140
C05	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
C06	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
C07	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
C09	Probe S1: Ratiometric (0.5 ~4. 5 V) 1= -1...4,2 bar 2= -0,4...9,3 bar 3= -1...9,3 bar 4= 0...17,3 bar 5= 0,85...34,2 bar 6= 0...34,5 bar 7= 0...45 bar 21= -1 ~ 12.8 bar 22= 0 ~ 20.7 bar 23= 1.86 ~ 43.0 bar 24= liquid level 25=0...60,0bar 26=0...90,0bar 27=signal 0~5V 28=0...20bar 29=0...25bar Current (4 ~ 20 mA) 8= -0,5...7 bar 9= 0...10 bar 10= 0...18,2 bar 11= 0...25 bar 12= 0...30 bar 13= 0...44,8 bar 14=shared-0,5...7 bar 15= shared 0...10 bar 16= shared 0...18,2 bar 17= shared 0...25 bar 18= shared 0...30 bar 19= shared 0...44,8 bar 20=signal 4~20mA	3	-1	29	-	I	R/W	143
C10	Probe S2: 0=user defined 2= NTC high temperature 4=0 ~ 10 V signal 6=PT1000 1= NTC normal 3= combined NTC 5=NTC low temperature	1	-1	6	-	I	R/W	144
C11	Probe S3: Ratiometric (0.5 ~4. 5 V) 1= -1...4,2 bar 2= -0,4...9,3 bar 3= -1...9,3 bar 4= 0...17,3 bar 5= 0,85...34,2 bar 6= 0...34,5 bar 7= 0...45 bar 21= -1 ~ 12.8 bar Current (4 ~ 20 mA) 8= -0,5...7 bar 9= 0...10 bar 10= 0...18,2 bar 11= 0...25 bar 12= 0...30 bar 13= 0...44,8 bar 14=shared-0,5...7 bar 15= shared 0...10 bar	3	-1	29	-	I	R/W	146

	22= 0 ~ 20.7 bar 23= 1.86 ~ 43.0 bar 24= liquid level 25=0...60,0bar 26=0...90,0bar 27=signal 0~5V 28=0...20bar 29=0...25bar	16= shared 0...18,2 bar 17= shared 0...25 bar 18= shared 0...30 bar 19= shared 0...44,8 bar 20=signal 4~20mA							
C12	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
C13	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
C14	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
C15	Probe S3 alarm management: 1= No action 2= Forced valve closing 3= Valve in fixed position		1	1	3	-	I	R/W	153
C16	Probe S4 alarm management: 1= No action 2= Forced valve closing 3= Valve in fixed position		1	1	3	-	I	R/W	154
P01	S1: calibration offset		0	-60 , -60	60 , 60	bar mA	A	R/W	33
P02	S1: calibration gain, 4 to 20 mA		1	-20	20	-	A	R/W	35
P03	Pressure S1: Minimum value		-1	-20	S1: Max	bar	A	R/W	31
P04	Pressure S1: Maximum value		9,3	S1: Min	200	bar	A	R/W	29
P05	Pressure S1: Minimum alarm value		-1	-20 (-290)	S1: Max alarm value	bar	A	R/W	38
P06	Pressure S1: Maximum alarm value		9,3	S1: Min alarm value	200	bar	A	R/W	36
P07	S2: calibration offset		0	-20 , -20	20 , 20	° C , V	A	R/W	40
P08	S2: calibration gain,0 ~ 10 V		1	-20	20	-	A	R/W	42
P09	Pressure S2: Minimum alarm value		-50	-60	S2: Max alarm value	° C	A	R/W	45
P10	Pressure S2: Maximum alarm value		105	S2: Min alarm value	200	° C	A	R/W	43
P11	S3: calibration offset		0	-60	60	Bar	A	R/W	34
P12	S3: calibration gain, 4 ~ 20 mA		1	-20	20	-	A	R/W	81

P13	Pressure S3: Minimum value	-1	-20	S3: Max	bar	A	R/W	32
P14	Pressure S3: Maximum value	9,3	S3: Min	200	bar	A	R/W	30
P15	Pressure S3: Minimum alarm value	-1	-20	S3: Max alarm value	bar	A	R/W	39
P16	Pressure S3: Maximum alarm value	9,3	S3: Min alarm value	200	bar	A	R/W	37
P17	S4: calibration offset	0	-20	20	°C	A	R/W	41
P18	Pressure S4: Minimum alarm value	-50	-60	S4: Max alarm value	°C	A	R/W	46
P19	Pressure S4: Maximum alarm value	105	S4: Min alarm value	200	°C	A	R/W	44
r01	Superheat set point	11	LowSH: threshold	180	K	A	R/W	49
r02	start-up delay after defrost	10	0	60	minute	I	R/W	167
r03	Hot gas bypass temperature set point	10	-60	200	°C	A	R/W	27
r04	Hot gas bypass pressure set point	3	-20	200	bar	A	R/W	61
r05	EPR pressure set point	3,5	-20	200	bar	A	R/W	28
r06	PID: proportional gain	15	0	800	-	A	R/W	47
r07	PID: integral time	150	0	1000	s	I	R/W	165
r08	PID: derivative time	5	0	800	s	A	R/W	48
A01	LowSH protection: threshold	5	-40	Superheat set point	K	A	R/W	55
A02	LowSH protection: integral time	15	0	800	s	A	R/W	54
A03	LOP protection: threshold	-50	-60 (-76)	MOP protection threshold	°C	A	R/W	51
A04	LOP protection: integral time	0	0	800	s	A	R/W	50
A05	MOP protection: threshold	50	LOP protection threshold	200	°C	A	R/W	53
A06	MOP protection: integral time	20	0	800	s	A	R/W	52

A07	MOP: suction temperature threshold (S2)	30	-85	200	°C	A	R/W	101
A08	Low superheat alarm delay (LowSH) (0= alarm disabled)	300	0	18000	s	I	R/W	170
A09	Low evaporation temperature alarm delay (LOP) (0= alarm disabled)	300	0	18000	s	I	R/W	168
A10	High evaporation temperature alarm delay (MOP) (0= alarm disabled)	600	0	18000	s	I	R/W	169
A11	Low suction temperature alarm threshold	-50	-60	200	°C	A	R/W	25
A12	Low suction temperature alarm delay (0= alarm disabled)	300	0	18000	s	I	R/W	136
F01	EEV minimum steps	50	0	9999	step	I	R/W	157
F02	EEV maximum steps	480	0	9999	step	I	R/W	158
F03	EEV closing steps	500	0	9999	step	I	R/W	163
F04	Valve opening at start-up	50	0	100	%	I	R/W	164
F05	Valve open in standby (0= disabled= valve closed; 1=enabled = valve open according to parameter F06)	0	0	1	-	D	R/W	22
F06	Valve position in stand-by 0 = 25% 1...100% = % opening	0	0	100	%	I	R/W	218
F07	Pre-position time	6	0	18000	s	I	R/W	217
F08	enable manual valve positioning	0	0	1	-	D	R/W	23
F09	Manual valve position	0	0	9999	step	I	R/W	166
F10	Power supply type 0= 24 Vac; 1= 24 Vdc	1	0	1	-	D		46
F11	Valve move direction: 0= direct 1= reverse	0	0	1	-	I	R/W	209
F12	Valve moving speed	50	10	500	PPS	I	R/W	159

rES	Reset to default parameters(password: 123)	0	0	999	-	I	R/W	130

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): • resolution 0.1 % fs; • measurement error: 2% fs maximum; 1% typical
		Current type pressure probe (4 to 20 mA): • 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: • 10 KΩ at 25° C, -50T90 ° C; • measurement error: 1° C in range -50T50 ° C; 3° C in range +50T90 ° C
		High temperature NTC: • 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: • 10 KΩ at 25 ° C, -40T120 ° C; • measurement error: 1 ° C in range -40T50 ° C; 3° C in range +50T90 ° C
		PT1000: • support class A and Class B; measurement range: -85 T 100° C
		0 to 10 V input (max 12 V): • resolution 0.1 % fs; • measurement error: 9% fs maximum; 8% typical
	S3	Ratiometric pressure probe (0.5 to 4..5V): • resolution 0.1 % fs; • measurement error: 2% fs maximum; 1% typical
		current pressure probe (4 to 20 mA): • 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: • 10 KΩ at 25° C, -50T90 ° C; • measurement error: 1° C in range -50T50 ° C; 3° C in range +50T90 ° C
		High temperature NTC: • 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: • 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	P1	Depends on Configuration	Automatic	Depends on parameter C13	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	P2	Depends on Configuration	Automatic	Depends on parameter C14	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	P3	Depends on configuration	Automatic	Depends on parameter C15	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	P4	Depends on configuration	Automatic	Depends on parameter C16	Check the probe connections. Check the "Probe S4 alarm management", & "Temperature S4: Minimum & Maximum alarm value "parameters
LowSH (low superheat)	LowSH protection activated	LSH	Depends on configuration	Automatic	Protection action activated	Check the "LowSH protection: threshold & alarm delay" parameters
LOP (low evaporation temperature)	LOP protection activated	LOP	Depends on configuration	Automatic	Protection action Activated	Check the "LOP protection: threshold & alarm delay" parameters
MOP (high evaporation temperature)	MOP protection activated	nOP	Depends on configuration	Automatic	Protection action Activated	Check the "MOP protection: threshold & alarm delay" parameters
Low suction temperature	Threshold and delay time exceeded	LSu	Depends on configuration	Automatic	No effect	Check the threshold and delay parameters
EEEPROM damaged	EEPROM for operating and/or unit parameters damaged	EEP	Depends on configuration	Replace controller/ contact service	Totally shutdown	Replace controller/ contact service
EEV motor error	Valve motor fault	EEU	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 (F09) Main power failure	bPr	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	nEt	No change	Automatic	No effect	Check serial cable connections C07 parameter wrongly configured, if controller work in alone, no network connection, C07 should equal to 5