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Electronic Circuit Protection
ESX10-T

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. Thus it is possible to switch on capacitive loads of up to 20,000 µF, 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 multicolour 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.

Features

- Selective load protection, electronic trip characteristics
- Active current limitation for safe connection of capacitive loads up to 20,000 µF and on overload/short circuit
- Current ratings 0.5 A...12 A
- Reliable overload disconnection with 1.1 x 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)
- Electronic **reset** input RE (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 2

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Weidmüller

Approvals

Authority	Voltage rating	Current ratings
UL2367 (E306740)	24VDC	0.5...12 A
UL1604 (E322549)	24VDC	0.5...12 A
(class 1, div. 2, group A, B, C, D)		
UL508/ cUL 508	24VDC	0.5...12 A
CSA file 165971 (LR16186):		
CSA C22.2 No: 213 (class I, div. 2)	24VDC	0.5...12 A
Groups A, B, C, D, T5		
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_0	ON condition: typically 20...30 mA depending on signal output
Status indication by means of	• **multicolour LED:** 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 - undervoltage (U_b < 8 V) - after switch-on till the end of the delay period • status output SF (option) • potential-free signal contact F (option) • ON/OFF/ condition of switch S1
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_K	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	

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

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 0V = 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: • 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
Signal output F	**ESX10-TB-101/-102**
Electrical data	potential-free signal contact max. 30VDC/0.5 A, min. 10 V/10 mA
ON condition LED green	voltage U_b applied, switch S1 is in ON position no overload, no short circuit
OFF condition LED off	• device switched off (switch S1 is in OFF position) • no voltage U_b applied
Fault condition LED orange	overload condition > 1.1 x I_n up to electronic disconnection
Fault condition LED red	electronic disconnection upon overload or short circuit device switched off with control signal (switch S1 is in ON position)
ESX10-TB-101	single signal, make contact contact SC/SO-SI open
ESX10-TB-102	single signal, break contact contact SC/SO-SI closed
Fault	signal output fault conditions: • no operating voltage U_b • ON/OFF switch S1 is in OFF position • red LED lighted (electronic disconnection)
Reset input RE	**ESX10-TB-124/-127**
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	see reset input RE
Control signal IN+ (terminal 21)	+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+

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	**LINE+ / LOAD+ / 0V**	
screw terminals		M4
max. cable cross section		
flexible with wire end ferrule w/wo plastic sleeve		20-6 AWG (0.5 - 10 mm²)
multi-lead connection (2 identical cables)		
rigid/flexible		20-11 AWG (0.5 - 4 mm²)
flexible with wire end ferrule without plastic sleeve		20-13 AWG (0.5 - 2.5 mm²)
flexible with TWIN wire end ferrule with plastic sleeve		20-9 AWG (0.5 - 6 mm²)
wire stripping length		10 mm
tightening torque (EN 60934)		1.2 Nm
Terminals	**aux. contacts**	
screw terminals		M3
max. cable cross section		
flexible with wire end ferrule w/wo plastic sleeve		23-13 AWG (0.25 – 2.5 mm²)
wire stripping length		8 mm
tightening torque (EN 60934)		0.5 Nm
Housing material	moulded	

Mounting	symmetrical rail to EN 50022-35x7.5
Ambient temperature	0...+50 °C (without condensation, see EN 60204-1)
Storage temperature	-20...+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
EMC (EMC directive, CE logo)	emission: EN 61000-6-3 susceptibility: EN 61000-6-2
Insulation co-ordination (IEC 60934)	0.5 kV/2 pollution degree 2 re-inforced 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 (W x H x D)	12.5 x 80 x 83 mm
Mass	approx. 65 g

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

current rating I_n	typically 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
0.5 A	70 mV	1.8 x I_n	0.5 A	0.5 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	1.5 x I_n	8 A	7 A
10 A	150 mV	1.5 x I_n	10 A	9 A
12 A	180 mV	1.3 x I_n	12 A	10.8 A

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 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.

Table 2: Specifications

Protection	to EN6052 housing IP30, terminals IP00
CE logo	to 2004/108/EG and 94/9/EG
UL	UL2367, File No E306740 UL508, File No E322549 UL 1604, 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 Ⓔx II 3G Ex nA II B T4 Gc X

Table 3: ESX10-T - Ordering Information

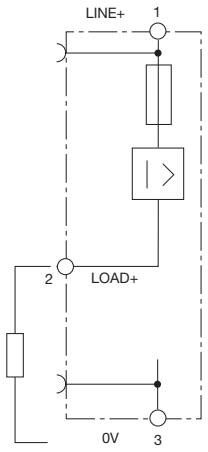
Version	Signal input			Signal output					
				Signal contact			Status output		
	without Signal Input	Control input ON/OFF Reset	Remote Reset	without Signal Output	single signal N/O (normally open NO)	single signal N/C (normally closed NC)	without Signal Output	Status OUT Positive 24V = OK	Status OUT ØV = OK
ESX10-TA-100	x			x			x		
ESX10-TB-101	x				x		x		
ESX10-TB-102	x					x	x		
ESX10-TB-114		x						x	
ESX10-TB-124			x	x				x	
ESX10-TB-127			x	x					x

ESX10-TA-100		ESX10-TB-101		ESX10-TB-102		ESX10-TB-114*		ESX10-TB-124**		ESX10-TB-127	
Current Rating (amps)	**Circuit Protection Part Number**	**Current Rating (amps)**	**N/O Contact Part Number**	**Current Rating (amps)**	**N/C Contact Part Number**	**Current Rating (amps)**	**Control Input Part Number**	**Current Rating (amps)**	**Reset Input Part Number**	**Current Rating (amps)**	**Reset Input Part Number**
0.5	**6720005305**	0.5	**6720005320**	0.5	**6720005340**	0.5	**6720005360**	0.5	**6720005380**	0.5	**6720005309**
1	**6720005301**	1	**6720005321**	1	**6720005341**	1	**6720005361**	1	**6720005381**	1	**6720005319**
2	**6720005302**	2	**6720005322**	2	**6720005342**	2	**6720005362**	2	**6720005382**	2	**6720005329**
3	**6720005303**	3	**6720005323**	3	**6720005343**	3	**6720005363**	3	**6720005383**	3	**6720005339**
4	**6720005304**	4	**6720005324**	4	**6720005344**	4	**6720005364**	4	**6720005384**	4	**6720005349**
6	**6720005306**	6	**6720005326**	6	**6720005346**	6	**6720005366**	6	**6720005386**	6	**6720005369**
8	**6720005308**	8	**6720005328**	8	**6720005348**	8	**6720005368**	8	**6720005388**	8	**6720005389**
10	**6720005310**	10	**6720005330**	10	**6720005350**	10	**6720005370**	10	**6720005390**	10	**6720005399**
12	**6720005312**	12	**6720005332**	12	**6720005352**	12	**6720005372**	12	**6720005392**	12	**6720005313**

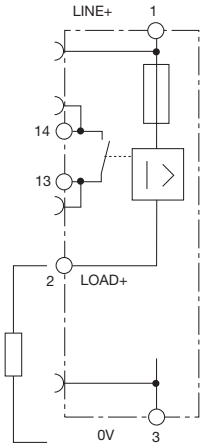
* Control force input on/off ** Reset input only to reset under fault conditions

ESX10-T Signal inputs / outputs (wiring diagram)

ESX10-TA-100
without signal input/output

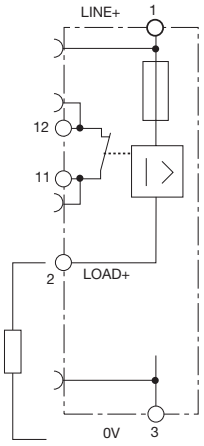


ESX10-TB-101
without signal input
with signal output F
(single signal, N/O)



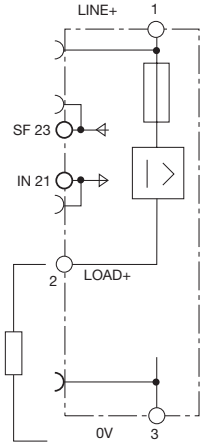
operating condition: 13-14 closed
fault condition: 13-14 open

ESX10-TB-102
without signal input
with signal output F
(single signal, N/C)



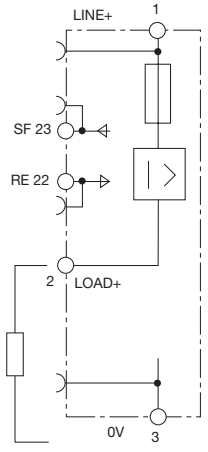
operating condition: 11-12 open
fault condition: 11-12 closed

ESX10-TB-114
with control input IN+
(+24VDC)
with status output SF
(+24 V = load output ON)



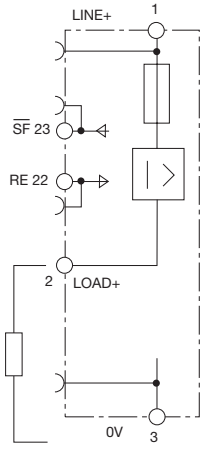
operating condition: SF +24 V = OK
fault condition: SF 0 V

ESX10-TB-124
with reset input RE
(+24VDC ↓)
with status output SF
(+24 V = load output ON)



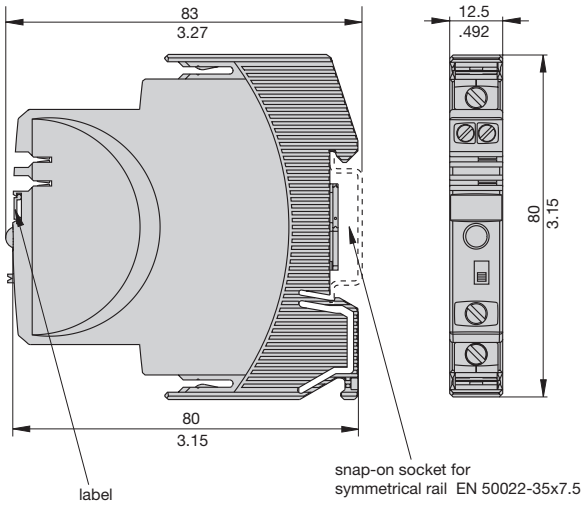
operating condition: SF +24 V = OK
fault condition: SF 0 V

ESX10-TB-127
with reset input RE
(+24VDC ↓)
with inverse status output SF
(0 V = load output ON)



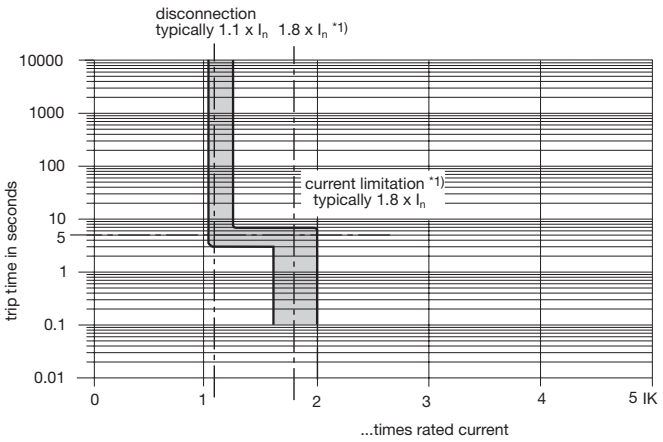
operating condition: SF 0 V = OK
fault condition: SF +24 V

Dimensions



This is a metric design and millimeter dimensions take precedence ($\frac{mm}{inch}$)

Time/Current characteristic curve (T_a = 25 °C)



*1) current limitation typically 1.8 x I_n times rated current at I_n = 0.5 A...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

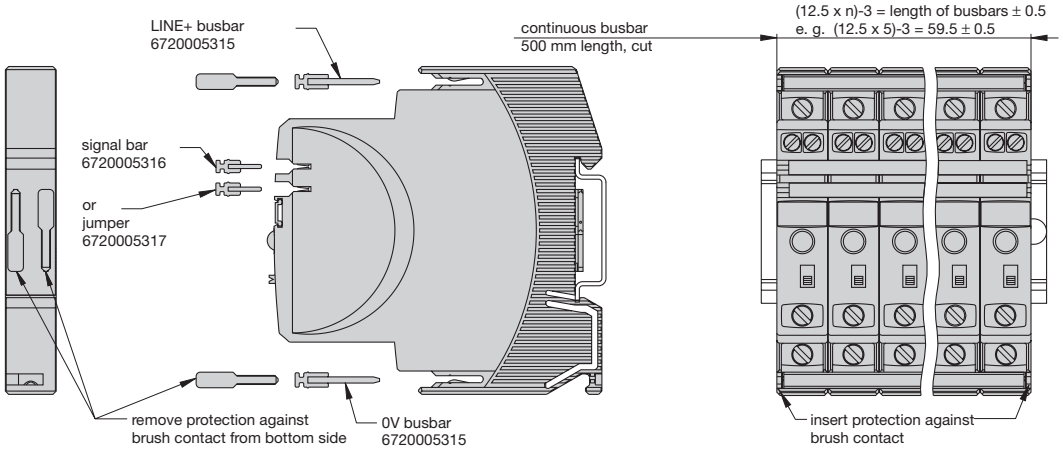
- The trip time is typically 3 s in the range between 1.1 and 1.8 x I_n*1).
- Electronic current limitation occurs at typically 1.8 x I_n*1) which means that under all overload conditions (independent of the power supply and the resistance of the load circuit) the max. overload before disconnection will 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.

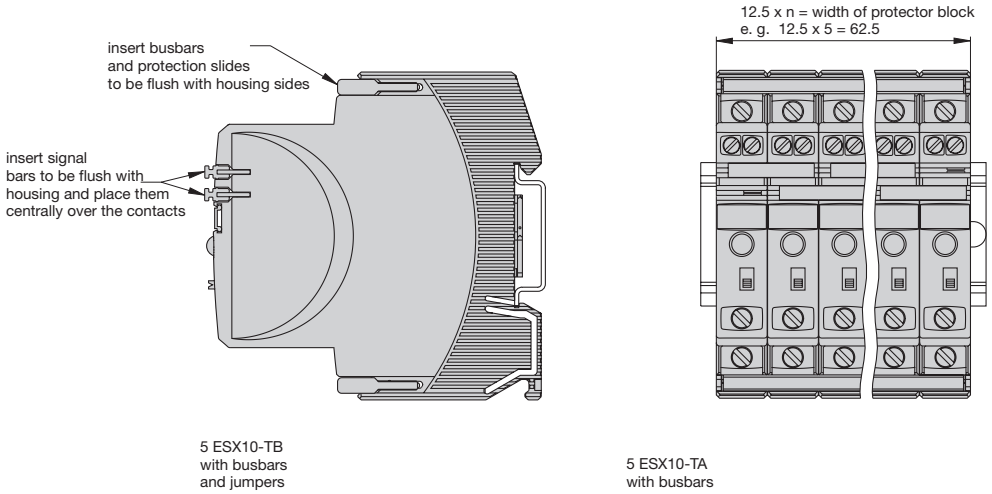
Table 4: Reliable trip of ESX10-T

Reliable trip of ESX10-T with different cable lengths and cross sections									
Resistivity of copper ρ_0 =			0.0178 (Ohm x mm²) / m						
U_b = DC 19.2 V (= 80 % of 24 V)			voltage drop of ESX10-T and tolerance of trip point (typically 1.1 x I_n = 1.05 ... **1.35 x 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 x 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 mm²		0.14	0.25	0.34	0.5	0.75	1	1.5
	cable length **L** in meter (= single length) ↓		**cable resistance in Ohm = (R_0 x 2 x L) / A** ↓						
	5		1.27	0.71	0.52	0.36	0.24	0.18	0.12
	10		2.54	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		8.90	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 mm² and 3 A	**214 m** →							
Example 2:	max. length at 1.5 mm² and 6 A	**106 m**							
Example 3:	mixed wiring: (Control cabinet – sensor/actuator level)	R1 = 40 m in 1.5 mm² and R2 = 5 m in 0.25 mm²: R1 = 0.95 Ohm, R2 = 0.71 Ohm **Total (R1 + R2) = 1.66 Ohm**							

Mounting examples for ESX10-T

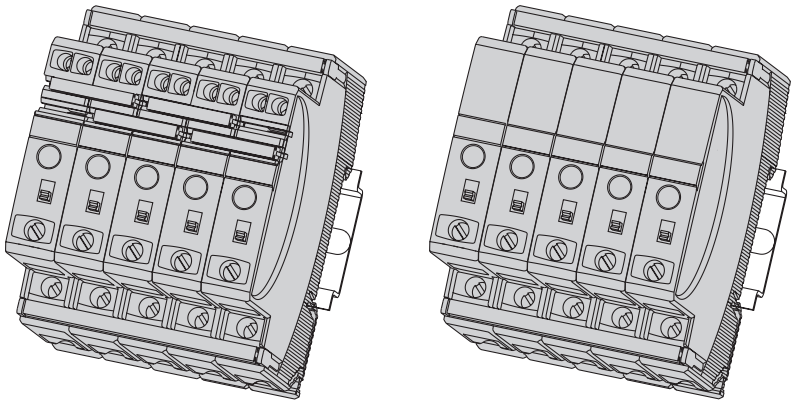
The ESX10-T features an integral power distribution system.





5 ESX10-TB
with busbars
and jumpers

5 ESX10-TA
with busbars



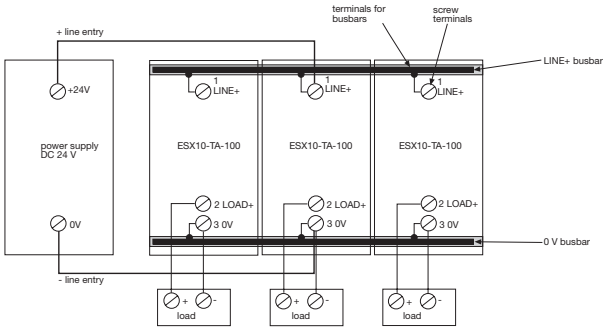
Mounting procedure:

Before wiring insert busbars into protection block.

Connection diagrams and application examples ESX10-T

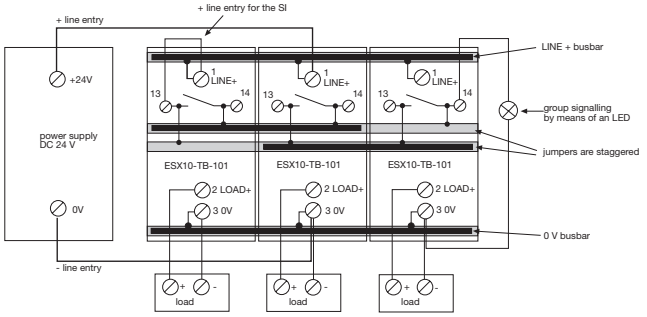
Signal contacts are shown in OFF or fault condition.

ESX10-TA-100



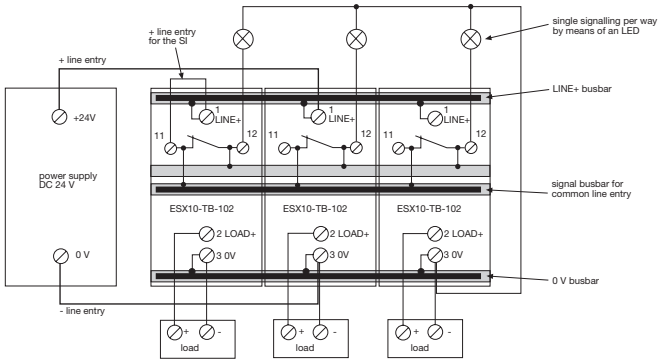
ESX10-TB-101

group signaling (series connection)



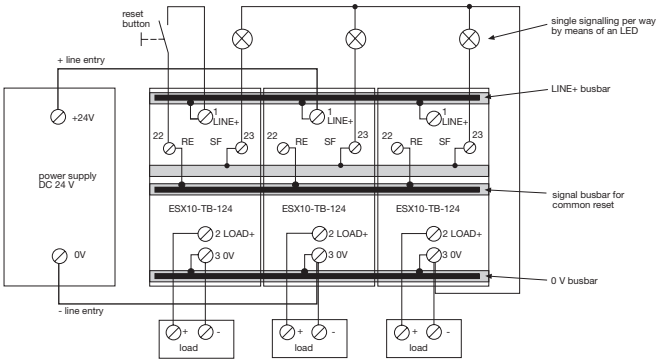
ESX10-TB-102

Single signaling with common line entry



ESX10-TB-124

Single signaling with common reset



Accessories for ESX10-T

Description

The ESX10-T features an integral 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

Description	Part No.	
Busbars for LINE+ and 0 V	**6720005315**	
max. load with one line entry (recommended: centre line entry)	I_{max}	50 A
max. load with two line entries	I_{max}	63 A
length:	500 mm	

Signal busbars for signal contacts and reset inputs	**6720005316**	
max. load with one line entry	I_{max}	1 A
with one series connection of signal contacts	I_{max}	0.5 A
length:	500 mm	

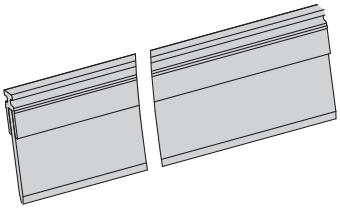
Jumpers for signal contacts	**6720005317**	
length:	21 mm	
packing unit:	10 pcs	

TS32 rail adapter	**9102100000**

(Remove protection walls/barriers before using adapter.)

For detailed installation instructions and approvals contact Weidmuller at 1-800-849-9343 or go to www.weidmuller.com

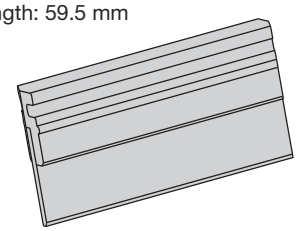
Busbars for LINE+ and 0 V
max. load with one line entry
(recommended: centre line entry)
max. load with two line entries
grey insulation, length: 500 mm
6720005315



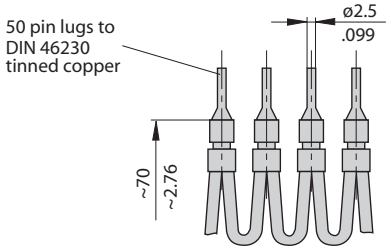
Busbars for LINE+ and 0 V
grey insulation
max. number of plug-on operations 10:

6720005335, (3-unit-block ESX10-T), length: 34.5 mm
6720005336, (4-unit-block ESX10-T), length: 47 mm
6720005337, (5-unit-block ESX10-T), length: 59.5 mm
packing unit: 10 pcs

6720005474, (8-unit-block ESX10-T), length: 97 mm
6720005475, (10-unit-block ESX10-T), length: 122 mm
packing unit: 4 pcs

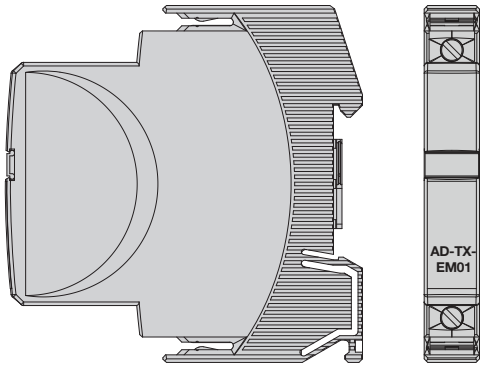


Connector bus link –K10
suitable for auxiliary contacts (series connection)
6720005476 (1.5 mm2, brown)



Supply module for LINE+ and 0 V
suitable for ESX10-T... versions
ampacity Imax 50 A
AD-TX-EM01

I_{max} 50A



All dimensions without tolerances are for reference only. In the interest of improved design, performance and cost effectiveness the right to make changes in these specifications without notice is reserved. Product markings may not be exactly as the ordering codes. Errors and omissions excepted.