

Description

The special device ESS20-1.. is a further extension of the product line "electronic circuit breakers". Type ESS20-1.. has a width of only 12.5 mm and selectively protects all DC 24 V loads through a combination of active electronic current limitation and well-proven circuit breaker technology including physical isolation and manual actuation. The ESS20-1.. can be plugged into the E-T-A power distribution socket Module 17plus, ensuring ease of installation and a significant reduction of wiring time.

DC 24 V switch-mode power supplies (10 A...40 A), which are widely used in automation 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.

The ESS20-1.. helps to overcome this problem as it responds to the overload condition faster than the switch-mode power supply. The highest possible overcurrent is limited to 1.8 or 1.5 times rated current. Thus it is possible to switch on capacitive loads up to **20.000 µF** but they are disconnected only in the event of an overload or short circuit. For optimal adjustment to the application conditions the current rating of the ESS20-1.. can be selected in fixed values from 0.5 A...10 A and in switchable variants 1 A/2 A or 3 A/6 A. Failure and status indication are provided by a bicolour LED and an integral short-circuit proof signal output.

Upon detection of overload or short circuit in the load circuit the MOSFET of the load output will be blocked and current flow in the load circuit will be interrupted. MOSFET and load circuit may be reset by means of the electronic reset input or manually by actuating the push-button (PUSH-PUSH operation). The load circuit may also be physically isolated during start-up of the equipment, e.g. for measuring purposes.

Features

- Selective load protection, electronic trip curve
- Active current limitation (1.8 or 1.5 times rated current $I_N = 8$ A or 10 A) with connection of capacitive loads up to 20,000 µF and at overload/short circuit.
- Reliable overload disconnection with $1.1 \times I_N$ plus, even with long load lines or small cable cross sections (see table 2).
- Selectable current ratings (fixed values 0.5 A...10 A or two steps: 1 A/2 A or 3 A/6 A).
- Manual ON/OFF button (push-push actuation) with physical isolation
- Clear status and failure indication through LED and signal output
- Electronic reset input
- Integral fail-safe element
- Width per unit only 12.5 mm
- Plug-in mounting utilising power distribution system Module 17 plus

Approvals

UL 1077

Attention: the user has to make sure that the cable cross sections of the relevant load circuit are suitable for the current rating of the ESS20 used.



ESS20-1..

Technical Data ($T_U = 25^\circ\text{C}$, $U_B = \text{DC } 24 \text{ V}$) ($T_U =$ ambient temperature at U_N)

Operating data

Operating voltage U_B	DC 24 V (18...32 V)
Current rating I_N	fixed current ratings: 0.5 A, 1 A, 2 A, 3 A, 4 A, 6 A, 8 A, 10 A switchable: 1 A/2 A or 3 A/6 A
Closed circuit current I_0	typically 22 mA
Status indication by means of	<ul style="list-style-type: none"> • bicolour LED: <ul style="list-style-type: none"> GREEN: unit is ON, load circuit/power-MOSFET is switched on, signal output on, supplying +DC 24 V ORANGE: in the event of overload or short circuit until electronic disconnection RED: unit switched off electronically, load circuit/power MOSFET off, status output blocked, undervoltage ($U_B < 8 \text{ V}$), after switch-on until end of switch-on delay. OFF: switched off manually with push-button, unit off load • signal output SF: <ul style="list-style-type: none"> - 1 signalisation per channel - load "ON" SF = +DC 24 V - load "OFF" SF = 0 V • ON/OFF position of push button

Load circuit

Load output	power MOSFET switching output (plus switching)
Max. data of load with side-by-side mounting	see table 1
Voltage drop U_{ON} at I_N	see table 1
Disconnection at overload	typically $1.1 \times I_N$ (1.05...1.35 $\times I_N$)
Short circuit current I_K	typically $1.8 \times I_N$ / active current limitation see table 1
Trip time	see time/current characteristics
for physical isolation	typically 3 s at $I_{load} > 1.1 \times I_N$
for electronic disconnection	typically 3 s...100 ms at $I_{load} > 1.8 \times I_N$ or $1.5 \times I_N$
Temperature disconnection	internal temperature monitoring with electronic disconnection
Low voltage monitoring of load output	with hysteresis, no reset necessary "OFF" at $U_B < 8 \text{ V}$ "ON" at $U_B > 16 \text{ V}$
Starting delay t_{start}	typically 0.5 sec after every switch-on and after applying U_B
Physical isolation	single pole (switch contact) of load circuit - by push-push actuation of the blue push button

Technical Data ($T_U = 25^\circ\text{C}$, $U_B = \text{DC } 24\text{ V}$) ($T_U = \text{ambient temperature at } U_N$)

Free-wheeling circuit	external free-wheeling diode recommended with inductive load
Several load outputs	must not be connected in parallel
Signal output SF	
Signal output SF	plus-switching signal output per unit, applies U_B to terminal 12 of module 17plus Ratings: DC 24 V / max. 0.5 A (short-circuit proof)
Signal output SF ON	signal output has +24 V level if - the load output has continuity (ON condition of load)
Signal output SF OFF	signal output has 0 V level if - the load output is electronically blocked (fault condition or switch-on delay) - the blue push button is in OFF position - no operating voltage U_B is connected. The signal output is connected to ground via a pull-down resistor (10 kOhm).
Reset input	
Reset input RE (terminal 13 or 14 of module 17plus Caution: unused slots have to be fitted with jumpers)	The electronically blocked ESS20-1.. may e.g. be reset via an external momentary switch due to the falling edge of a short +DC 24 V impulse. The reset signal will be fed in terminal 13 or 14 of the module 17plus and is internally pre-wired. The reset simultaneously affects all blocked ESS20-1.. channels of the power distribution system, all switched on ESS20-1.. channels remain unaffected.
Reset input level:	
voltage	max. +DC 32 V
high	> DC 8 V...DC 32 V
low	< DC 3 V...0 V
current consumption	at +DC 24 V typically 2.6 mA
min. pulse length	10 ms
General data	
Fail-safe element	back-up fuse for ESS21 not required as it has an integral redundant fail-safe element (thermal E-T-A circuit breaker); push button in OFF position with tripped fail-safe element
Blade terminals	6.3 mm to DIN 46244-A6.3-0.8
Housing material	plastics
Mounting	plug-in type for E-T-A power distribution socket Module 17plus
Ambient temperature	0...+50 °C (without moisture condensation, cf. 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
Protection class	housing IP30 DIN 40050, terminals IP00 DIN 40050
EMC requirements (EMC directive, CE logo)	emitted interference: EN 50081-1 immunity: EN 61000-6-2
Insulation co-ordination (IEC 60934)	0.5 kV/2 re-inforced insulation in operating area
Dielectric strength	(see dimensions)
operating area	test voltage AC 1000 V
installation area	test voltage AC 500 V
Insulation resistance (OFF condition of push button)	>100 MΩ (DC 500 V) between [LINE (+) - LOAD (+)]
Approvals	UL 1077 under preparation
Dimensions (B x H x T)	12.5 x 105 x 60 mm
Mass	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	
			$T_U = 40^\circ\text{C}$	$T_U = 50^\circ\text{C}$
0.5 A	100 mV	$1.8 \times I_N$	0.5 A	0.5 A
1 A	140 mV	$1.8 \times I_N$	1 A	1 A
2 A	180 mV	$1.8 \times I_N$	2 A	2 A
3 A	140 mV	$1.8 \times I_N$	3 A	3 A
4 A	190 mV	$1.8 \times I_N$	4 A	4 A
6 A	280 mV	$1.8 \times I_N$	6 A	5 A
8 A	220 mV	$1.5 \times I_N$	8 A	7 A
10 A	280 mV	$1.5 \times I_N$	10 A	9 A
1 A/2 A	140 mV/280 mV	$1.8 \times I_N$	1 A/2 A	1 A/2 A
3 A/6 A	140 mV/280 mV	$1.8 \times I_N$	3 A/6 A	3 A/5 A

Attention: when mounted side-by-side without convection the ESS20-1.. should not carry more than 80 % of its rated load with 100 % ON duty because of the integral thermal circuit breaker.

Ordering information

Type

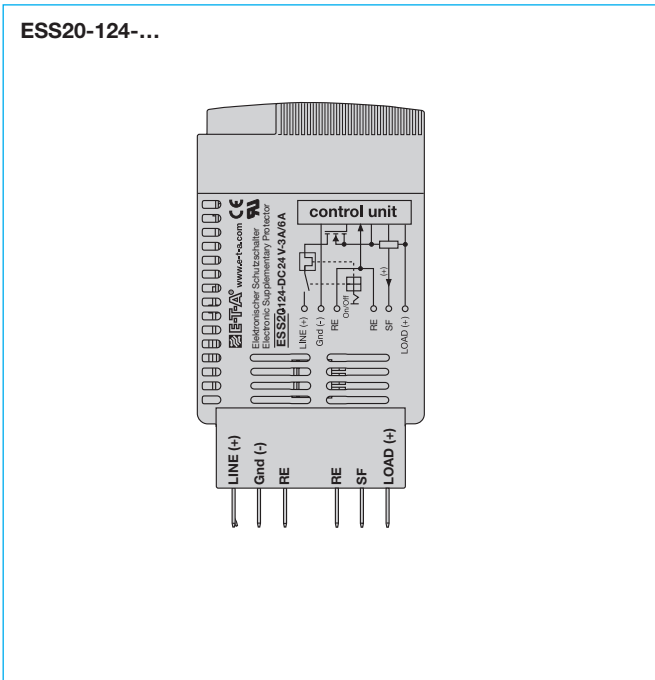
ESS20 Electronic Circuit Breaker with current limitation (e.g. typically $1.8 \times I_N$ or $1.5 \times I_N$, see table 1)

Version

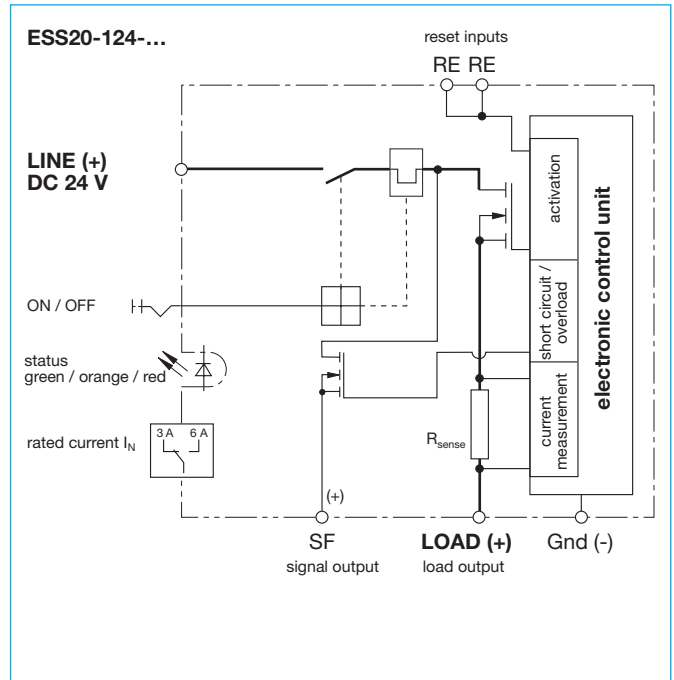
1	without physical isolation in the event of a failure
2	Control input with reset input RE
4	Signal output status output SF (single signalisation, plus switching)
DC 24 V	Operating voltage rated voltage DC 24 V
0.5 A	Current rating
1 A	
2 A	
3 A	
4 A	
6 A	
8 A	
10 A	
1 A/2 A	(selectable)
3 A/6 A	(selectable)
ESS20 - 1 2 4 - DC 24 V - 3 A/6 A	ordering example (recommended type)

Attention: the user has to make sure that the cable cross sections of the relevant load circuit are suitable for the current rating of the ESS20 used.

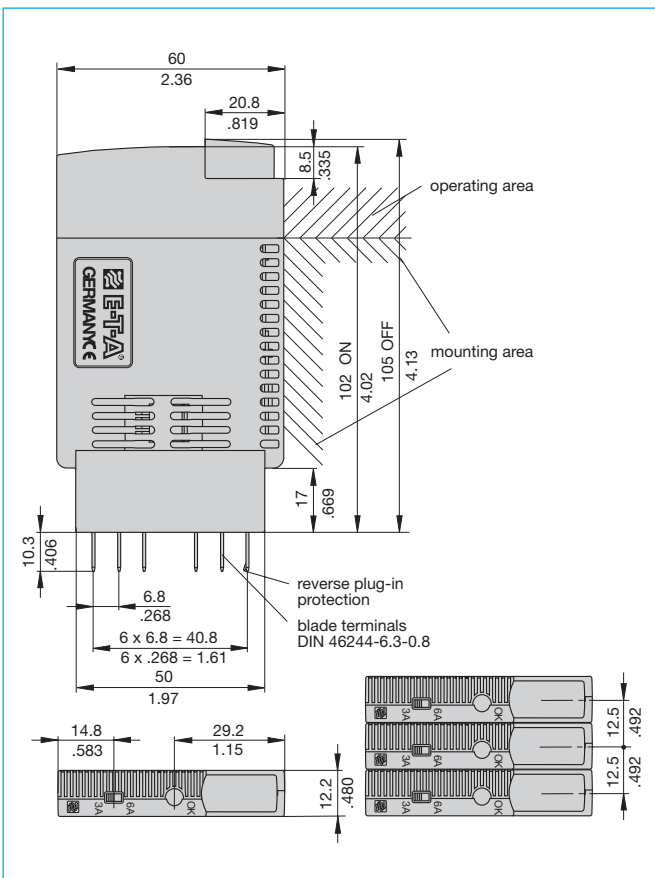
Terminal wiring diagram ESS20-124 (e. g. switchable 3 A/6 A)



Basic circuit diagram ESS20-124 (e. g. switchable 3 A/6 A)



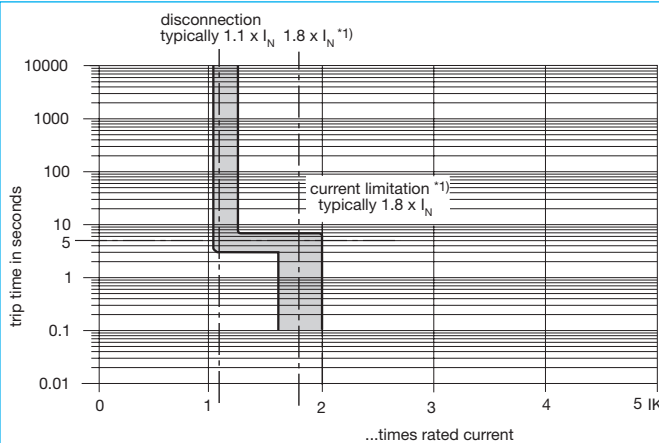
Dimensions



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

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.

Time/Current characteristic curve ($T_A = 25\text{ }^\circ\text{C}$)



- The trip time is typically 3 s in the range between 3 s.
- Electronic current limitation starts at $1.8 \times I_N$ *1) which means that under all overload conditions (independent of the power supply and the resistance of the load circuit) the max. overload until disconnection will not exceed $1.8 \times I_N$ *1) times the current rating. Trip time depends on extent of overcurrent. In the event of an overload of $1.8 \times I_N$ *1) plus the trip time will be up to 3 s, in the event of a short circuit it will be 100 ms.
- Without current limitation to typically $1.8 \times I_N$ *1) a much higher overcurrent would occur in the event of overload or short circuit.

*1) current limitation typically $1.8 \times I_N$ times rated current at $I_N = 0.5\text{ A} \dots 6\text{ A}$
 current limitation typically $1.5 \times I_N$ times rated current at $I_N = 8\text{ A} \dots 10\text{ A}$

Table 2: Reliable trip of ESS20

Reliable trip of ESS20 with different cable lengths and cross sections

Resistivity of copper $\rho_0 =$	0.0178 (Ohm x mm ²) / m		
$U_B = \text{DC } 19.2\text{ V}$ (= 80 % v. 24 V)	voltage drop of ESS20 and tolerance of trip point (typically $1.1 \times I_N = 1.05 \dots 1.35 \times I_N$) have been taken into account.		
ESS20-selected rating I_N (in A) →	3	6	→ ESS20 trips after 3 s
e. g. trip current $I_{ab} = 1.25 \times I_N$ (in A) →	3.75	7.5	
R_{max} in Ohm = $(U_B / I_{ab}) - 0.050$ →	5.07	2.51	

The ESS20 reliably trips from 0 Ohm to max. circuitry resistance R_{max}

Cable cross section A in mm ² →	0.14	0.25	0.34	0.5	0.75	1	1.5
cable length L in meter (= single length) ↓	cable resistance in Ohm = $(R_0 \times 2 \times L) / A$						
	↓	↓	↓	↓	↓	↓	↓
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: $R_1 = 40\text{ m}$ in 1.5 mm² and $R_2 = 5\text{ m}$ in 0.25 mm²:
 (Control cabinet – sensor/actuator level) $R_1 = 0.95\text{ Ohm}$, $R_2 = 0.71\text{ Ohm}$ **Total ($R_1 + R_2$) = 1.66 Ohm**

Accessories for ESS20-1..

Description

Module 17plus is a power distribution system for use with electronic circuit breaker ESS20-1..

Each module accommodates two breakers with an individual housing width of only 12.5 mm and fits onto all industry standard mounting rails.

The two-way modules can be interconnected to provide as many ways as required with a terminal block fitted at each end for connection of signalling circuits. A distribution busbar can be fitted on the supply side of the modules (positive pole) though each pole of multipole circuit breakers must be individually connected.

Electrical connections are by means of spring-loaded terminals. The reference potential for the ESS20-1.. (GND pin 11) is also looped through and connected to the terminals at the sides.

The integral signal output SF of the ESS20-124 may be picked off at terminal 12 of the corresponding channel (single signalisation). The reset input RE may be connected via terminal 13 or 14.



Technical data

Connection	Spring-loaded terminals for solid conductors and stranded cables with and without wire end ferrules. Please use appropriate screw driver size (SD) for removing the spring loaded terminals.
LINE feed (1)	spring-loaded terminals for 0.5-6 mm ² (AWG 10), SD 2 (0.8x4.0)
LOAD output (2)	spring-loaded terminals for 0.25-4 mm ² (AWG 12), SD 1 (0.6x3.5)
Reference potential GND/ group signal terminals (11 or 13, 14):	spring-loaded terminals for 0.25-2.5 mm ² (AWG 14), SD 1 (0.6x3.5)
individual signal terminal (12)	spring-loaded terminal for 0.25-1.5 mm ² (AWG 16), SD 0 (0.4x2.5)

Test probe for testing the group signal for line interruption: ≤ 2 mm Ø

Voltage rating (without ESS20-1..):	AC 433 V; DC 65 V
Current rating (without ESS20-1..)	
LINE feed (1)	50 A
LOAD output (2)	25 A
Reference potential GND (11)	10 A
Individual signal (12)	1 A (with ESS20-1..: 0.5 A)
Group signal /(13-14)	1 A (with ESS20-1..: 0.5 A)
Internal resistance values (without ESS20-1..)	
LINE-LOAD (1-2)	≤ 5 mΩ
Group signal (13-14) per module	≤ 8 mΩ per pole +5 mΩ for each additional module

Busbar for power distribution	
insulated busbar (blue or red):	I_{max} 32 A
non-insulated busbar:	I_{max} 50 A
(The non-insulated busbar, too, meets brush contact safety standards when fitted.)	

Dielectric strength of Module 17plus (without ESS20-1..)	
between main circuits (without busbar):	1,500 V
main circuit to auxiliary circuit:	1,500 V
between auxiliary circuits:	1,500 V

Mass: Module 17plus (centre piece)	approx. 85 g
terminal blocks (pair)	approx. 30 g

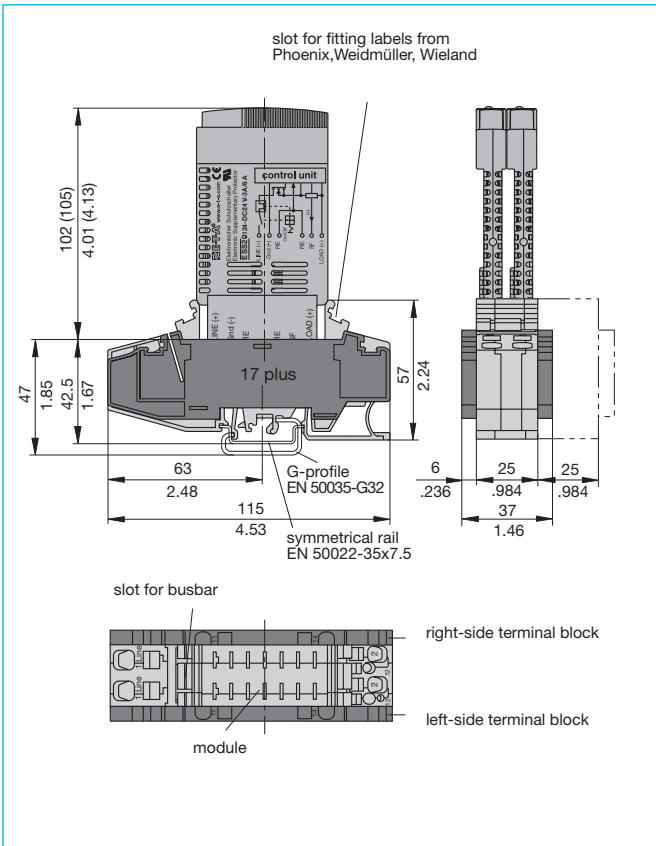
Ordering information

17PLUS-Q02-00	Module 17plus, centre piece, two-way
17PLUS-QA0-LR	one each left- and right-side terminal block for supply feed from the side by means of screw terminal, connection of signalisation etc.

Pin configuration, fitted with ESS20-1..

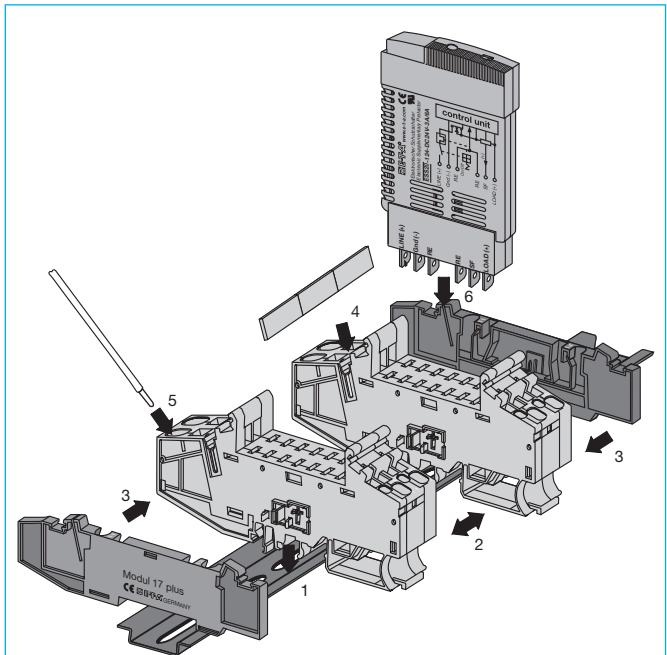
ESS20-124 Module 17 plus			
LINE (+)	(1)		operating voltage PLUS, DC 24 V
Gnd	(11)		operating voltage MINUS
RE	(13)		reset input RE
RE	(14)		reset input RE
SF	(12)		signal output SF
LOAD (+)	(2)		protected load output

Dimensions



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

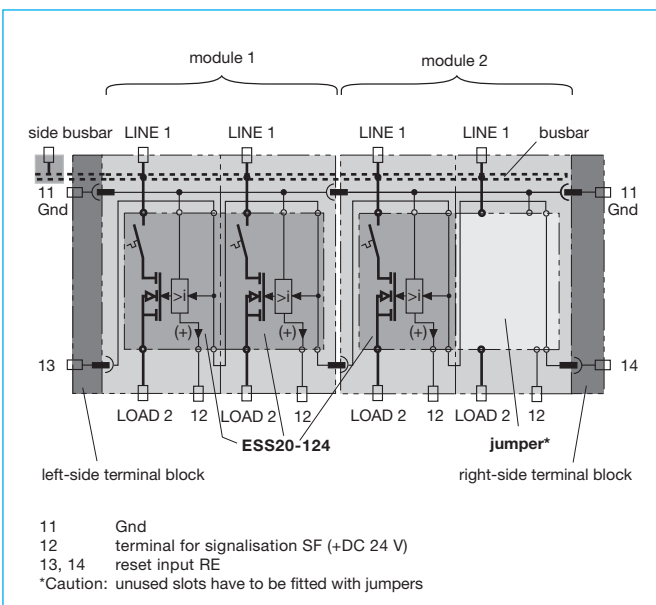
Installation example



Installation:

- 1 Clip modules onto DIN rails.
- 2 Push modules together (side-by-side).
- 3 Snap on right-side and left-side terminal blocks.
- 4 Cut busbar to required length and fit on supply side of the modules.
- 5 Connect line feed with spring-loaded terminals.
- 6 Plug in ESS20-1...

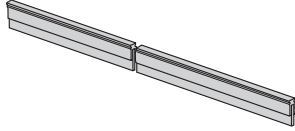
Connection diagram pour ESS20-124



Accessories

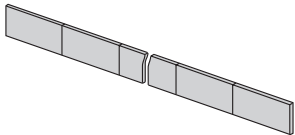
Busbar 32 A

X 222 005 01 blue insulation, 500 mm/19.68 in.
 X 222 005 02 red insulation, 500 mm/19.68 in.
 X 222 005 03 grey insulation, 500 mm/19.68 in.



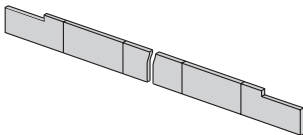
Busbar 50 A

Y 307 016 01 non-insulated, 500 mm/19.68 in.

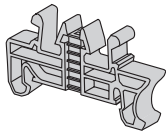


Busbar 50 A

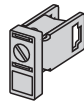
Y 307 016 11 non-insulated, 500 mm/19.68 in.



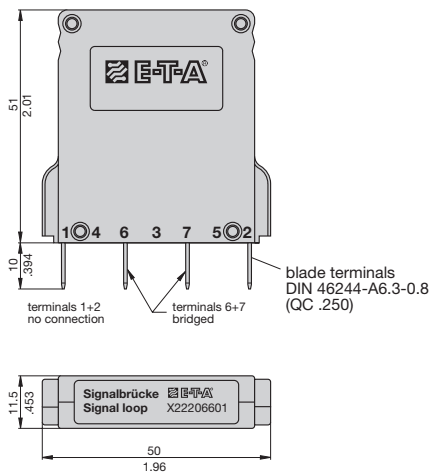
End bracket X 222 004 01



Screw terminal for busbar X 211 156 01 non insulated



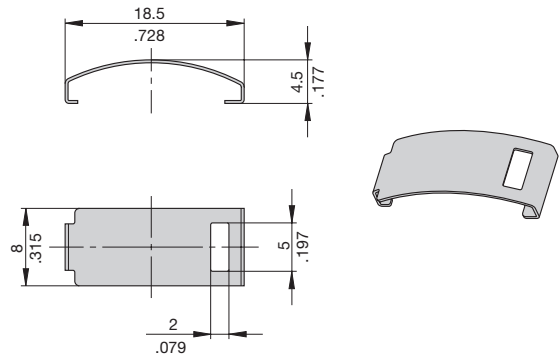
Jumper X 222 066 01



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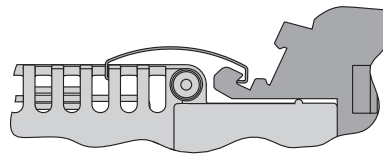
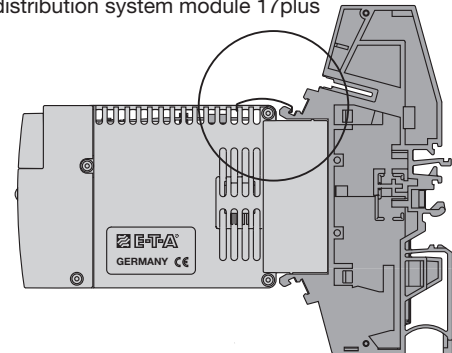
Accessories for ESS20-1..

Retaining clip Y 307 754 01

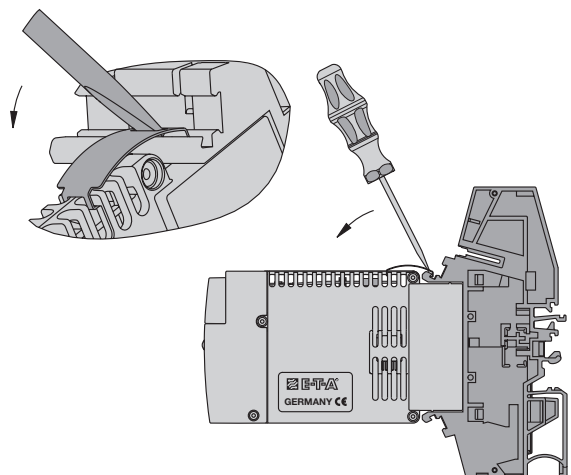


Accessories for ESS20-1..

ESS20 with retaining clip Y 307 754 01
 for power distribution system module 17plus



Removal of retaining clip Y 307 754 01



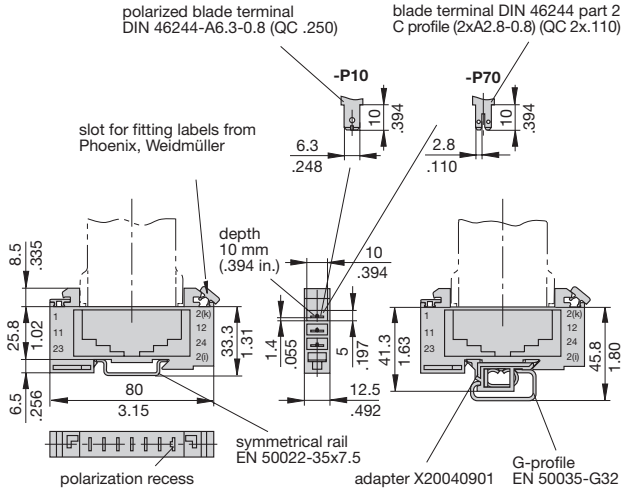
Accessories for ESS20-1..

Single mounting sockets (up to 16 A max. load)

17-P10-Si
17-P70-Si

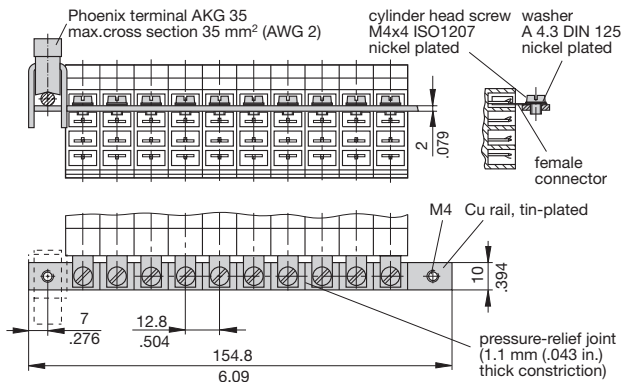
(with adapter)

17-P10-Si-20025
17-P70-Si-20025

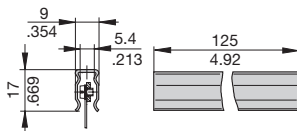


Bus bar (10-way) (supplied as a complete package) for type 17 socket

(for max. 100 A continuous load),
more positions available on request
X 211 157 01 with terminal
X 211 157 02 without terminal



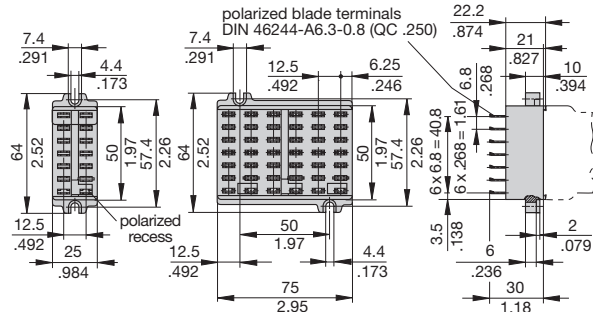
Insulating sleeving for bus bar (10-way) Y 303 824 01



2-way mounting socket 23-P10-Si

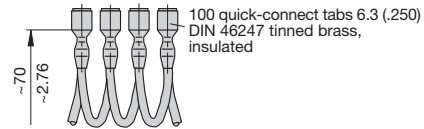
(retaining clip Y 300 581 03 available on request)

6-way mounting socket 63-P10-Si



Connector bus links -P10

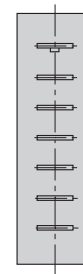
X 210 588 01/ 1.5 mm², (AWG 16), brown (up to 13 A max. load)
X 210 588 02/ 2.5 mm², (AWG 14), black (up to 20 A max. load)
X 210 588 03/ 2.5 mm², (AWG 14), red (up to 20 A max. load)
X 210 588 04/ 2.5 mm², (AWG 14), blue (up to 20 A max. load)



Pin selection, fitted with ESS20-124

ESS20-124 17-P10-Si

LINE (+)	[2(k)]
Gnd	[12]
RE	[24]
	[2(i)]
RE	[23]
SF	[11]
LOAD (+)	[1]



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