SIEMENS

Climatix extension module ECV

POL94E.00/xxx, POL94U.00/xxx

The ECV extension modules are designed for use in connection with a broad range of bipolar stepper motors.

- Power supply AC 24 V or DC 24 V
- 3 universal I/Os
- Power supply for active sensors on board
- 1 relay output
- 1 digital input AC 115/230 V (galvanically separated)
- Bipolar stepper motor driver (chopper drive);
  unipolar motors in bipolar-current mode only, full step (5, 6, 8-wires)
- Peripheral bus interface
- POL94U.00/xxx only:
  uninterruptible power supply (UPS) for driving the electronic valve to a safe position in case of a power failure

Electronic expansion valve

Electronic expansion valves control the refrigerant mass flow in evaporators for chiller, air-conditioner and refrigerator applications. In addition, modulating valves can be used for several control functions such as liquid injection, hot gas bypass and evaporator pressure regulation.

The POL94X.00/xxx extension module is designed as a driver for electronic expansion valves, features a channel drive for a wide range of bipolar stepper motors. With the main controller, POL94X.00/xxx module controls refrigerant superheat and optimizes the efficiency of the refrigerant circuit, to enhance the maximum capacity for chillers, air-conditioners and refrigerators.
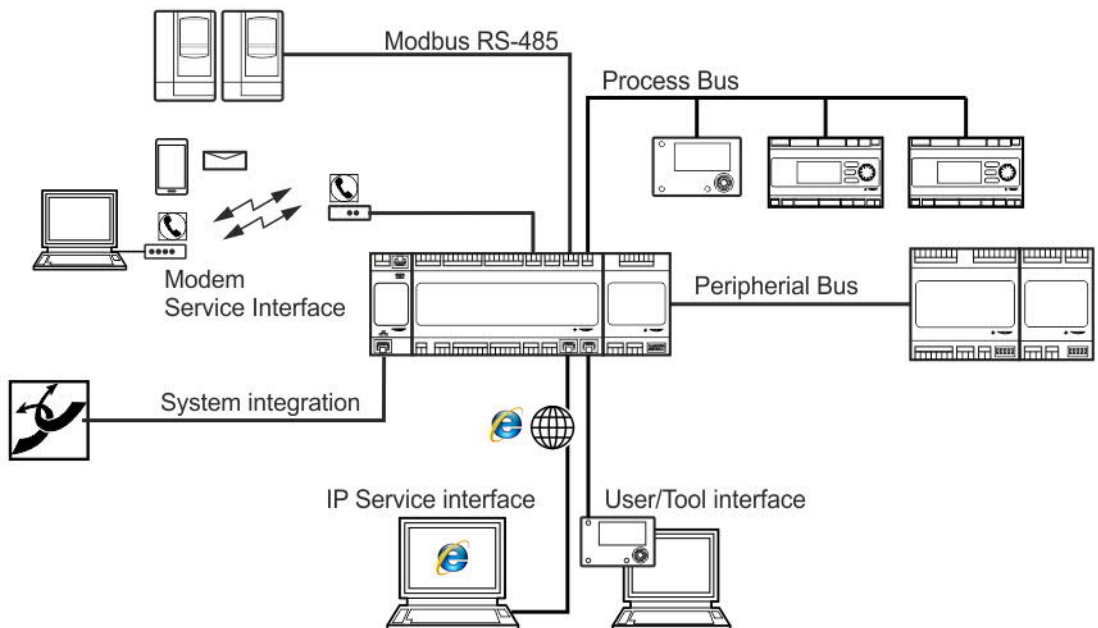
Bipolar stepper motors

Bipolar permanent magnet and hybrid motors have two windings. The drive circuitry for such a motor requires an H-bridge control circuit for each winding. Briefly, an H-bridge allows the polarity of the power applied to each end of each winding to be controlled independently.

Installation concept
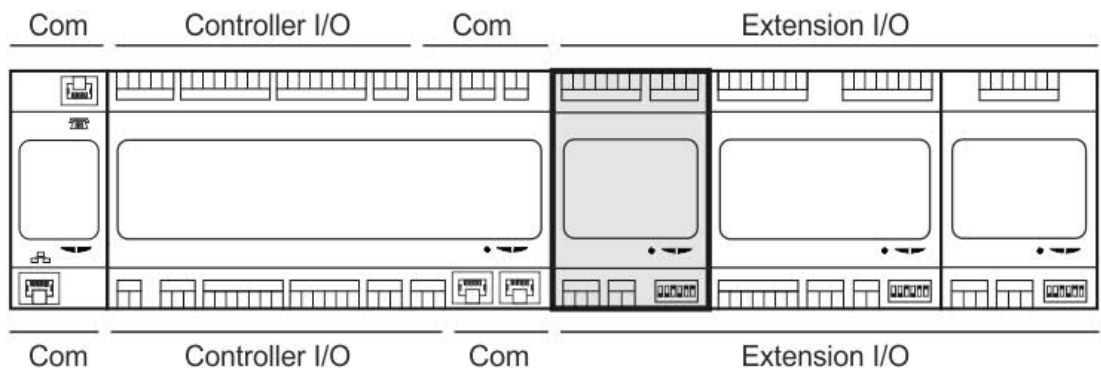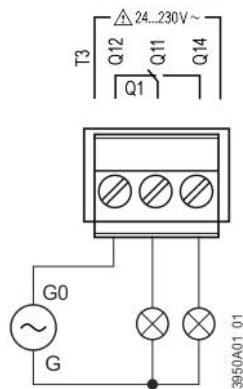

Communication concept

General data

Dimensions (width x height x depth)	72 x 110 x 75 mm
Weight excl. packaging POL94E.00/xxx POL94U.00/xxx	 152 g 191 g
Base	Plastic, pigeon-blue RAL 5014
Housing	Plastic, light-grey RAL 7035

Power supply

| Power supply AC/DC 24 V	
Operating voltage	AC 24 V -15%, +20%; DC 24 V +/-10%
Current with AC 24 V	900 mA
Current with DC 24 V	500 mA
Frequency	45…65 Hz
Power consumption	ca. 18 VA
Connection interface	Peripheral bus

Inputs and outputs

Relay output Q1 (T3)	
Relay: Type, contact	Monostable, NO/NC contact
Switching voltage	AC 24…230 V (-20%, +10%)
Rated current (res. / ind.)	Max. AC 3 A / 2 A (cosφ 0.6)
Switching current at AC 19 V	Min. AC 30 mA

Connecting signal lamps to relay outputs

⚠	**⚠ WARNING**
	Note the following for installation: • Do not mix SELV / PELV and mains power on the same terminal • Use external protection for inductive load

Digital input DL1 (T4)	
0/1 digital signal (binary)	Galvanically separated voltage contact
Rated voltage	AC 115…230 V (-15%, +10%)
Frequency range	45…65 Hz
Input current	3 mA at AC 230 V
Delay	100 ms
Pulse frequency	Max. 5 Hz
Configurable	Via software
Reference potential	Terminals ⊥
Contact voltage	Max. DC 24 V (SELV)
Overvoltage protection	Up to 40 V
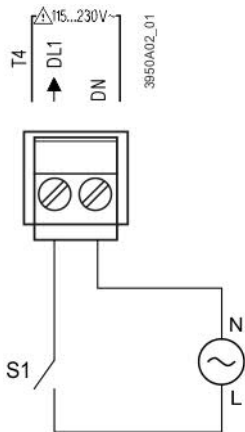
Connecting a AC 230 V signal to a galvanically separated digital input

Universal I/Os X1…X3 (T1)	
Configurable	Via software
Reference potential	Terminals ⊥
Contact voltage	Max. DC 24 V (SELV)
Overvoltage protection	Up to 40 V

Analog inputs X1…X3 (T1)	
Ni1000	
Sensor current	1.4 mA
Resolution	0.1 K
Accuracy within the range -50…150 °C	0.5 K

Pt1000	
Sensor current	1.8 mA
Resolution	0.1 K
Accuracy within the range -40…120 °C	0.5 K

NTC 10k		
Sensor current	140 µA	
Temperature range	Accuracy	Resolution
-50…-26 °C	1 K	0.2 K
-25…74 °C	0.5 K	0.1 K

NTC 10k		
75…99 °C	1 K	0.3 K
100…124 °C	3 K	1.0 K
125…150 °C	6 K	2.5 K

NTC 100k		
Sensor current	140 µA	
Temperature range	Accuracy	Resolution
-25…-11 °C	3 K	0.2 K
-10…9 °C	1 K	0.1 K
10...99 °C	0.5 K	0.1 K
100...150 °C	1 K	0.2 K

0…2.500 Ω	
Sensor current	1.8 mA
Resolution	1 Ω
Accuracy	4 Ω

| DC 0…5 V input for ratiometric sensors	
Resolution	1 mV
Accuracy at 0 V	2 mV
Accuracy at 5 V	25 mV
Input resistance	100 kΩ
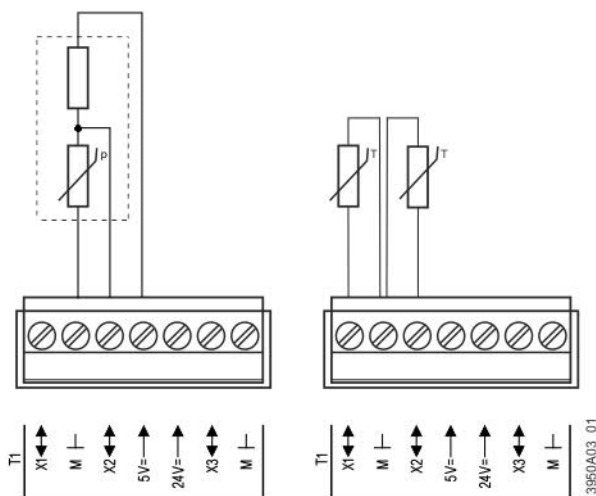
Connecting ratiometric sensor to universal I/O

Connecting ratiometric sensor to universal I/O

DC 0…10 V input	
Resolution	1 mV
Accuracy at 0 V	2 mV
Accuracy at 5 V	25 mV
Accuracy at 10 V	50 mV
Input resistance	100 kΩ

| DC 4…20 mA input	
Resolution	1 µA
Accuracy at 4 mA	25 µA
Accuracy at 12 mA	70 µA
Accuracy at 20 mA	120 µA

Voltage source DC 0…10V   Current transmitter
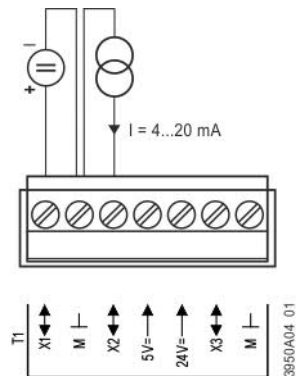
Voltage input DC…10 V and current input 4…20 mA

| Digital inputs X1…X3 (T1)	
0/1 digital signal (binary)	For potential-free contacts
Sampling voltage / current	DC 24 V / 8 mA
Contact resistance	Max. 200 Ω (closed) Min. 50 kΩ (open)
Delay	10 ms
Pulse frequency	Max. 20 Hz
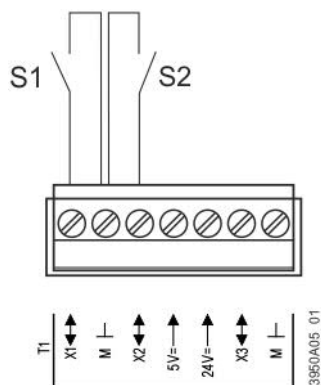
Connecting floating contacts to universal I/Os

Analog/digital outputs X1…X2 (T1)	
DC 0...10 V output	
Resolution	11 mV
Accuracy at 0 V	66 mV
Accuracy at 5 V	95 mV
Accuracy at 10 V	124 mV
Output current	1 mA (short-circuit-proof)

DC output for off board loads	
Switching voltage	DC 24 V
Switching capacity	Max. 25 mA
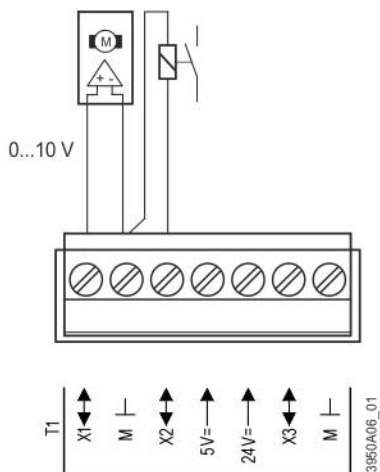
Connecting voltage output and off board relay to universal I/Os

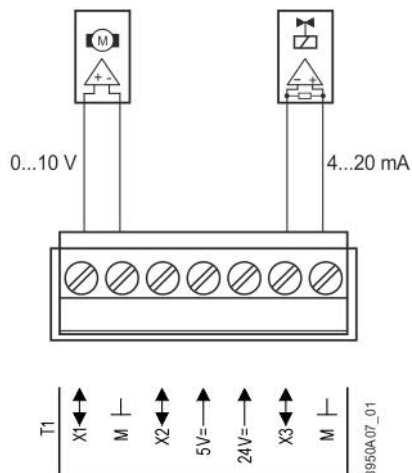| Analog output X3 (T1)	
DC 0...10 V output	
Resolution	11 mV
Accuracy at 0 V	66 mV
Accuracy at 5 V	95 mV
Accuracy at 10 V	124 mV
Output current	1 mA (short-circuit-proof)

DC 4…20 mA output	
Resolution	22 µA
Accuracy at 4 mA	150 µA
Accuracy at 12 mA	196 µA
Accuracy at 20 mA	243 µA

Connecting voltage output and current output to universal I/Os

| Power supply for active sensors (DC 24 V) and ratiometric sensors (DC 5 V)	
Voltage / current	DC 5 V ±2.5% / 20 mA DC 24 V +10 %, -25% / 40 mA
Reference potential	Terminals ⊥
Connection	Short-circuit-proof

Sensor supply — Connecting ratiometric sensor to universal I/O

Pressure transmitter — Ratiometric sensor
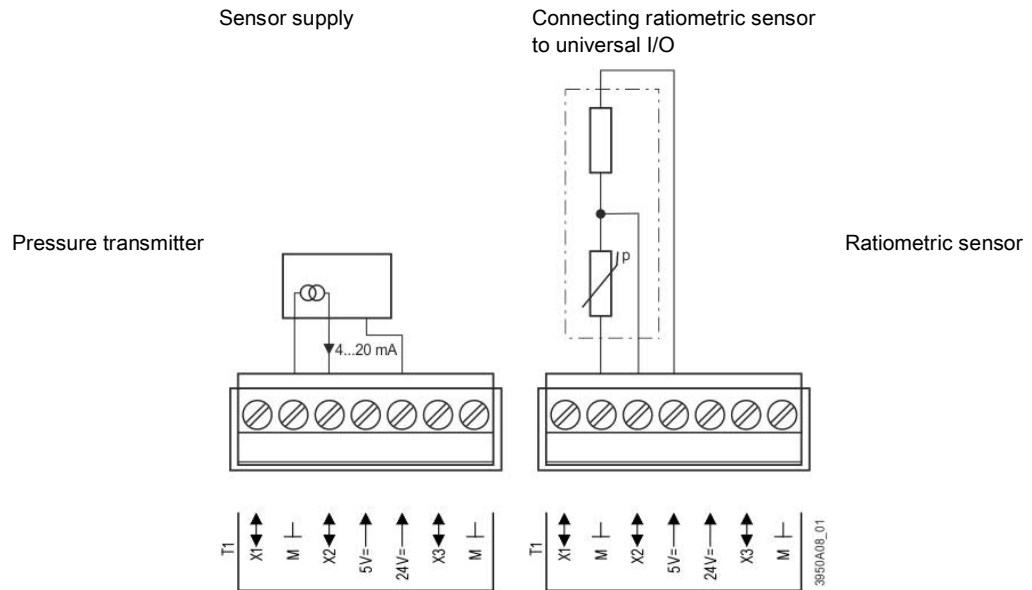
Motor driver

Driver for bipolar stepper motor (T2)	
Constant-current mode	Short-circuit-proof
Switching frequency	15 kHz
Mode	Full step
Max. motor cable length	10 m NOTICE! Heed the recommendations of the EEV manufacturer, too!
Max. motor phase current	1.0 A
Max. motor power POL94E	15 W
Max. motor power POL94U	10 W
Programmable current	0.1…1.0 A
Programmable hold current	0.0…0.5 A
Motor voltage	Max. 42 V
Programmable speed	Max. 500 steps per second
Programmable acceleration	Max. 500 steps per [second]^2
Programmable traverse path	200…60'000 steps
Programmable overdrive	0…5'000 steps
Protection	Thermal shutdown
Programmable reference point	Zero or traverse path
Diagnostics	At startup and in operation

UPS (POL94U.00/XXX only)	
Energy storage	Ultracaps (10 x 10 F at 1,98 V)
Max. charge	> 87 Ws
Charging time	< 2 min
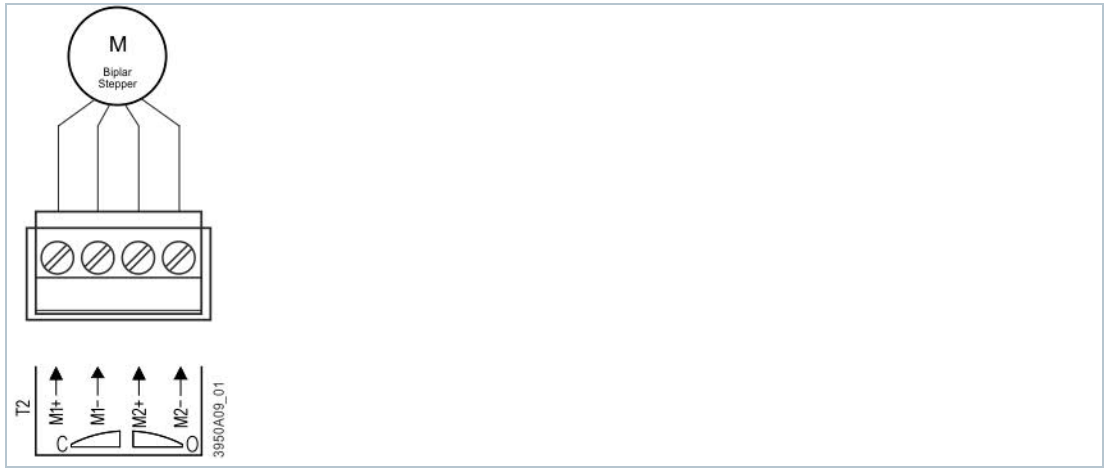
ℹ️ See also "Approved valve settings [➜ 14]"!

Terminals and interfaces

Connection terminals	
Possible plugs for I/O signals (not included)	Phoenix FKCVW 2,5 / x-ST
	Phoenix FKCT 2,5 / x-ST
	Phoenix MVSTBW 2,5 / x-ST
	Phoenix FRONT-MSTB 2,5 / x-ST
Solid wire	0.5…2.5 mm²
Stranded wire (twisted or with ferrule)	0.5…1.5 mm²
Cable lengths	In compliance with load, local regulations and installation documents

Peripheral bus	
Board-to-board (not included)	ZEC1,0/4-LPV-3,5 GY35AUC2CI1
Board-to-wire (not included)	ZEC1,0/4-ST-3,5 GY35AUC1R1,4
Solid wire	0.2…1.0 mm²
Stranded wire (twisted or with ferrule)	0.2…1.0 mm²
Total cable length	Max. 30 m
Addressing	DIP switches 1…5
Termination	DIP switch 6

Conformity

Environmental conditions	
Operation	IEC 60721-3-3 class 3K5
Temperature POL94E	-40...70 °C (-40... 158 °F)
Temperature POL94U	-40...60 °C (-40... 140 °F)
Relative humidity	5%...95% r.h. (non-condensing)
Absolute humidity	1...29 g/m³
Atmospheric pressure	Min. 700 hPa (corresponding to max. 3'000 m above sea level)
Mechanical conditions	IEC 60721-3-3 class 2M2
Transport (packaged for transport)	IEC 60721-3-2 class 2K3
Temperature	-40…70 °C (-40... 158 °F)
Humidity	5%...95% r.h. (non-condensing)
Atmospheric pressure	Min. 260 hPa (corresponding to max. 10'000 m above sea level)
Mechanical conditions	IEC 60721-3-2 class 3M2

Protection	
Housing type	IP20 (EN 60529)
Protection class	II

Standards, directives and approvals	
Product standard	EN 60730-1 Automatic electronic controls for household and similar use.
Electromagnetic compatibility (application range)	For residential, commercial, light-industrial and industrial environments.
EU conformity (CE)	CB1T3950xx
RCM conformity	CB1T3909en_C1
UL approvals	UL916, UL873
RCM conformity	CSA Class 4812
EAC	Eurasian conformity
ACPEIP	Chinese conformity

Environmental compatibility
The product environmental declaration (CB1E3930_01) contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

LEDs for diagnostics

LED BSP

Mode	LED
Application running	Green on
BSP error (software error)	Red flashing at 2 Hz
Hardware error	Red on

LED BUS

This LED indicates the status of the communication with the controller.

Mode	LED
Communication running but • application parameter wrong or missing, or • factory calibration not correct	Orange on
Communication running, IO working	Green on
Communication down	Red on

LEDs (green) ECV opening and closing

2 LEDs for the motor which show the status of the motor.

| Status	LED "O" (open)	LED "C" (close)
Motor not moving in this direction	Off	Off
Valve is moving to the fail safe position in case of power fail (only for UPS versions)	Off	Off
Motor full open if referenced	On	Off
Valve is closing	Off	250 ms On / 250 ms Off
Valve is opening	250 ms On / 250 ms Off	Off
Valve moving to close-failsafe position	Off	50 ms On / 450 ms Off
Valve is moving to open-failsafe position	50 ms On / 450 ms Off	Off
Stepper error *	50 ms On / 450 ms Off	50 ms On / 450 ms Off

* for example, diagnostics detects an error at startup, such as not connected or shortened coil.

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The firmware of the POL94x.00 features various diagnostic functions such as diconnection detection, undervoltage detection or shorted coil. The "disconnect detection" function is always active, even when the device is on hold.

Addressing with DIP switches

The extension module is equipped with DIP switches for communication with the controller. Switches 1, 2, 3, 4, and 5 are configurable to set the slave address, while switch 6 acts as peripheral bus termination. When the extension module operates as the termination in the network, switch 6 must be set to "ON"
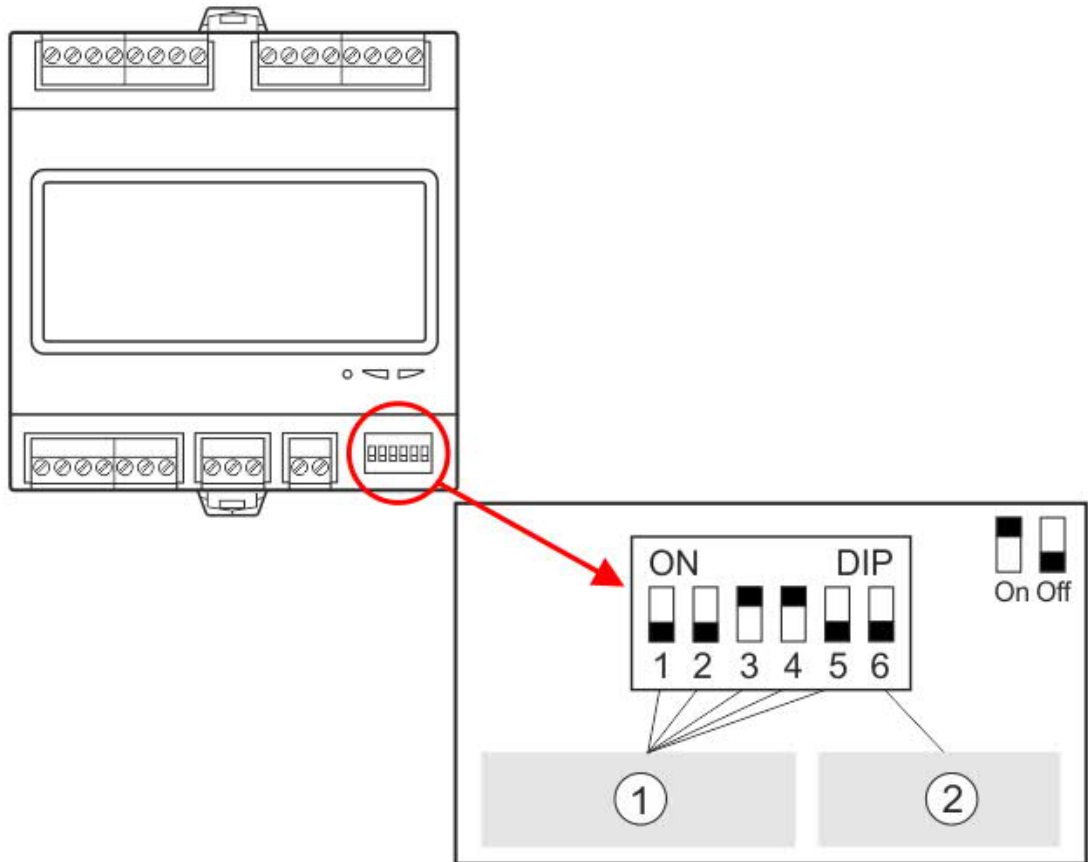
The bit order for the switches is from 5 to 1. The lowest bit is 5 while the highest bit is 1. The following table shows the logic of slave address:

Switch 1	2^4
Switch 2	2^3
Switch 3	2^2
Switch 4	2^1
Switch 5	2^0

By combining switches 1, 2, 3, 4 or 5, a maximum of 31 slave addresses can be configured. The configuration formula is as follows: 24+23+22+21+20=31.

Below are some configuration examples:

DIP switch configuration of extension module					
Slave address (controller)	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Schematics
1	Off	Off	Off	Off	On	
2	Off	Off	Off	On	Off	
3	Off	Off	Off	On	On	

DIP switch configuration of extension module						
Slave address (controller)	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Schematics
4	Off	Off	On	Off	Off	ON DIP 1 2 3 4 5 6
5…29						
30	On	On	On	On	Off	ON DIP 1 2 3 4 5 6
31	On	On	On	On	On	ON DIP 1 2 3 4 5 6

Approved valve settings

!	NOTICE
	Please note the following regarding approved valve settings! • Always consult in addition the valve manufacturer's EEV documentation and follow its recommendations. • Special EEV procedures must be implemented in the HVAC application. • To figure out and set up your dedicated valve parameters contact your local Siemens representative.

Examples of approved settings

Application parameters	Manufacturer: Danfoss
Valve type	ETS 12.5, 25, 50, 100, 250, 400 (SKUs 034G0000…034G4999)
CurrentSetpoint	120 mA
Speed	300 steps / second
Acceleration	0 [1/s²]
OverdriveOpen	0 steps
OverdriveClose	300 steps
HoldCurrentSetpoint	0 mA
DeadTimeSync	60 minutes
Step mode	full step

ℹ️ Maximum cable length 8 m.
If a longer cable is used, communication inductors such as the Danfoss AKA211 should be used.

Application parameters	Manufacturer: Sporlan		
Valve Type	**SER** AA, A, B, C, D	**SERI** F, G, J, K, L	**SEHI** P, 175, 400, T
CurrentSetpoint	120 mA	140 mA	160 mA
Speed	200, 400 steps/s	220 steps/s	240 steps/s
Acceleration	0 [1/s²]		
OverdriveOpen	0 steps		
OverdriveClose	300 steps		
HoldCurrentSetpoint	0 mA		
DeadTimeSync	480 minutes		
TraversePath	2500 steps	2500 steps	6386 steps
Step Mode	full step		

Ordering

Type	Stock number	Details	MOQ
POL94E.00/STD	S55663-J480-A100	ECV extension module without UPS	1
POL94U.00/STD	S55663-J490-A100	ECV extension module with UPS	1

Equipment combinations

EEV

For compatible electronic expansion valves, refer to the respective declarations of compatibility, see chapter Product documentation [➜ 16].

Accessories

Designation	Stock number	Phoenix type	MOQ
POL094.E6/STD Set of spring connectors	POL094.E6/STD	1 x Phoenix FKCT 2,5/2-ST GY7035 1 x Phoenix FKCT 2,5/3-ST KMGY1 1x Phoenix FKCT 2,5/4-ST KMGY 1 x Phoenix FKCT 2,5/7-ST GY7035 1 x Phoenix ZEC1,0/4-LPV-3,5 GY35AUC2CI1	1
POL094.E5/STD Set of screw connectors	S55843-Z948-F100	1 x Phoenix MVSTBW 2,5/2-ST GY7035 1 x Phoenix MVSTBW 2,5/3-ST GY7035 1 x Phoenix MVSTBW 2,5/4-ST GY7035 1 x Phoenix MVSTBW 2,5/7-ST GY7035 1 x Phoenix ZEC1,0/4-LPV-3,5 GY35AUC2CI1	1
POL002.43/STD Connectors for Remote Ext	S55843-Z24-D100	2 x Phoenix ZEC 1,0 / 4-ST-3,5 GY35AUC1R1,4	50

Devices are from PHOENIX CONTACT, www.phoenixcontact.com

Product documentation

Document ID	Title	Topic
Q3900en	Climatix range	Climatix product range
M3910	Mounting instruction Climatix	Mounting and installation
A6V11724227	Danfoss declaration of compatibility	EEV compatibility
A6V11787080	Sporlan declaration of compatibblity	EEV compatibility

Notes

Security

⚠	**⚠ CAUTION**
	National safety regulations
	Failure to comply with national safety regulations may result in personal injury and property damage.
	● Observe national provisions and comply with the appropriate safety regulations.

Engineering

⚡	**⚠ WARNING**
	Risk of death or serious injury due to contact with relay connections.
	Contact with relay connections at voltages above 42 V_{eff} can lead to electric shocks.
	● Use external protection for inductive load of relay outputs.
	● Use external fuse for over current protection of relay and Triac outputs.
	● Do not mix SELV / PELV and line voltage on the same terminal.
	● AC230 V cables must be double-insulated against safety extra-low voltage (SELV) cables.

Mounting

Refer to the mounting instructions for Climatix.

Installation

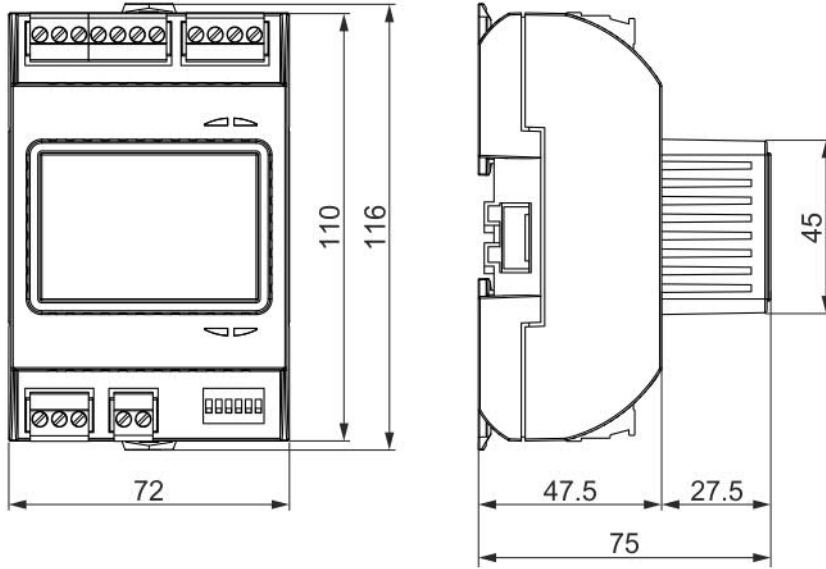| ⚡	**⚠ WARNING**
	No internal line protection for supply lines to external consumers
	Risk of fire and injury due to short-circuits
	● Adapt the line diameters as per local regulations to the rated value of the installed fuse.

Disposal

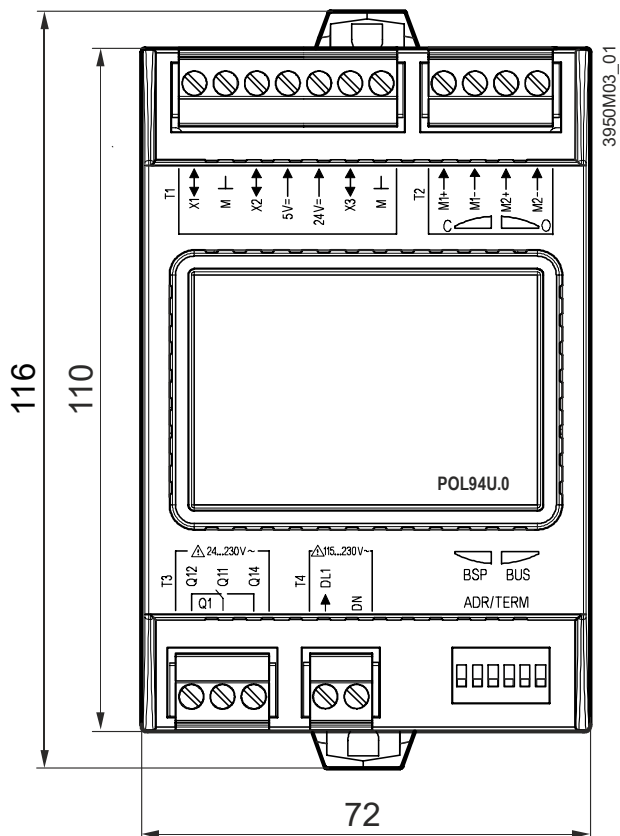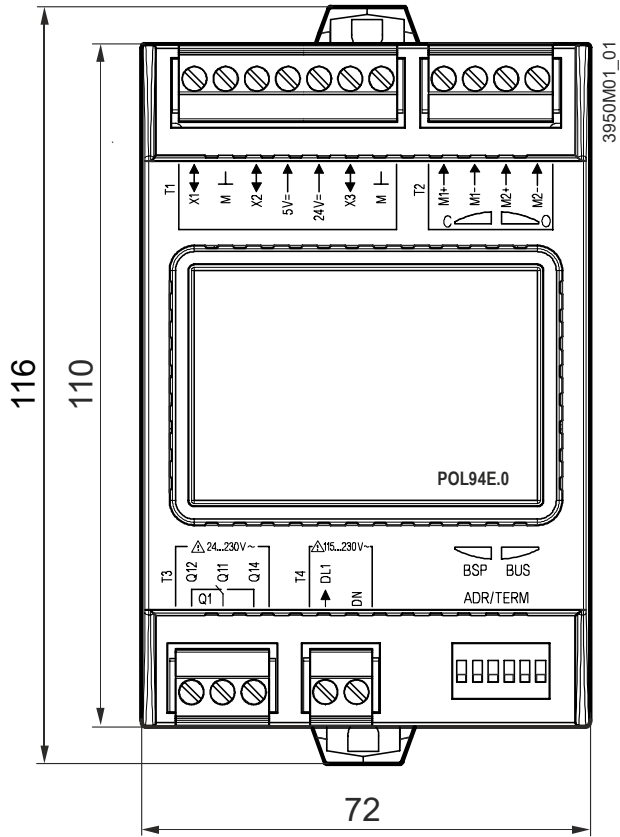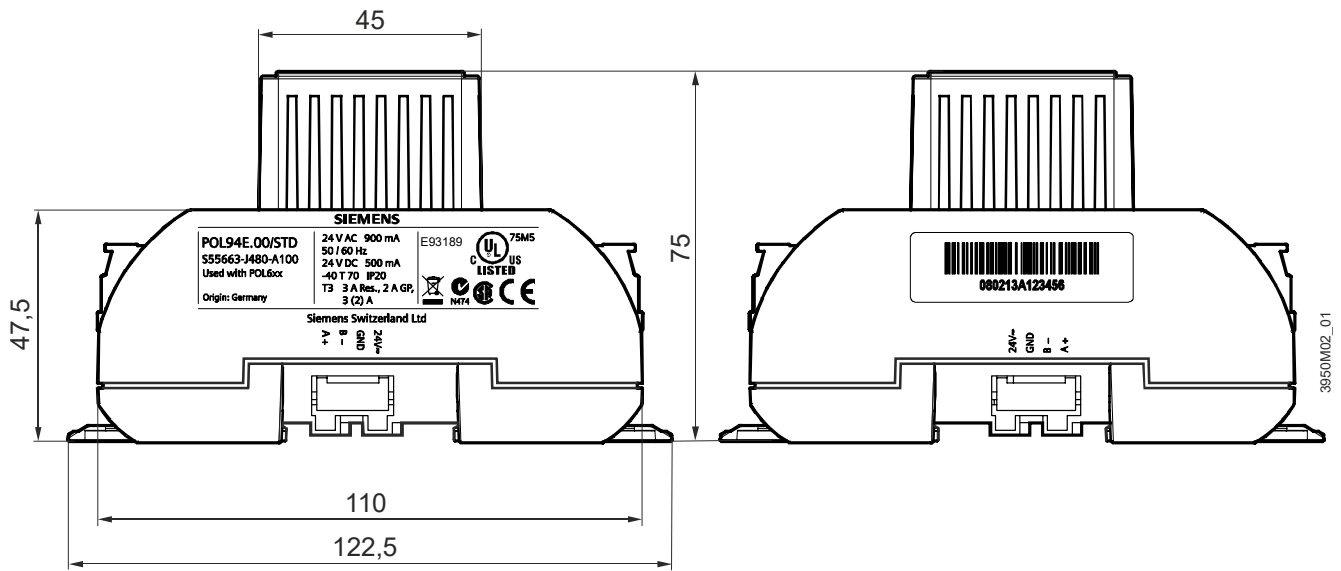|	The device is considered an electronic device for disposal in accordance with the European Guidelines and may not be disposed of as domestic garbage.
	• Dispose of the device through channels provided for this purpose.
	• Comply with all local and currently applicable laws and regulations.

Warranty

Technical data on specific applications are valid only together with Siemens products listed under "Equipment combinations". Siemens rejects any and all warranties in the event that third-party products are used.

Layout of EVC modules: POL94E.00/XXX, POL94U.00/XXX

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110
72

T1 X1 M X2 5V= 24V= X3 M T2 M1+ M1- M2+ M2-
C O

POL94E.0

T3 ⚠ 24...230V~ Q12 Q11 Q14 T4 ⚠ 115...230V~ DL1 DN BSP BUS
Q1 ADR/TERM

3950M01_01

116
110
72

T1 X1 M X2 5V= 24V= X3 M T2 M1+ M1- M2+ M2-
C O

POL94U.0

T3 ⚠ 24...230V~ Q12 Q11 Q14 T4 ⚠ 115...230V~ DL1 DN BSP BUS
Q1 ADR/TERM

3950M03_01

POL94E.00/STD
S55663-J480-A100
Used with POL6xx
Origin: Germany

24 V AC 900 mA
50 / 60 Hz
24 V DC 500 mA
-40 T 70 IP20
T3 3 A Res., 2 A GP,
      3 (2) A

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Siemens Switzerland Ltd

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