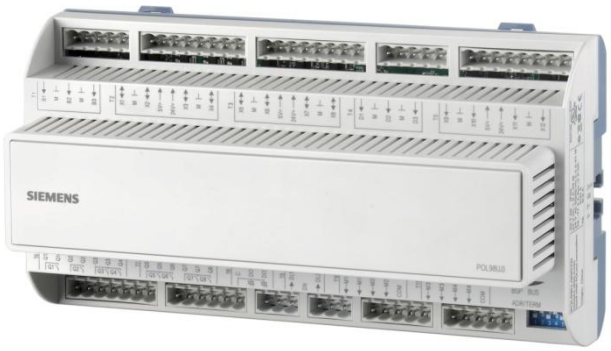
SIEMENS

3944



Climatix™

Climatix Extension Modules ECV2

POL98U.00/XXX
POL98E.00/XXX

The ECV2 extension modules are products of Climatix range. They are designed for driving a broad range of EEV valves with bipolar 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)**
- **3 analog inputs NTC 10k and NTC 100k**
- **12 universal IOs**
- **3 digital inputs for potential-free contacts**
- **DC 24 V and DC 5 V power supply on board for active sensors**
- **8 relay outputs**
- **2 Triac outputs: DO1, DO2 (AC 24…230 V)**
- **2 digital inputs galvanic isolated for AC 115/230 V**
- **Peripheral bus interface for local/remote extension IOs**
- **LED indicator for stepper motor driver**

POL98U.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)

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.

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.

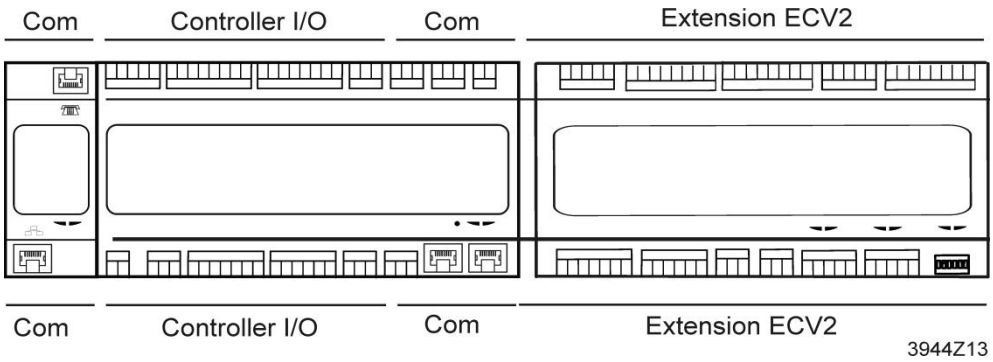
Bipolar stepper motors

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

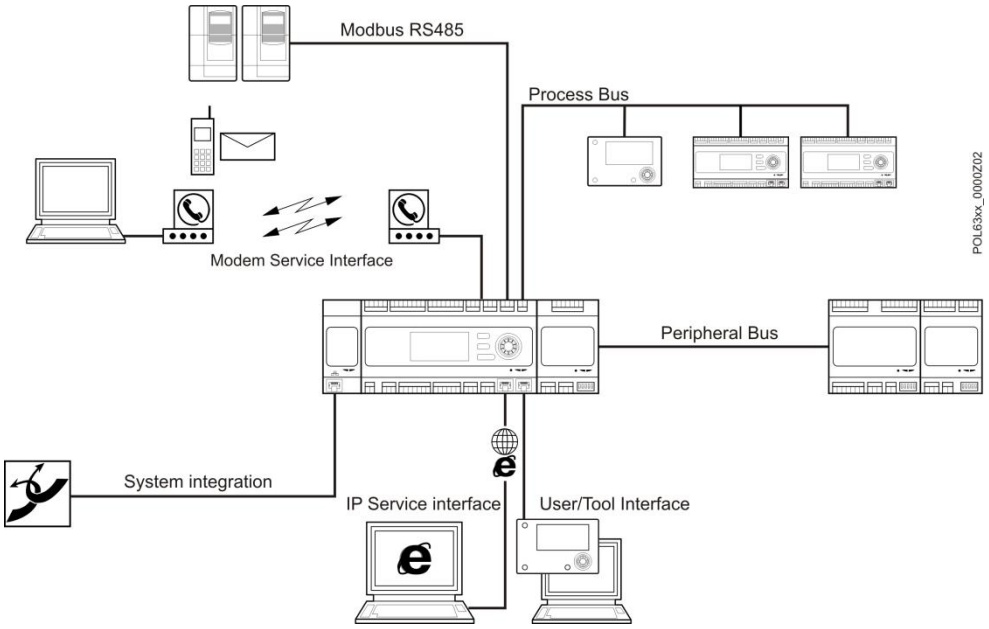
Bipolar permanent magnet and hybrid motors are constructed with exactly the same mechanism as is used on unipolar motors, but the two windings are wired more simply, with no center taps. Thus, the motor itself is simpler but the drive circuitry needed to reverse the polarity of each pair of motor poles is more complex.

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



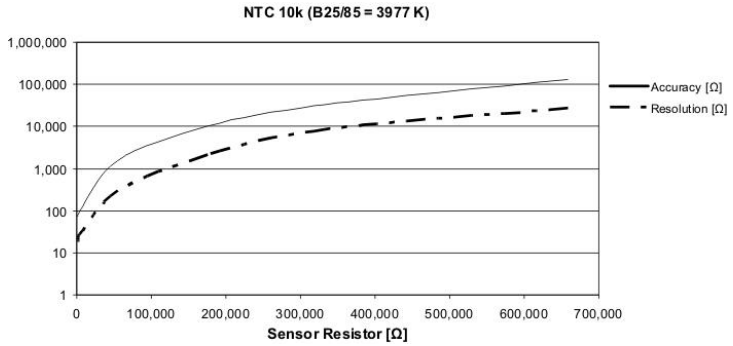
Disposal

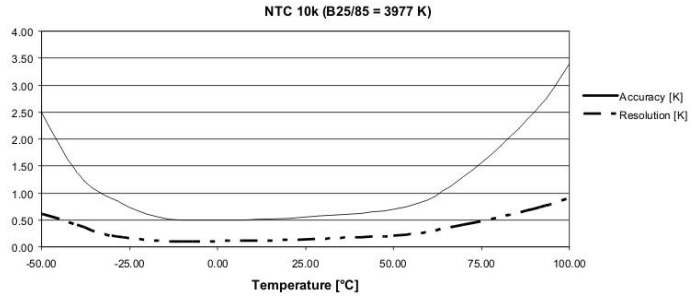
The devices are considered electronics devices for disposal in term of European Directive 2012/19/EU and may not be disposed of as domestic waste.

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

Technical data

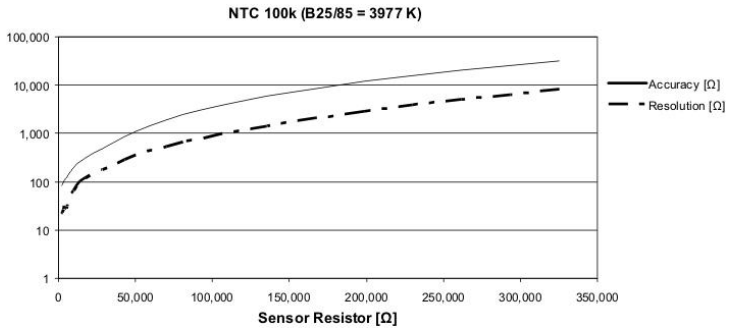
Power supply	Operating voltage	AC 24 V ± 20%; DC 24 V ± 10%
	Frequency	45…65 Hz
	Max. AC-Current consumption	2.2 A, 41 W
	Max. DC-Current consumption	1.9 A, 39 W
	Connection	Peripheral bus
Power distribution	Max pass through current	3.15A @ AC 24V / 3.54A @ DC 24V
General data	Dimensions in mm	207 x 110 x 75
	Weight excl. packaging	
	POL98U.00/XXX	479.2 g
	POL98E.00/XXX	439.5 g
	Base	Plastic, pigeon-blue RAL 5014
	Housing	Plastic, light-grey RAL 7035
Analog inputs	**NTC 10k ($B_{25/85}$ = 3977 K)**	
B1...B3 (T1)	Sensor current	60 µA @ 25 °C

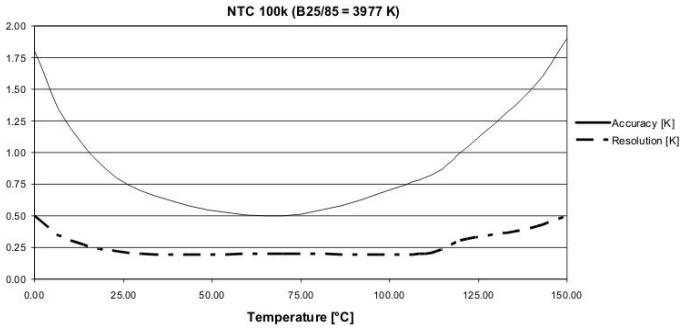




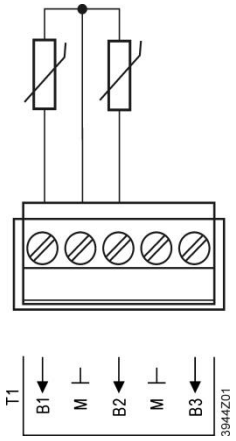
NTC 100k ($B_{25/85}$ = 3977 K)

Sensor current 15 µA @ 25 °C





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

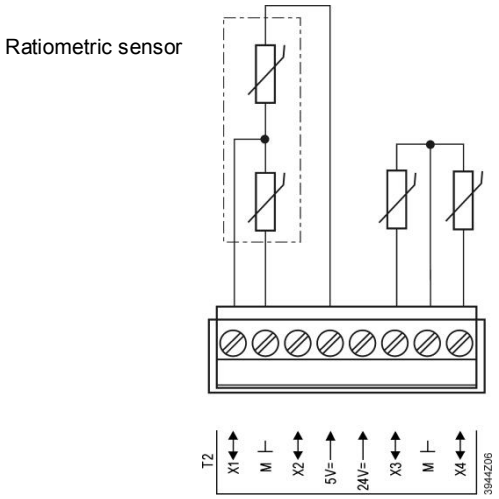


Connecting thermistor to analog-input

Universal IOs
X1…X12 (T2, T3, T5)

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

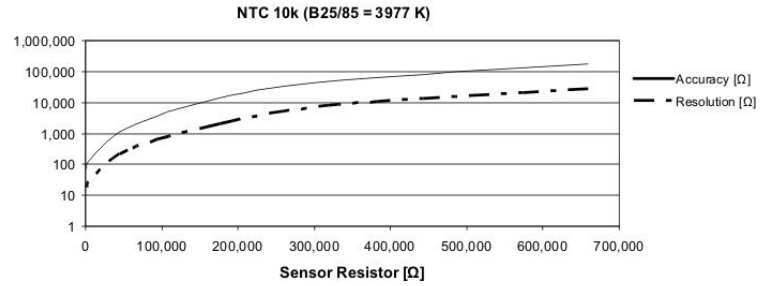


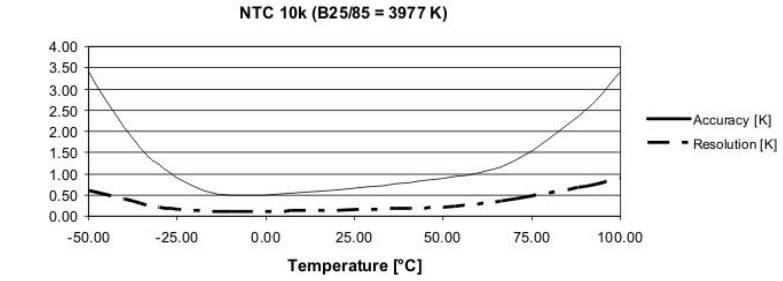
Connecting a ratiometric sensor to universal IO

Connecting NTC to universal IO

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

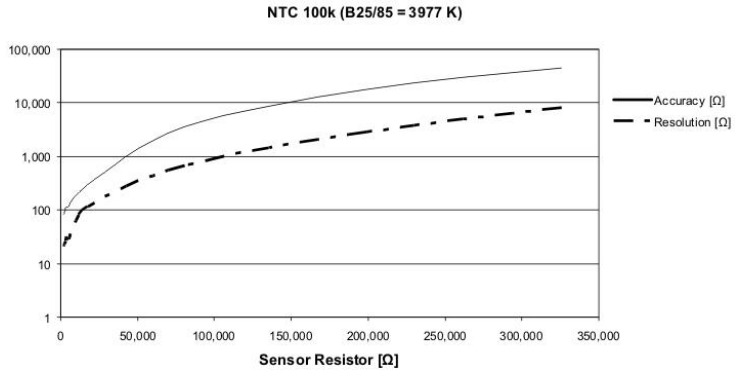
Sensor current Max. 140 µA

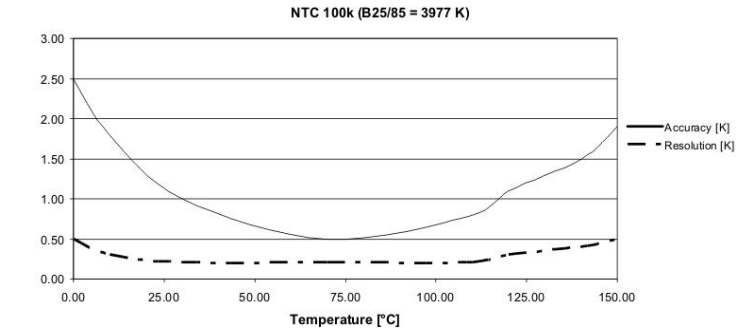




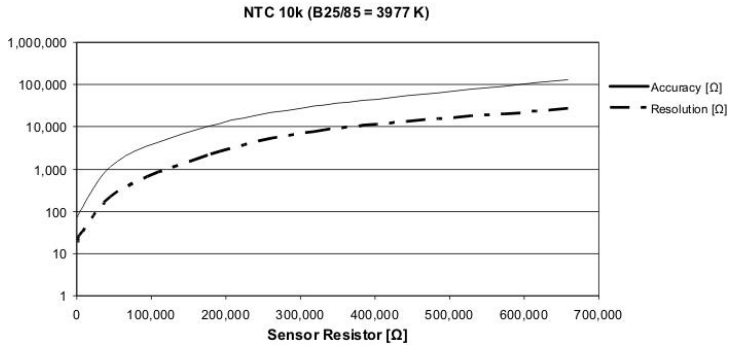
NTC 100k ($B_{25/85}$ **= 3977 K**)

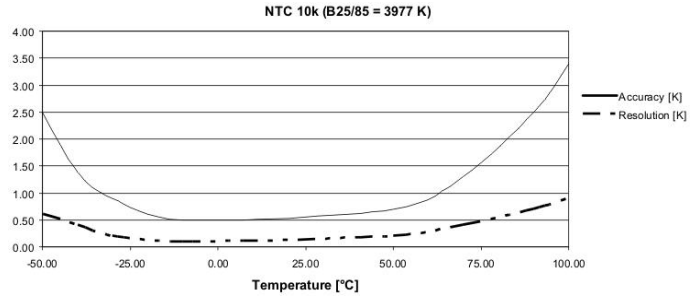
Sensor current Max. 140 µA





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 ($\mathbf{B_{25/85}}$ **= 3977 K**)	
Sensor current	Max. 500 µA



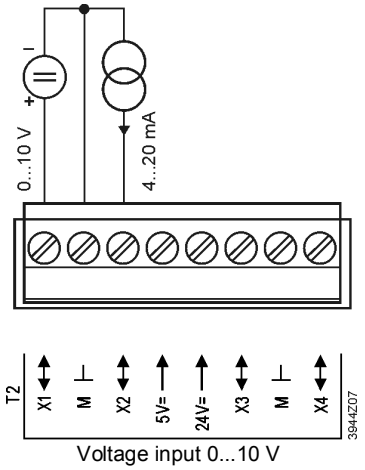


Note ☞ These data are acquired under operating temperature of 25 °C.

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…20 mA / 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…20 mA / 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

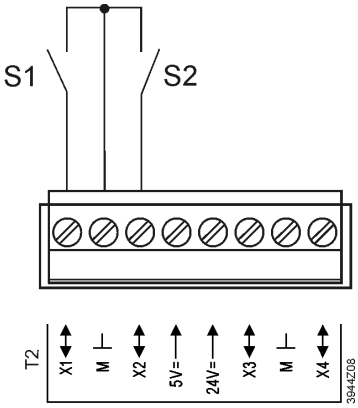
Note ☞ These data are acquired under operating temperature of 25 °C.



Voltage input 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

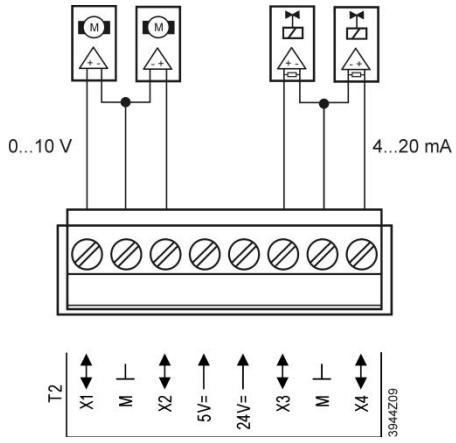


Connecting floating contacts to universal IO

Analog outputs (X1…X4)

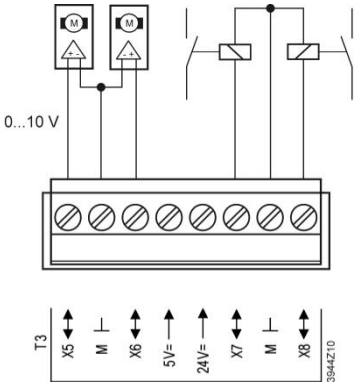
DC 0…10 V output	
Resolution	11 mV
Accuracy at 0 V	66 mV
Accuracy at 5 V	95 mV
Accuracy at 10 V	124 mV
Output current	1 mA (short-circuit proof)
DC 4…20 mA output	
Resolution	22 µA
Accuracy at 4 mA	220 µA
Accuracy at 12 mA	196 µA
Accuracy at 20 mA	243 µA

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



Voltage output and current output from universal IO

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

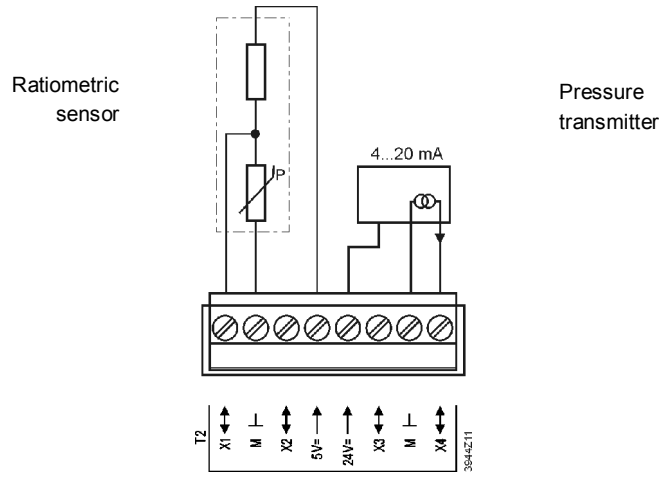


Voltage output and off board relays from universal IO

Powering sensors active/ratiometric
5V, 24V (T2, T3)

3 x 2 outputs	
Voltage/current	DC 5 V, 3 x 20 mA ±2.5%[1)]
Voltage/current	DC 24 V, 3 x 40 mA (-25%, +10%)[2)]
Reference potential	Terminals ⊥
Connection	Short-circuit proof

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

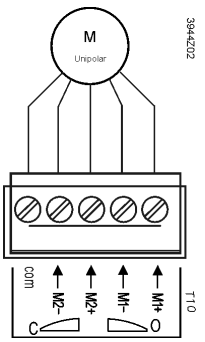


Connecting a ratiometric sensor
24 V sensor supply voltage

Motor driver
M1+…COM (T10, T11)

Driver for bipolar stepper motor	
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…0.5 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
UPS (POL98U.00)	
Energy storage	Ultracaps (6 x 25F at 2,21 V)
Usable energy	187Ws
Charging time	<3 min

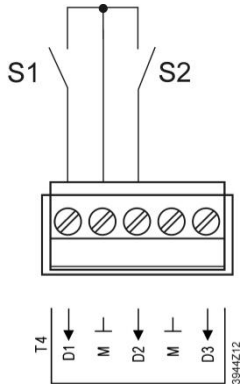
[1)] from VVS11 0.05...0.6A



Note ☞ For dedicated valve parameters, approved by valve manufacturers please contact your local Siemens representative.
Examples of approved valves parameters are listed on page 20

Digital inputs voltage free
D1...D3 (T4)

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. 30 Hz



Connecting floating contact to digital input

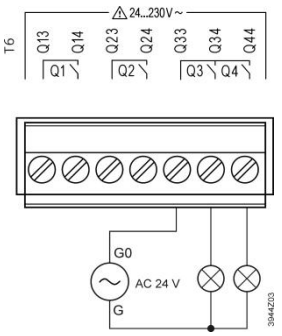
Relay outputs
Q1...Q8 (T6, T7)

Relay: type, contact	Monostable, NO contact
Contact rating	
Switching voltage	AC 24 V…230 V (-20%, +10%)
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 <u>not</u> mix SELV / PELV and line voltage on the same terminal.

Use external protection for inductive load.



Connecting control-lamps to relay output

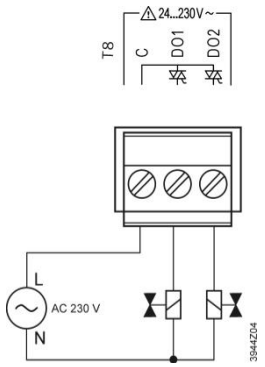
Triac outputs
DO1, DO2 (T8)

Triac output values	
Switching voltage	AC 24…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 <u>not</u> mix SELV / PELV and line voltage on the same terminal.

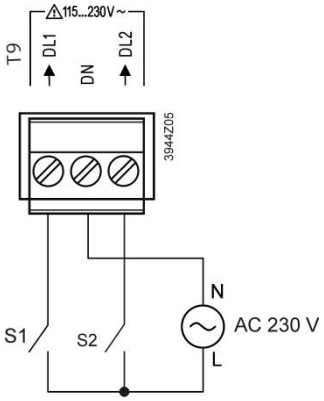
Use external protection for inductive load.



Connecting solenoid valves to Triac output

Digital inputs
AC 230 V
DL1…DL2 (T9)

0/1 digital signal (binary)	Galvanic isolated contact
Nominal voltage	AC 115…230 V (-15%, +10%)
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 galvanic isolated digital input

Connection terminals	Possible plugs for IO signals (not included)	Phoenix FKCVW 2,5 / x-ST 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 GY35AUC2CI1
	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 Switch 1…5
	Termination	DIP Switch 6
Environmental conditions	Operation	3K5 according IEC 721-3-3
	Temperature	-40...70 °C (POL98E.00) -40...60 °C (POL98U.00)
	Relative humidity	5%....95% (non-condensing)
	Absolute humidity	1...29 g/m³
	Air 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. (no condensation)
	Air pressure	Min. 260 hPa, corresponding to Max. 10,000 m above sea level
Protection	Degree of protection	IP20 (EN 60529)
	Pollution degree	II as per EN 60730-1
	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

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

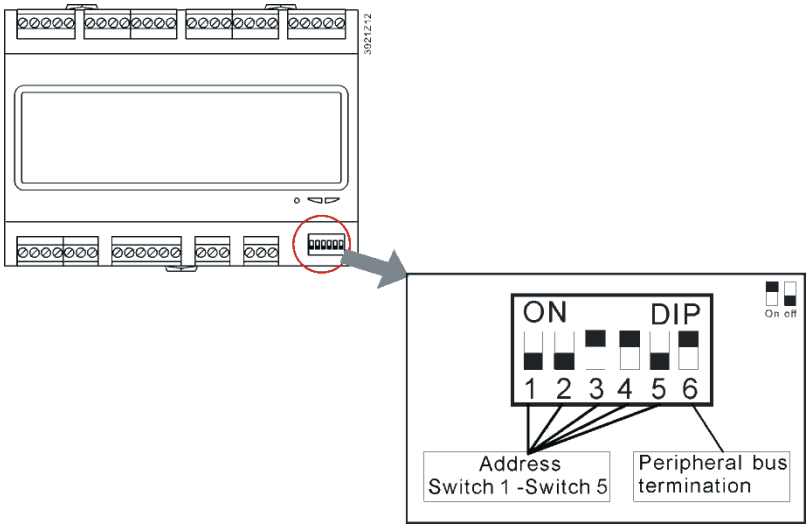
Note ☞

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).

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, not during hold on.

DIP switches

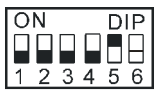
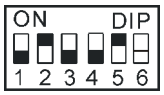
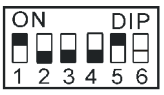
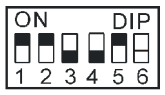
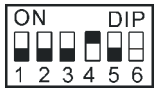
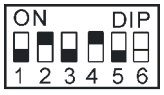
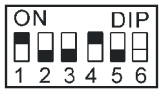
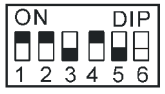
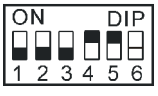
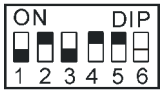
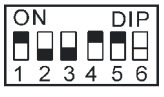
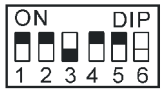
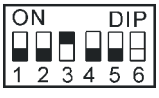
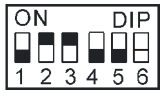
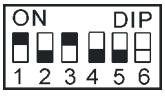
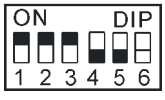
DIP switch is equipped with the extension module to communicate with the controller. Switch 1, 2, 3, 4, and 5 are configurable to set the slave address, while switch 6 acts as peripheral bus termination. When extension module works as the termination in the network, switch 6 needs to be set as ON.

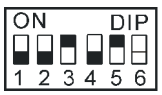
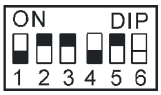
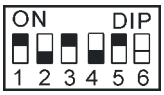
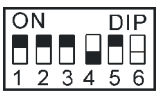
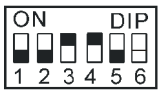
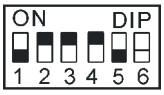
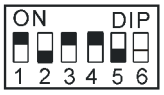
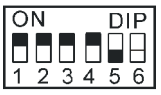
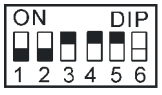
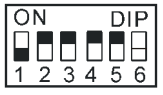
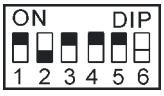
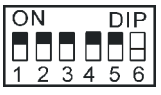
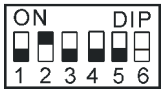
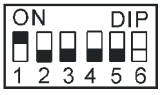
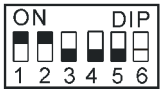


The order of bits for the switch is from 5 to 1, 5 is the lowest bit, while 1 is the highest bit. The following table shows the logic of slave address:

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 below: $2^4+2^3+2^2+2^1+2^0=31$.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	

DIP Switch configuration of extension module							
No.	**Schematics**	**No.**	**Schematics**	**No.**	**Switch 5**	**No.**	**Schematics**
5		13		21		29	
6		14		22		30	
7		15		23		31	
8		16		24			

Notes ☞ The same address of extension module must be respectively set in the application program of the controller. Zero cannot be set as the slave address.

Order data

Extension Module 32 IOs	POL98E.00/STD POL98U.00/STD

Accessory parts

Plug set (spring cage, cable top entry) 2 x Phoenix FKCT 2,5/3-ST KMGY 4 x Phoenix FKCT 2,5/5-ST GY7035 1 x Phoenix FKCT 2,5/6-ST GY7035 1 x Phoenix FKCT 2,5/7-ST GY7035 3 x Phoenix FKCT 2,5/8-ST GY7035 1 x Phoenix ZEC 1,0 / 4-LPV-3,5 GY35AUC2CI1	POL098.E6/STD
Plug set (screw type, side entry) MVSTBW	POL098.E5/STD
Board-to-wire connector 2 x Phoenix ZEC 1,0 / 4-ST-3,5 GY35AUC1R1,4	POL002.43/STD 50 pcs

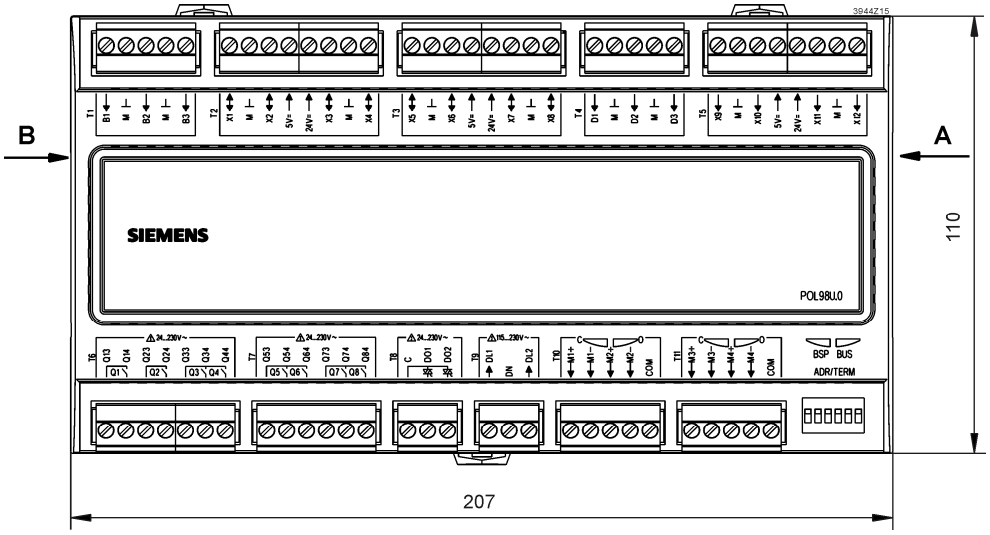
Engineering notes

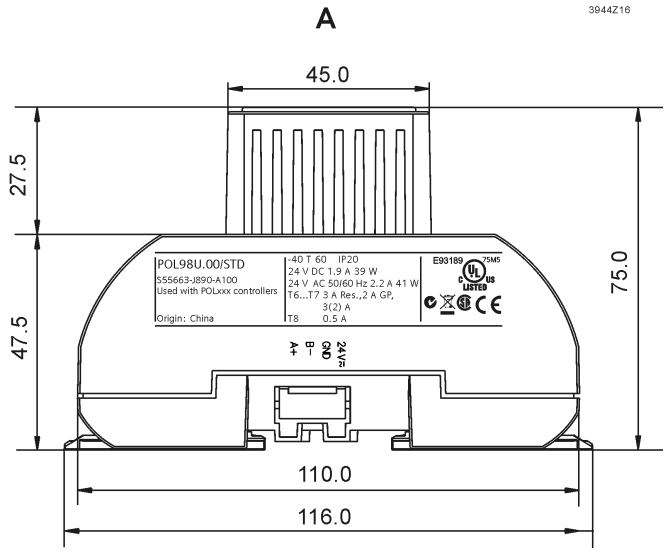
Warning

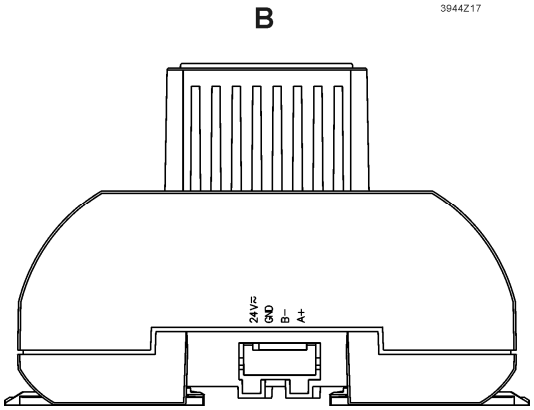
To ensure protection against accidental contact with relay connections carrying voltages above 42 V_{eff}, the module must be installed in an enclosure (preferably a control panel). It must be impossible to open the enclosure without the aid of a key or tool.

AC 230 V cables must be double-insulated against safety extra low-voltage (SELV) cables.

Dimensions (mm)







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.				

Published by:
Siemens Switzerland Ltd.
Building Technologies Division
International Headquarters
Gubelstrasse 22
6301 Zug
Switzerland
Tel. +41 41-724 24 24
www.siemens.com/buildingtechnologies