

Electronic Circuit Protection

ESX10-T



Features

- Selective load protection, electronic trip characteristics
- Active current limitation for safe connection of capacitive loads up to 20,000 μ F and on overload/short circuit
- Current ratings 0.5 A...12 A
- Reliable overload disconnection with $1.1 \times I_n$ plus, even with long load lines or small cable cross sections (see table 4)
- Manual ON/OFF button (S1)
- Control input IN+ for remote ON/OFF signal (option)
- Clear status and failure indication through LED, status output SF or Si contact F
- Integral fail-safe element adjusted to current rating
- Width per unit only 12.5 mm
- Rail mounting
- Ease of wiring through busbar LINE+ and 0 V as well as signal bars and bridges
- Hazardous area approved- Class 1 Div 2, Zone 2, ATEX Zone

Electronic circuit protection type ESX10-T is designed to ensure selective disconnection of 24VDC load systems. 24VDC power supplies, which are widely used in industry today, will shut down the output in the event of an overload with the result that one faulty load in the system can lead to complete disconnection of all loads.

Through selective disconnection, the ESX10-T responds much faster to overload or short circuit conditions than the switch-mode power supply. This is achieved by active current limitation. The ESX10-T limits the highest possible current to 1.3 to 1.8 times the selected rated current of the circuit protector. It is possible to switch on capacitive loads of up to 20,000 μ F, but they are disconnected only in the event of an overload or short circuit.

For optimal alignment with the characteristics of the application, the current rating of the ESX10-T can be selected in fixed values from 0.5 A... 12 A. Failure and status indication are provided by a multicolor LED and an integral short-circuit-proof status output or a relay signal contact. Remote operation is possible by means of a remote reset signal or a remote ON/OFF control signal. The manual ON/OFF button allows separate actuation and reset of individual load circuits.

Upon detection of overload or short circuit in the load circuit, the MOSFET of the load output will be blocked to interrupt the current flow. The load circuit can be re-activated via the remote electronic reset input, control input or manually by means of the ON/OFF button.

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Approvals

Authority	Voltage rating	Current ratings
UL2367 (E306740)	24VDC	0.5...12A
UL 121201 (E320024) (class 1, div.2, group A, B, C, D)	24VDC	0.5...12A
UL508/ cUL 508	24VDC	0.5...12A
CSA file 165971 (LR16186):		
CSA C22.2 No: 213 (class I, div. 2) Groups A, B, C, D, T5	24VDC	0.5...12A
CSA C22.2 No: 14	24VDC	0.5... 12 A
Class 2 meets requirements for Class 2 current limitation (ESX10-T... 0.5 A / 1 A / 2 A / 3 A)		

Technical data (T_{ambient} = 40°C, operating voltage U_b = 24VDC)

Operating data	
Operating voltage U _b	24VDC (18... 32 V)
Current rating I _n	fixed current ratings: 0.5, 1 A, 2 A, 3 A, 4 A, 6 A, 8 A, 10 A, 12 A
Closed current I _g	ON condition: typically 20... 30 mA depending on signal output
Status indication by means of	<ul style="list-style-type: none"> • status output SF (option) • potential-free signal contact F (option) • ON/OFF/ condition of switch S1 • Multicolor LED: <ul style="list-style-type: none"> GREEN: unit is ON, power-MOSFET is switched on - status output SF ON, supplies + 24VDC ORANGE: in the event of overload or short circuit until electronic disconnection RED: unit electronically disconnected - load circuit/Power-MOSFET OFF OFF: manually switched off (S1 = OFF) or device is dead - under voltage (U_b < 8 V) - after switch-on till the end of the delay period
Load circuit	
Load output	Power-MOSFET switching output (high side switch)
Overload disconnection	typically 1.1 x I _n (1.05... 1.35 x I _n)
Short-circuit current I _{sc}	active current limitation (see table 1)
Trip time for electronic disconnection	see time/current characteristics - typically 3 s at I _{Load} > 1.1 x I _n - typically 3 s... 100 ms at I _{Load} > 1.8 x I _n (or 1.5 x I _n /1.3 x I _n)
Temperature disconnection	internal temperature monitoring with electronic disconnection
Low voltage monitoring load output	with hysteresis, no reset required load "OFF" at U _b < 8 V
Starting delay t _{start}	typically 0.5 sec after every switch-on and after applying U _b
Disconnection of load circuit	electronic disconnection
Free-wheeling circuit	external free-wheeling diode recommended with inductive load
Several load outputs must not be connected in parallel	
Status output SF	
ESX10-TB-114/-124/	
Electrical data	plus-switching signal output, nominal data: 24VDC / max. 0.2 A (short circuit proof) status output is internally connected to GND with a 10 kOhm resistor
Status OUT	ESX10-TB-114/-124 (signal status OUT), at U _b = +24 V +24 V = S1 is ON, load output connected through OV = S1 is ON, load output blocked and/or switch S1 is OFF ESX10-TB127 reverse red LED lit
OFF condition	0 V level at status output when: <ul style="list-style-type: none"> • switch S1 is in ON position, but device is still in switch-on delay • switch S1 is OFF, or control signal OFF, device is switched off • no operating voltage U_b
Reset input RE	
ESX10-TB-124	
Electrical data	voltage: max. +32VDC high > 8VDC ≤ 32VDC low ≤ 3VDC > 0 V power consumption typically 2.6 mA (+24VDC) min. pulse duration typically 10 ms
Reset signal RE (terminal 22)	The electronically blocked ESX10-TB-124 may remotely be reset via an external momentary switch due to the falling edge of a +24 V pulse. A common reset signal can be applied to several devices simultaneously. Switched on devices remain unaffected.
Control input IN+	
ESX10-TB-114	
Electrical data control signal IN+ (terminal 21)	see reset input RE +24V level (HIGH): device will be switched on by a remote ON/OFF signal 0 V level (LOW); device will be switched off by a remote ON/OFF signal
Switch S1 ON/OFF	unit can only be switched on with S1 if a HIGH level is applied to IN+

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Technical Data (T_{ambient} = 40°C, operating voltage U_b = 24VDC)

General data	
Fail-safe element:	backup fuse for ESX10-T not required because of the integral redundant fail-safe element
Terminals	
Screw terminals max. cable cross section	M4
Flexible with wire end ferrule w/wo plastic sleeve multi-lead connection (2 identical cables)	20-6 AWG (0.5 - 10 mm ²)
Rigid/flexible	20-11AWG (0.5 - 4 mm ²)
Flexible with wire end ferrule without plastic sleeve	20-13 AWG (0.5 - 2.5 mm ²)
Flexible with TWIN wire end ferrule with plastic sleeve	20-9 AWG (0.5 - 6 mm ²)
Wire stripping length	10 mm
Tightening torque (EN 60934)	0.5 Nm
Terminals	
Screw terminals max. cable cross section	M3
Flexible with wire end ferrule w/wo plastic sleeve	23-13 AWG (0.5 - 4 mm ²)
Wire stripping length	8 mm
Tightening torque (EN 60934)	0.5 Nm
Other general data	
Housing material	molded
Mounting	symmetrical rail to EN 50022-35x7.5
Ambient temperature	-25...+50°C (without condensation, see EN 60204-1)
Storage temperature	-40...+70°C
Humidity	96 hrs/95 % RH/40 °C to IEC 60068-2-78-Cab climate class 3K3 to EN 60721
Vibration	3 g, test to IEC 68-2-6 test Fc
Degree of protection	housing: IP20 DIN 40050 terminals: IP20 DIN 40050
MC (EMC directive, CE logo)	emission: EN 61000-6-3 susceptibility: EN 61000-6-2
Insulation coordination (IEC 60934)	0.5 kV/2 pollution degree 2 re-reinforced insulation in operating area
Dielectric strength	max. 32VDC (load circuit)
Insulation resistance (OFF condition)	n/a, only electronic disconnection
Approvals	UL2367, File E306740, Solid State Overcurrent Protectors UL1604 (class I, div. 2, zone 2), UL508, CE logo CSA C22.2 No. 142 - file 165971, C22.2 No. 213 - file 165971, C1D2 Groups A, B, C, D, Temp Code T5; Ambient 0°-40°C
Dimensions	12.5 x 80 x 83 mm
Mass	approximately 65 g

Table 1: Voltage drop, current limitation, max. load current

Current rating I _n	Typical voltage drop U _{ON} at I _n	Active current limitation (typically)	Max. load current at 100% ON duty	
			T _u = 40° C	T _u = 50° C
.05 A	70 mV	1.8 x I _n	.05 A	.05 A
1 A	80 mV	1.8 x I _n	1 A	1 A
2 A	130 mV	1.8 x I _n	2 A	2 A
3 A	80 mV	1.8 x I _n	3 A	3 A
4 A	100 mV	1.8 x I _n	4 A	4 A
6 A	130 mV	1.8 x I _n	6 A	5 A
8 A	120 mV	1.8 x I _n	8 A	7 A
10 A	150 mV	1.8 x I _n	10 A	9 A
12 A	180 mV	1.8 x I _n	12 A	10.8 A

Table 2: Specifications

Protection	to EN6052
	housing IP30, terminals IP00
CE	to 2004/108/EG and 94/9/EG
UL	UL2367, File No E306740
	UL508, File No E322549
	UL1604, File NO E320024
CSA	CSA C22.2 No 14, File No 165971 (LR16186)
	CSA C22.2 No 142, File No 165971 (LR16186)
	CSA C22.2 No 213, File No 165971 (LR16186)
ATEX	IEC/EN60079-0 /14/-15
	⊕ II 3G Ex nA II B T4 Gc X

Attention: when mounted side-by-side without convection the ESX10-T should not carry more than 80% of its rated load with 100% ON duty due to the thermal effects.

Please note:

- The user should ensure that the cable cross sections of the relevant load circuit are suitable for the current rating of the ESX10-T used.
- Automatic start-up of machinery after shut down must be prevented (Machinery Directive 98/37/EG and EN 60204-1).
In the event of a short circuit or overload the load circuit will be disconnected electronically by the ESX10-T.
- Refer to UL/CSA file for proper wiring and installation techniques.

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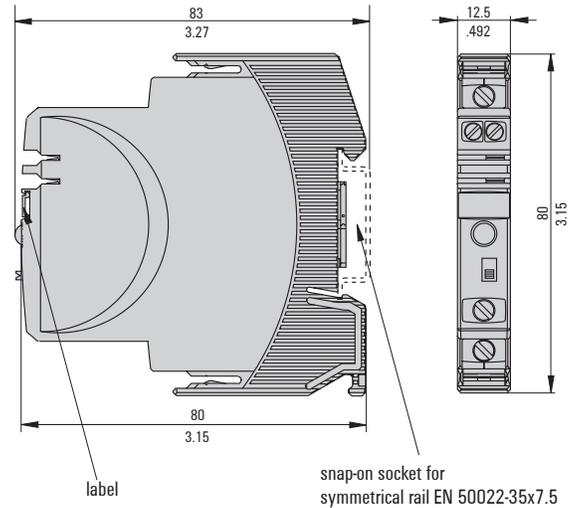
Table 3: ESX10-T - Ordering information

Version	Signal input			Signal contact		Signal output	
	without Signal Input	Control input ON/OFF Reset	Remote Reset	without Signal Output	without Signal Output	Status OUT Positive 24V = OK	Status OUT OV = OK
ESX10-TA-100	x			x	x		
ESX10-TB-114		x				x	
ESX10-TB-124			x	x		x	

ESX10-TA-100		ESX10-TB-114*		ESX10-TB-124**	
Current rating (amps)	Circuit protection order number	Current rating (amps)	Control input order number	Current rating (amps)	Reset input order number
0.5	6720005305	0.5	7940100380	0.5	7940112773
1	7940100338	1	7940100381	1	7940100390
2	7940100339	2	7940100382	2	7940126645
3	7940100340	3	6720005363	3	7940100392
4	7940100341	4	6720005364	4	7940100393
6	7940100343	6	7940100385	6	7940100394
8	7940100344	8	7940100386	8	7940100395
10	7940100345	10	7940100388	10	7940100397
12	7940100346	12	7940100389	12	7940100398

* Control force input on/off ** Reset input only to reset under fault conditions

Dimensions

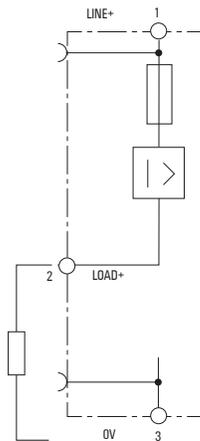


This is a metric design and millimeter dimensions take precedence (mm / inch)

ESX10-T Signal inputs / outputs (wiring diagram)

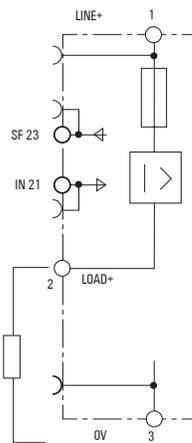
ESX10-TA-100

without signal input/output



ESX10-TB-114

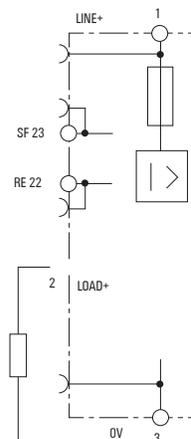
with control input IN+ (+24VDC) with status output SF (+24 V = load output ON)



operating condition: SF +24 V = OK
fault condition: SF 0 V

ESX10-TB-124

with reset input RE (+24VDC ↓) with status output SF (+24 V = load output ON)



operating condition: SF +24 V = OK
fault condition: SF 0 V

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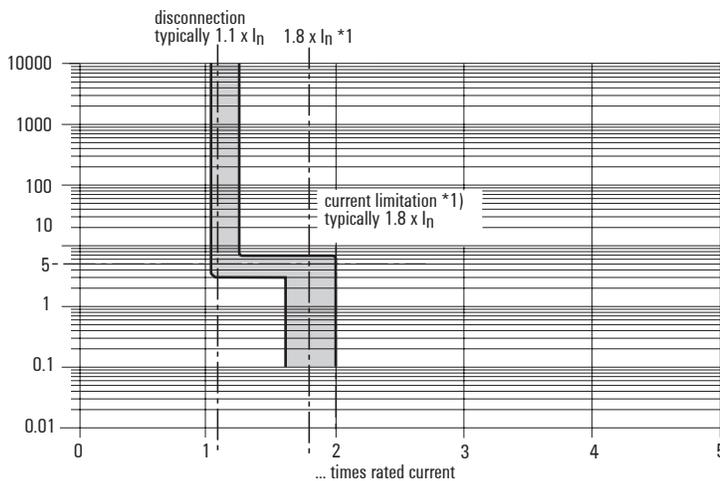
ESX10-T

Table 4: Reliable trip of ESX10-T

Reliable trip of ESX10-T with different cable lengths and cross sections			
Resistivity of copper $\rho_0 =$	0.0178 (Ohm x mm ²) / m		
$U_b = DC 19.2 V (= 80\% \text{ of } 24 V)$	voltage drop of ESX10-T and tolerance of trip point (typically $1.1 \times I_n = 1.05 \dots 1.35 \times I_n$) have been taken into account.		
ESX10-T-selected rating I_n (in A)	→	3	6
e. g. trip current $I_{ab} = 1.25 \times I_n$ (in A)	→	3.75	7.5 → ESX10-T trips after 3 s
R_{max} in Ohm = $U_b / I_{ab} - 0.050$	→	5.07	2.51

The ESX10-T reliably trips from 0 Ohm to max. circuitry resistance R_{max}								
Cable cross section A in mm ²	cable length L in meter (= single length) ↓	cable resistance in Ohm = $(R_0 \times 2 \times L) / A$						
		0.14	0.25	0.34	0.5	0.75	1	1.5
5		1.27	0.71	0.52	0.36	0.24	0.18	0.12
10		2.57	1.42	1.05	0.71	0.47	0.36	0.24
15		3.81	2.14	1.57	1.07	0.71	0.53	0.36
20		5.09	2.85	2.09	1.42	0.95	0.71	0.47
25		6.36	3.56	2.62	1.78	1.19	0.89	0.59
30		7.63	4.27	3.14	2.14	1.42	1.07	0.71
35		8.980	4.98	3.66	2.49	1.66	1.25	0.83
40		10.17	5.70	4.19	2.85	1.90	1.42	0.95
45		11.44	6.41	4.71	3.20	2.14	1.60	1.07
50		12.71	7.12	5.24	3.56	2.37	1.78	1.19
75		19.07	10.68	7.85	5.34	3.56	2.67	1.78
100		25.34	14.24	10.47	7.12	4.75	3.56	2.37
125		31.79	17.80	13.09	8.90	5.93	4.45	2.97
150		38.14	21.36	15.71	10.68	7.12	5.34	3.56
175		44.50	24.92	18.32	12.46	8.31	6.23	4.15
200		50.86	28.48	20.94	14.24	9.49	7.12	4.75
225		57.21	32.04	23.56	16.02	10.68	8.01	5.34
250		63.57	35.60	26.18	17.80	11.87	8.90	5.93
Example 1:	max. length at 1.5 mm ² and 3 A	214 m →						
Example 2:	max. length at 1.5 mm ² and 6 A	106 m →						
Example 3:	mixed wiring: (Control cabinet - sensor/actuator level)	R1 = 40 m in 1.5 mm ² and R2 = 5 m in 0.25 mm ² : R1 = 0.95 Ohm, R2 = 0.71 Ohm	Total (R1 + R2) = 1.66 Ohm					

Time/Current characteristic curve ($T_a = 25^\circ C$)



The trip time is typically 3 s in the range between 1.1 and 1.8 x I_n ⁽¹⁾.

Electronic current limitation occurs at typically 1.8 x I_n ⁽¹⁾ which means that under all overload conditions (independent of the power supply and the resistance of the load circuit) the max. overload before disconnection will not exceed 1.8 x I_n ⁽¹⁾ times the current rating. Trip time is between 100 ms and 3 sec (depending on overload or at short circuit).

Without this current limitation a considerably higher overload current would flow in the event of an overload or short circuit.

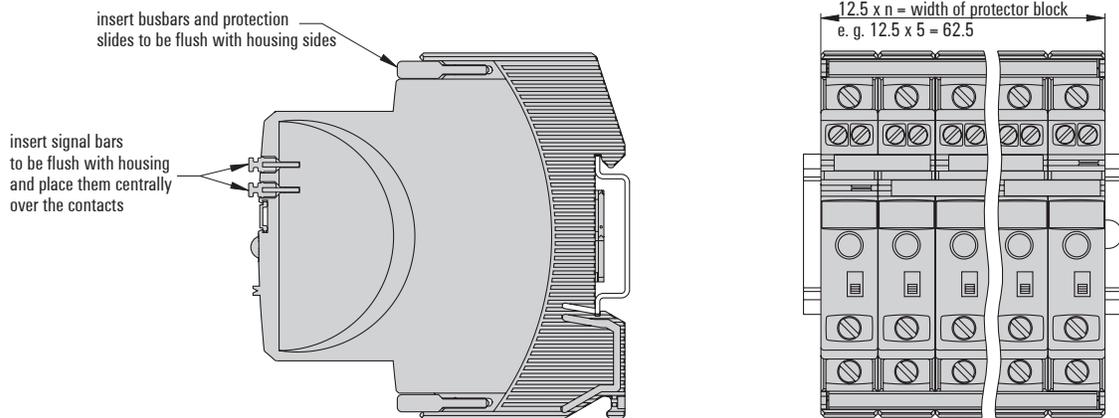
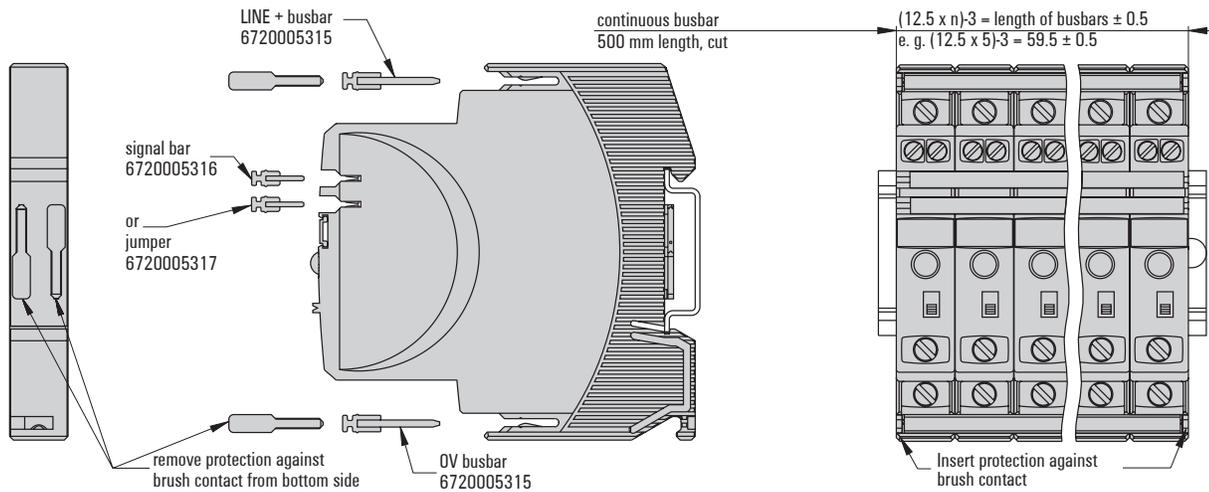
*1) current limitation typically 1.8 x I_n times rated current at $I_n = 0.5 A \dots 6 A$
 current limitation typically 1.5 x I_n times rated current at $I_n = 8 A$ or 10 A
 current limitation typically 1.3 x I_n times rated current at $I_n = 12 A$

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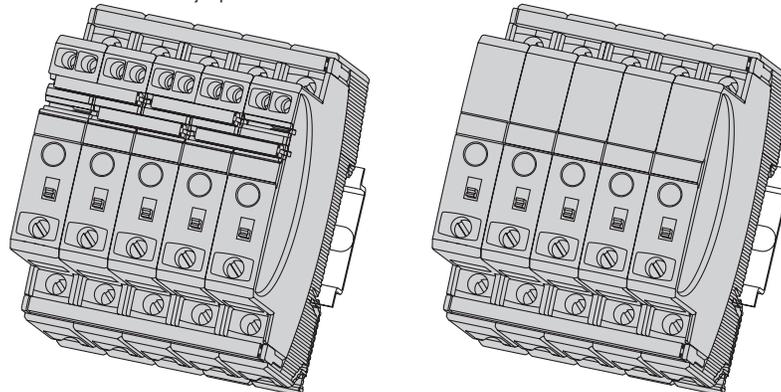
Mounting examples for ESX10-T

The ESX10-T features an integral power distribution system



5 ESX10-TB with busbars and jumpers

5 ESX10-TA with busbars



Mounting procedure:

Before wiring, insert busbars into protection block.

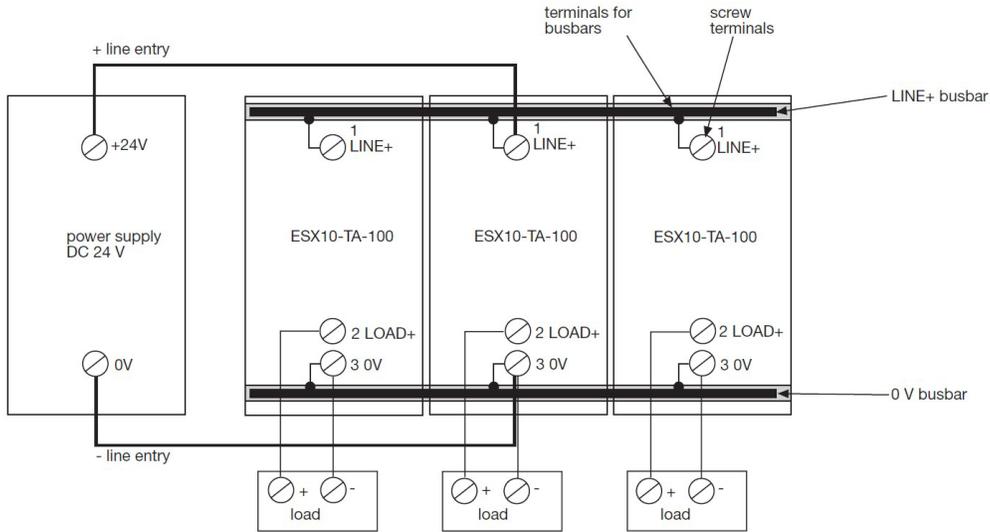
Electronic Circuit Protection

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Connection diagrams and application examples ESX10-T

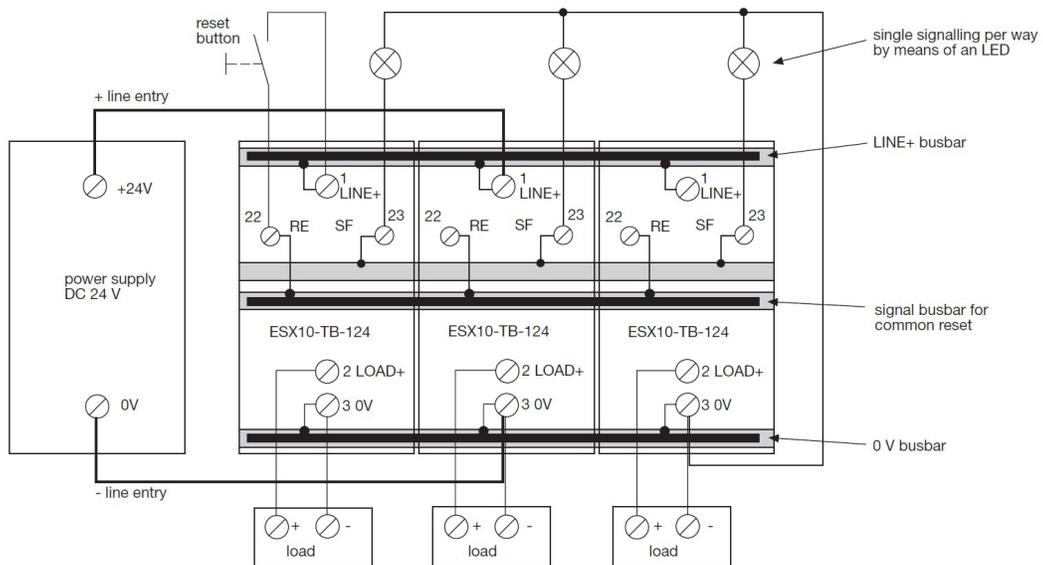
Signal contacts are shown in OFF or fault condition

ESX10-TA-100



ESX10-TB-124

Single signaling with common reset



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Accessories for ESX10-T

Description

The ESX10-T features an integra power distribution system.

The following wiring modes are possible with various pluggable current and signal busbars:

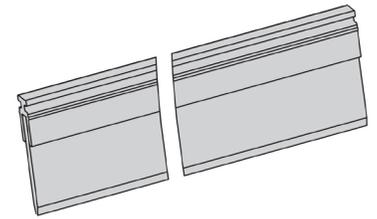
- LINE +(24VDC)
- 0 V

Caution: The electronic devices ESX10-T require a 0 V connection.

- Signal contacts
- Reset inputs

Busbars

Description	Ampacity	Ampacity	Insulation Color	Length	Qty.	Order No.
Busbars for LINE+ and 0 V	With one line entry: I _{max} 50 A (recommended: center line entry)	With two line entries: I _{max} 63 A	Grey	500 mm	1	6720005315
Signal busbars for signal contacts and reset inputs	with one line entry: 1 A	With one series connection of signal contacts: 0.5 A	Grey	500 mm	1	6720005316

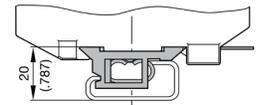


Jumper

Description	Length	Qty.	Order No.
Jumpers for signal contacts	21 mm	10	6720005317

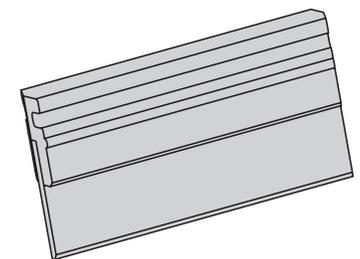
Rail Adapter

Description	Qty.	Order No.
TS32 rail adapter (remove protection walls/barriers before using adapter)	1	9102100000



Busbars for Line+ and 0 V

Description	Insulation Color	Length	Qty.	Order No.
ESX10-T 3-unit block	Grey	34.5 mm	1	6720005335
ESX10-T 4-unit block	Grey	47 mm	1	6720005336
ESX10-T 5-unit block	Grey	59.5 mm	10	6720005337
ESX10-T 8-unit block	Grey	97 mm	1	6720005474
ESX10-T 10-unit block	Grey	122 mm	4	6720005475



Supply module

Description	Ampacity	Insulation Color	Length	Qty.	Order No.
Supply module for LINE+ and 0 V - suitable for ESX10-T: AD-TX-EM01	I _{max} 50 A	Grey	34.5 mm	1	7940098836

