SIEMENS

Climatix™

Climatix Extension Modules ECV2

POL96U.00/XXX
POL96E.00/XXX

ECV2 extension modules are products of Climatix range. They are designed for driving a broad range of EEV valves with bipolar or unipolar stepper motors. IOs of ECV2 extension modules can be configured for various applications of chiller and heat pump. The extension modules offer the following features:

- Power supply AC 24 V or DC 24 V
- 2 independent channels supporting bipolar [*] stepper motors (chopper drive)
- 12 universal IOs
- DC 24 V and DC 5 V power supplies on board for active sensors
- 4 relay outputs
- 2 Triac outputs: DO1, DO2 (AC 24…230 V)
- 1 digital input galvanically isolated for AC 115/230 V
- Peripheral bus interface for local/remote extension IOs
- LED indicator for stepper motor driver

POL96U.00/XXX has a UPS for driving the electronic valve to a safe position when power failure occurs.

*) unipolar motors in bipolar-current mode only, full step (5, 6, 8-wires)

Building Technologies

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

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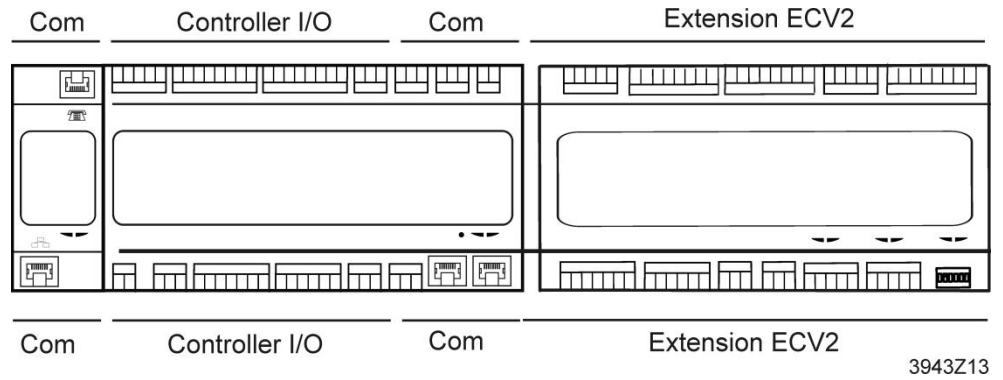
ECV2 extension modules are designed as an electronic expansion valves driver, featuring two independently channel drive bipolar stepper motors. With the main controller one ECV2 module independently can manage two electronic expansion valves. Each channel of ECV2 module controls refrigerant superheat and optimizes the efficiency of the refrigerant circuit, to enhance the maximum capacity for chillers, air-conditioners and refrigerators.
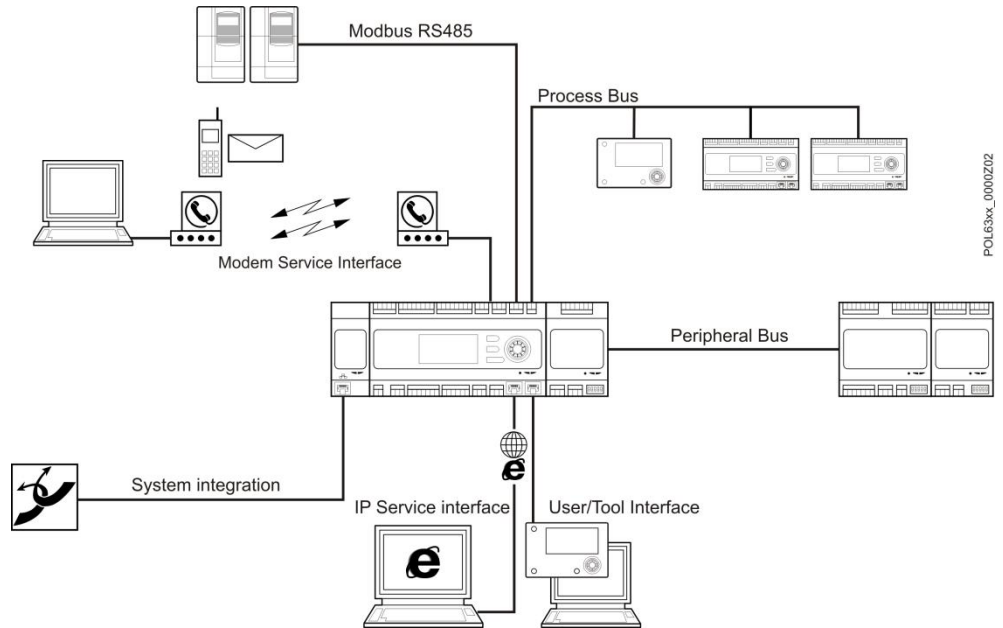
Bipolar stepper motors

Modulating refrigerant valves that are equipped with bipolar stepper motors are available for a wide capacity range.

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

Com | Controller I/O | Com | Extension ECV2

Com | Controller I/O | Com | Extension ECV2

3943Z13

Communication concept

Modbus RS485

Process Bus

Modem Service Interface

Peripheral Bus

System integration

IP Service interface | User/Tool Interface

POL63xx_0000Z02

Disposal

The devices are considered electronics devices for disposal in term of European Directive 2012/19/EU and may not be disposed of as domestic waste.

- Dispose of the device via the channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

Technical data

Power supply		
	Operating voltage	AC 24 V ± 20%; DC 24 V ± 10%
	Frequency	45…65 Hz
	Max. AC-Current consumption	2.2 A, 41 W
	Max. DC-Current consumption	1.9 A, 39 W
	Connection	Peripheral Bus

Power distribution		
	Max pass through current	3.15A @ AC 24V / 3.54A @ DC 24V

General data		
	Dimensions in mm	180 x 110 x 75
	Weight excl. packaging	
	POL96U.00/XXX	422.6g
	POL96E.00/XXX	385.5g
	Base	Plastic, pigeon-blue RAL 5014
	Housing	Plastic, light-grey RAL 7035

Universal IOs X1…X12 (T1, T2, T3)		
	Configurable	By software
	Reference potential	Terminals ⊥
	Contact voltage	Max. DC 24 V (SELV)
	Over voltage protection	Max. 40 V

Analog inputs (X1…X8)

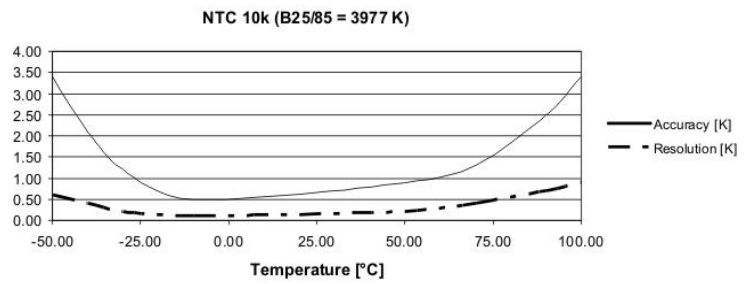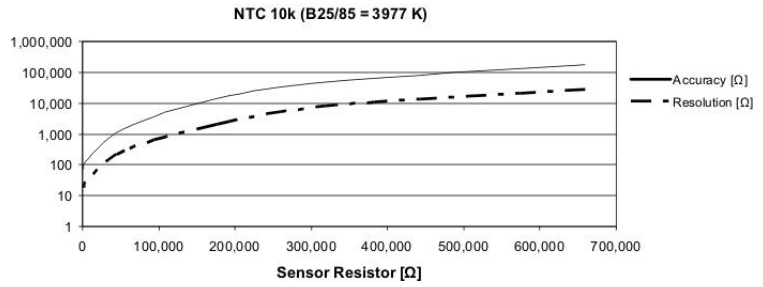|		
Ni1000		
	Sensor current	Max. 1.4 mA
	Resolution	0.1 K
	Accuracy in the range -50…150 °C	0.8 K
Pt1000		
	Sensor current	Max. 1.8 mA
	Resolution	0.1 K
	Accuracy in the range -40…120 °C	0.9 K
0...2.5 kΩ		
	Sensor current	Max. 1.8 mA
	Resolution	1 Ω
	Accuracy	5 Ω
DC 0…5 V input for ratiometric sensors		
	Resolution	1 mV
	Accuracy at 0 V	10 mV
	Accuracy at 5 V	30 mV
	Input resistance	100 kΩ

Ratiometric sensor
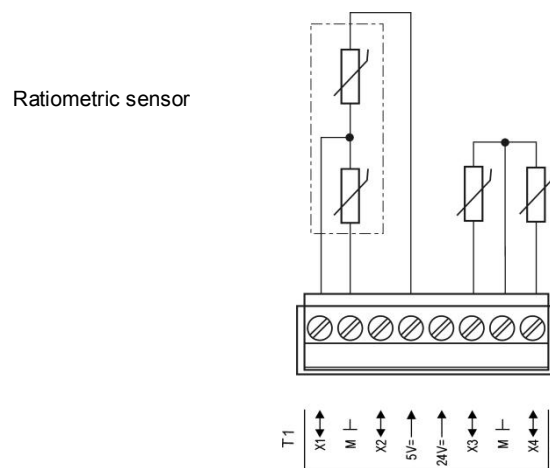
Connecting a ratiometric sensor to universal IOs
Connecting NTC to universal IO

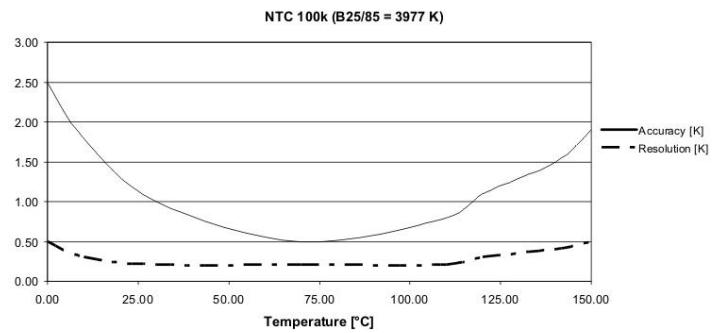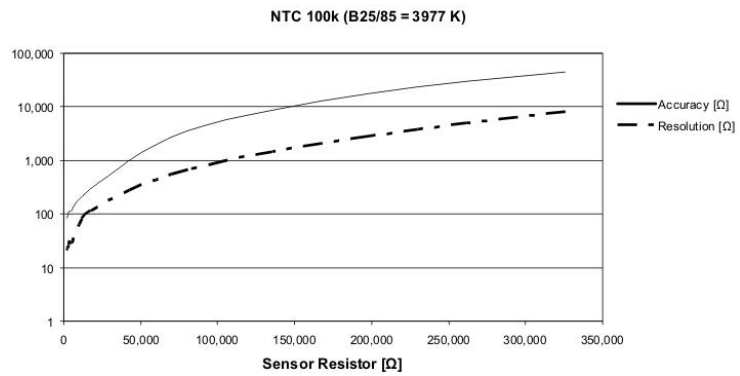## NTC 10k ($B_{25/85}$ = **3977 K**)

Sensor current   Max. 140 µA

NTC 10k (B25/85 = 3977 K)

NTC 10k (B25/85 = 3977 K)

NTC 100k ($B_{25/85}$ = **3977 K**)

Sensor current   Max. 140 µA

NTC 100k (B25/85 = 3977 K)

NTC 100k (B25/85 = 3977 K)

Analog inputs (X9…X10)

Ni1000

Sensor current	Max. 1.4 mA
Resolution	0.3 K
Accuracy in the range -50…150 °C	0.7 K

Pt1000

Sensor current	Max. 1.8 mA
Resolution	0.3 K
Accuracy in the range -40…120 °C	1.0 K

NTC 10k ($B_{25/85}$ **= 3977 K**)

Sensor current	Max. 500 µA

NTC 10k (B25/85 = 3977 K)

NTC 10k (B25/85 = 3977 K)
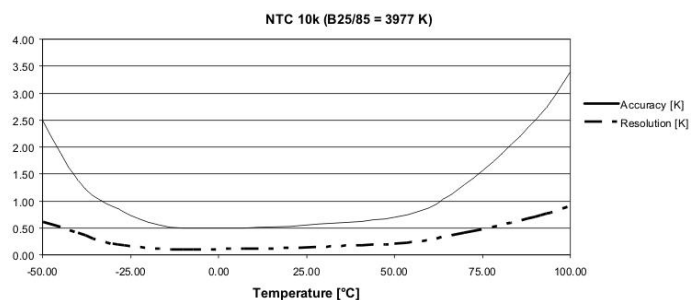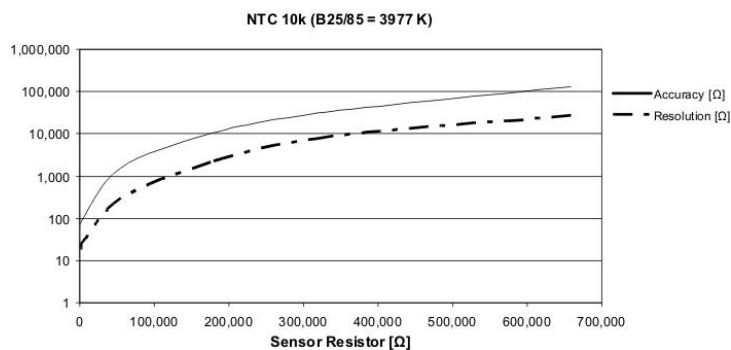
Note ☞ These data are acquired under operating temperature of 25 °C.

Analog inputs (X1…X8)

DC 0...10 V input

Resolution	1 mV
Accuracy at 0 V	10 mV
Accuracy at 5 V	30 mV
Accuracy at 10 V	50 mV
Input resistance	100 kΩ

DC 0/4…20 mA input

Resolution	1 µA
Accuracy at 4 mA	40 uA
Accuracy at 12 mA	80 uA
Accuracy at 20 mA	120 uA
Impedance of DC 0/4…20 mA	Typ. 450 Ω

Analog inputs (X11...X12)

DC 0...10 V input

Resolution	11 mV
Accuracy at 0 V	45 mV
Accuracy at 5 V	60 mV
Accuracy at 10 V	80 mV
Input resistance	100 kΩ

DC 0/4…20 mA input

Resolution	21 µA
Accuracy at 4 mA	85 uA
Accuracy at 12 mA	100 uA
Accuracy at 20 mA	120 uA
Impedance of DC 0/4…20 mA	Typ. 500 Ω

Note 👉 These data are acquired under operating temperature of 25 °C.

Voltage input DC 0...10 V
Current input 4...20 mA
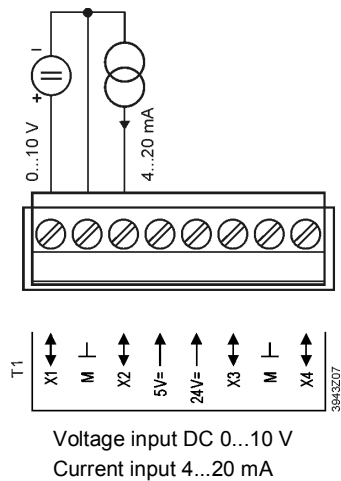
Digital inputs (X1…X8)

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
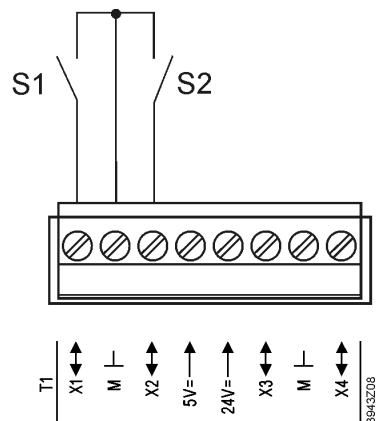
Connecting floating contacts to universal IOs

Analog output (X1...X4)

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	220 µA
Accuracy at 12 mA	196 µA
Accuracy at 20 mA	243 µA

Note 👉 These data are acquired under operating temperature of 25 °C.
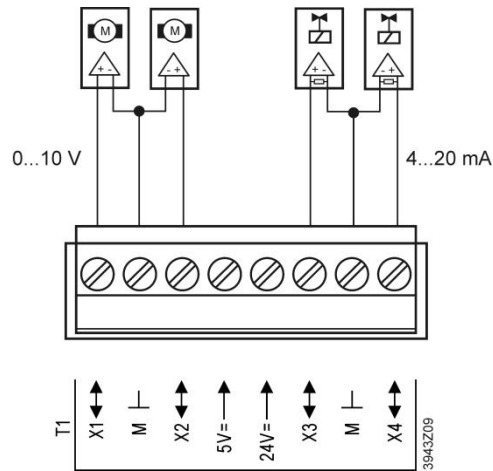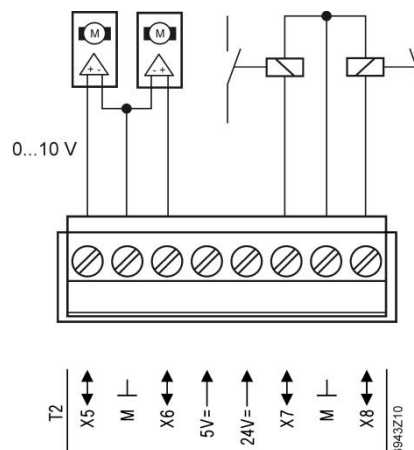

Connecting voltage output and current output to universal IOs

Analog / digital outputs (X5...X8)

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 offboard relays to universal IOs

Powering sensors	**3 x 2 outputs**	
Active / ratiometric	Voltage / current	DC 5 V: 3x20 mA / ±2.5%[1]
5 V, 24 V (T2, T3)	Voltage / current	DC 24 V: 3x40 mA, -25% to +10% accuracy[2]
	Reference potential	Terminals ⊥
	Connection	Short-circuit-proof

[1] avoid pulsating current
[2] max. capacitive load 100µF

Ratiometric sensor

Pressure transmitter

4...20 mA
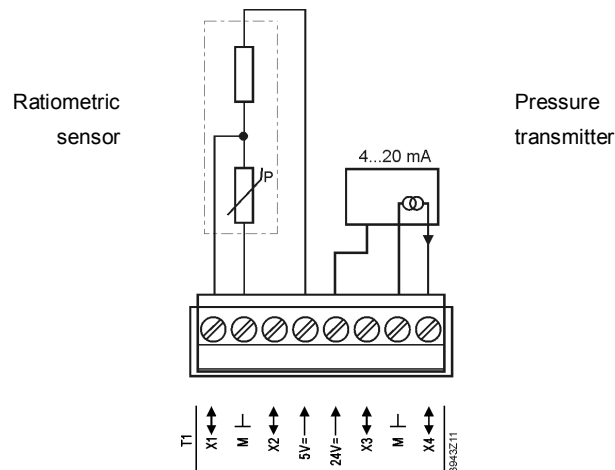
Connecting a ratiometric sensor
AC 24 V sensor supply voltage

Motor driver	**Driver for bipolar stepper motor**	
M1+…COM (T7, T8)	Constant-current mode	Short-circuit-proof
	Switching frequency	50 kHz (variable)
	Full-step mode	4 steps per revolution
	Programmable current	0.1…0.5 A[1]
	Programmable hold current	0.0…0.5 A
	Motor voltage	Max. 42 V
	Programmable speed	Max. 500 steps per s
	Programmable traverse path	0….30,000 steps
	Programmable overdrive	0…2,500 steps
	Programmable reference point	Zero or max. point
	Max. output power for each motor	10 W
	Length of motor cable	<10 m

[1] from VVS11 0.05...0.6 A

UPS (POL96U.00)	Energy storage Ultracaps	(6 x 25 F at 2.21 V)
	Usable energy	>187 Ws
	Charging time	<3 min
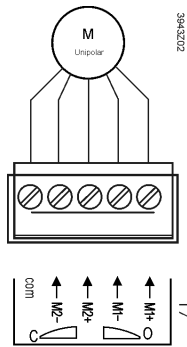
Note	☞	For dedicated valve parameters, approved by valve manufacturers please contact your local Siemens representative.

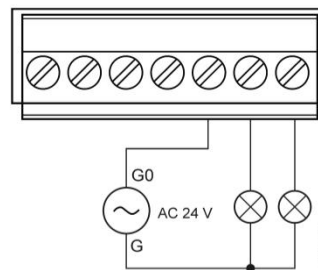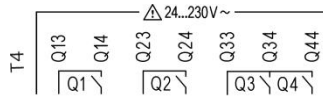Examples of approved valves parameters are listed on page 17

Relay outputs
Q1...Q4 (T4)

Relay: type, contact	Monostable, NO contact
Contact rating	
Switching voltage	AC 24 V…230 V
Nominal current (res. / ind.)	Max. AC 3 A/2 A (cosφ 0.6)
Switching current at AC 19 V	Min. AC 30 mA

Warning

Do not mix SELV / PELV and line voltage on the same terminal.

Use external protection for inductive load.

Connecting indicator lamps to relay outputs

Triac outputs
DO1, DO2 (T5)

Triac output values
Switching voltage	AC 24 V…230 V
Switching capacity	Max. 0.5 A
Min. current	10 mA
Max. external supply line fusing	2.0 A slow wire fuse or circuit breaker

Warning

Do not mix SELV / PELV and line voltage on the same terminal.

Use external protection for inductive load.
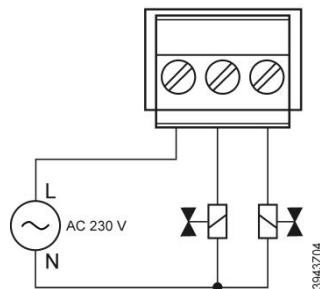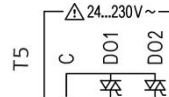
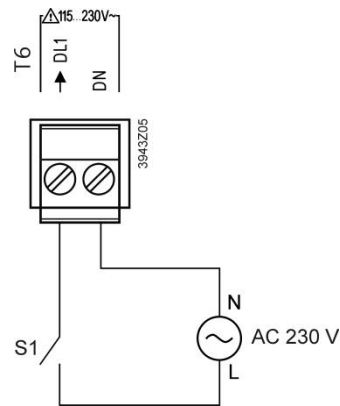Connecting solenoid valves to Triac output

Digital input AC 230 V	0/1 digital signal (binary)	Galvanically isolated contact
DL1 (T6)	Nominal voltage	AC 115 V…AC 230 V
	Frequency range	45…65 Hz
	Sample current	3 mA @ AC 230 V
	Delay	100 ms
	Pulse frequency	Max. 5 Hz

Connecting a AC 230 V signal to a galvanically isolated digital input

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

Peripheral bus	Power supply	Ueff = AC 24 V ± 20%, fmain = 45...65 Hz or U = DC 24 V ± 10%, no internal fuse
	Bus termination	120 Ω +1 nF
	Board-to-board (not included)	ZEC 1,0 / 4-LPV-3,5 GY35AUC2Cl1
	Board-to-wire (not included)	ZEC 1,0 / 4-ST-3,5 GY35AUC1R1,4
	Stranded wire (twisted and with ferrule)	0.2…1.0 mm²
	Cable lengths	Max. 30 m
	Addressing	DIP switches 1…5
	Termination	DIP switch 6

Environmental conditions	Operation	3K5 according IEC 721-3-3
	Temperature	-40...70 °C (POL96E.00)
		-40...60 °C (POL96U.00)
	Relative humidity	5%....95% (non-condensing)
	Absolute humidity	1...29 g/m³
	Atmospheric pressure	Min. 700 hPa, corresponding to Max. 3,000 m above sea level
	Transport	IEC 60721-3-2
	Temperature	-40...70 °C
	Humidity	<95% r.h. (non-condensing)
	Atmospheric pressure	Min. 260 hPa, corresponding to Max. 10,000 m above sea level

Protection	Degree of protection	IP20 (EN 60529)
	Pollution degree	2
	Safety class	Suitable for use in plants with safety class II

Standards	EU Conformity (CE)	CB1T3434xx *)
	RCM Conformity	CB1T3434en_C1 *)
	Listings	
		UL916, UL873
		CSA C22.2M205

*) The documents can be downloaded from http://siemens.com/bt/download.

BSP LEDs

The status of the BSP LED is defined as below:

Mode	LED
BSP upgrade mode in progress	Per second flashing between red and green.
Application not loaded	Orange flashing with 50ms on and 1000ms off
Application loaded but not running or BSP Upgrade mode active	Orange
Application running	Green
BSP error (software error)	Red flashing with 2Hz
Hardware error	Red
Fail safe mode (in case that the BSP upgrade was interrupted)	Orange with Red flashing every second for 500ms

BUS LEDs

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

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

Note ☞ POL96X.00/XXX is a programmable extension module (for programming instruction of local application see Sapro Online-Help).
In case that a failsafe drive is performed (driver connected and referenced), all outputs and LEDs are switched off during the fail safe drive! If the position is reached and the internal super capacitor has still power, the internal application starts again and can control the outputs (therefore BSP LED green).

ECV closing and opening LEDs

In addition to the standard LED, the stepper has two LEDs for each motor which show the status of the motor.

Status	Open LED	Close LED
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	Green flashing 250 ms ON 250 ms Off
Valve is opening	Green flashing 250 ms ON / 250 ms OFF	OFF
Valve is moving to the fail safe position closed	OFF	Green short flashing 50 ms ON / 450 ms OFF
Valve is moving to the fail safe position open	Green short flashing 50 ms ON / 450 ms OFF	OFF
Stepper error (for example, the diagnostics detected an error at startup, such as not connected or shortened coil)	Green short flashing 50 ms ON // 450 ms OFF	Green short flashing 50 ms ON / 450 ms OFF

Note ☞

Firmware of POL96X.00/XXX features different diagnostic functions such as disconnection detection, under voltage detection or shorted coil. The function "disconnection detection" is active only during valve / motor positioning, but not during hold on.

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.
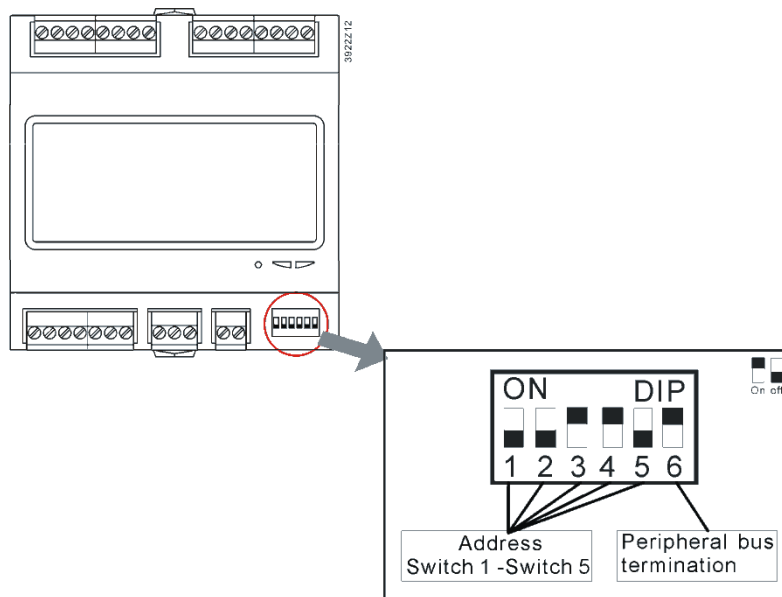
The order of bits for the switch is from 5 to 1, 5 is the lowest bit while 1 is the highest bit. The following table shows the logic of slave address:

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, maximum 31 slave addresses can be configured. The configuration formula is as follows: $2^4+2^3+2^2+2^1+2^0=31$. Below are some configuration examples:

DIP Switch configuration of Extension Module							
No.	Schematics	No.	Schematics	No.	Switch 5	No.	Schematics
1		9		17		25	
2		10		18		26	
3		11		19		27	
4		12		20		28	
5		13		21		29	
6		14		22		30	
7		15		23		31	
8		16		24			

Note 👉 The same address of extension module must be set in the application program of the controller. Zero cannot be set as the slave address.

Order data	Extension module 21 IOs	POL96E.00/STD
		POL96U.00/STD

Accessory parts	Plug set (screw type, side entry)	POL096.E5/STD
	1 x Phoenix MVSTBW 2,5/2-ST GY7035	
	1 x Phoenix MVSTBW 2,5/3-ST KMGY	
	2 x Phoenix MVSTBW 2,5/5-ST GY7035	
	1 x Phoenix MVSTBW 2,5/7-ST GY7035	
	3 x Phoenix MVSTBW 2,5/8-ST GY7035	
	1 x Phoenix ZEC 1,0/4-LPV-3,5 GY35AUC2CI1	
	Plug set (spring cage, cable top entry) FKCT	POL096.E6/STD
	Board-to-wire connector	POL002.43/STD
	2 x Phoenix ZEC 1,0 / 4-ST-3,5 GY35AUC1R1,4	50 pcs

Engineering notes

⚠ **Warning**	**To ensure protection against accidental contact with relay connections carrying voltages above 42 V$_{eff}$, the module must be installed in an enclosure (preferably a control panel). It must be impossible to open the enclosure without the aid of a key or tool.**
	AC 230 V cables must be double-insulated against safety extra low-voltage (SELV) cables.

Dimensions (mm)

3943Z12

A

3943Z13

B

3944Z17

Siemens
Building Technologies

Climatix Extension Modules ECV2

CB1N3943en_02
2016-08-30
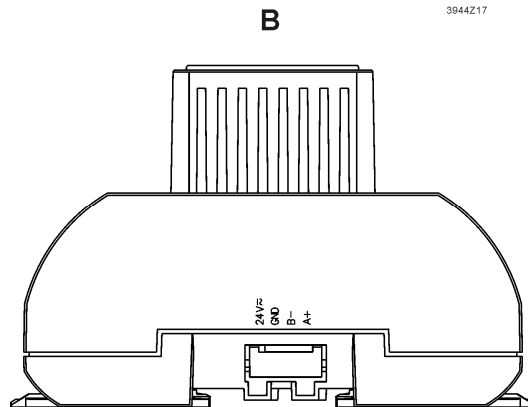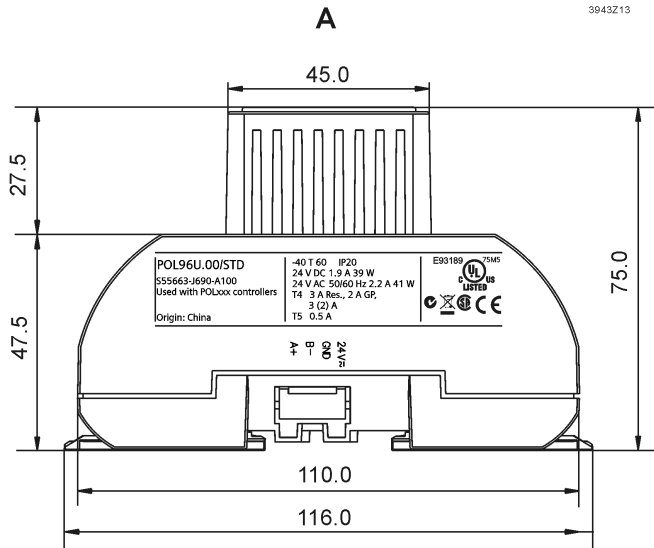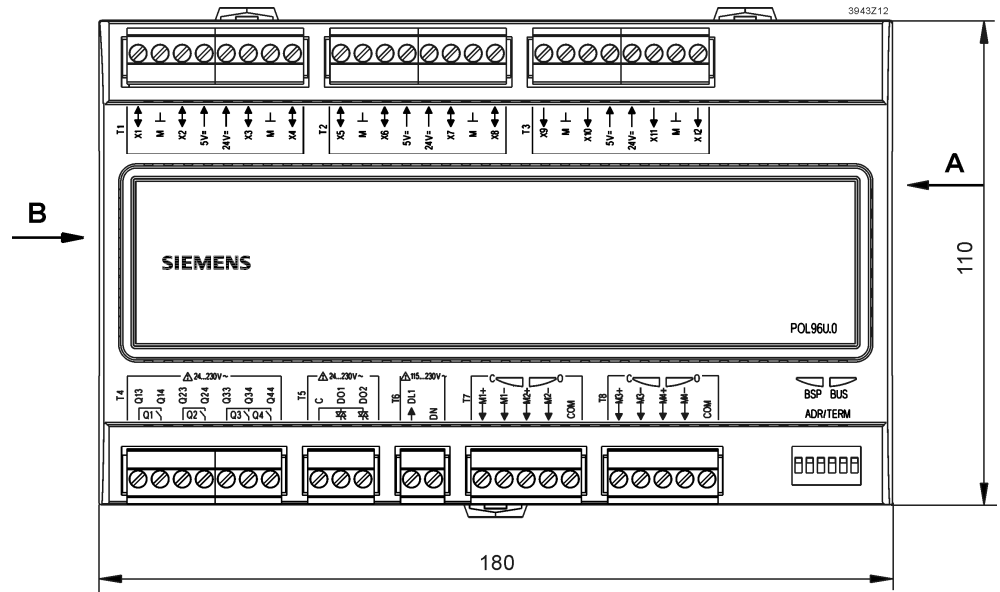
Valve settings

Manufacturer	Unit / Dimension	Danfoss
Valve Type		ETS 12.5, 25, 50, 100, 250, 400 *
CurrentSetpoint	[mA]	120
Speed	[Steps/s]	300
OverdriveOpen	[Steps]	0
OverdriveClose	[Steps]	300
HoldCurrentSetpoint	[mA]	0
DeadTimeSync	[Min.]	60
DelayDirection	[ms]	200
Step Mode		Full Step
* (SKUs 034G0000-034G4999) Maximum cable length 8 m. If a longer cable length is used, communication inductors such as the Danfoss AKA211 should be used.		

Manufacturer	Unit / Dimension	Sporlan		
Valve Type		**SER** AA, A, B, C, D	**SERI** F, G, J, K, L	**SEHI** P, 175, 400, T
CurrentSetpoint	[mA]	120	140	160
Speed	[Steps/s]	200, 400	240	200, 400
DelayDirection	[ms]	200		
OverdriveOpen	[Steps]	0		
OverdriveClose	[Steps]	300		
HoldCurrentSetpoint	[mA]	0		
DeadTimeSync	[Min.]	480		
TraversePath	[Steps]	2500	2500	6386
Step Mode		Full Step		
Sporlan EEVs are designed for long life and durability. Reinitializing the EEV (overdriving to zero position) more than three times per day is not needed.				

Siemens   Climatix Extension Modules ECV2   CB1N3943en_02
Building Technologies   2016-08-30