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 x 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

Authority	Voltage rating	Current ratings
UL 1077	DC 24 V	0.5...10 A

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 °C, U_B = DC 24 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	● bicolour LED: 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 V), after switch-on until end of switch-on delay. OFF: switched off manually with push-button, unit off load ● signal output SF: - 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 x I_N (1.05...1.35 x I_N)
Short circuit current I_K	typically 1.8 x I_N / active current limitation see table 1
Trip time for physical isolation 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
Temperature disconnection	internal temperature monitoring with electronic disconnection
Low voltage monitoring of load output	with hysteresis, no reset necessary “OFF” at U_B < 8V “ON” at U_B > 16V
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

5

Technical Data (T_U = 25 °C, U_B = DC 24 V) (T_U = 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 1,000 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, File E67320 Supplementary Protectors for use in Electrical Equipment CE logo
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 °C	T_U = 50 °C
0.5 A	100 mV	1.8 x I_N	0.5 A	0.5 A
1 A	140 mV	1.8 x I_N	1 A	1 A
2 A	180 mv	1.8 x I_N	2 A	2 A
3 A	140 mV	1.8 x I_N	3 A	3 A
4 A	190 mV	1.8 x I_N	4 A	4 A
6 A	280 mV	1.8 x I_N	6 A	5 A
8 A	220 mV	1.5 x I_N	8 A	7 A
10 A	280 mV	1.5 x I_N	10 A	9 A
1 A/2 A	140 mV/280 mV	1.8 x I_N	1 A/2 A	1 A/2 A
3 A/6 A	140 mV/280 mV	1.8 x 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 x I_N or 1.5 x I_N, see table 1)

Version

1 without physical isolation in the event of a failure

Control input

2 with reset input RE

Signal output

4 status output SF (single signalisation, plus switching)

Operating voltage

DC 24 V rated voltage DC 24 V

Current rating

0.5 A
1 A
2 A
3 A
4 A
6 A
8 A
10 A
1 A/2 A (selectable)
3 A/6 A (selectable)

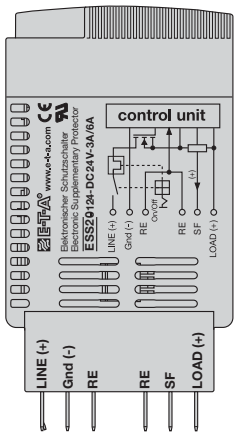
ESS20 - 1 2 4 - DC 24 V -3 A/6 A ordering example (recommended type)

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.

5

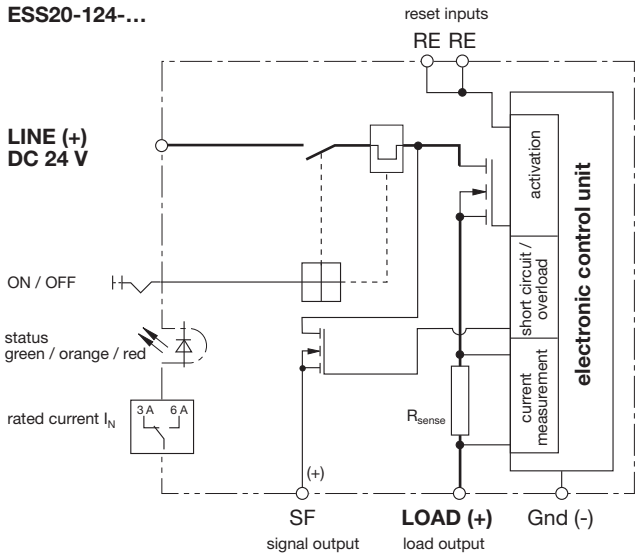
Terminal wiring diagram ESS20-124 (e. g. switchable 3 A/6 A)

ESS20-124-...

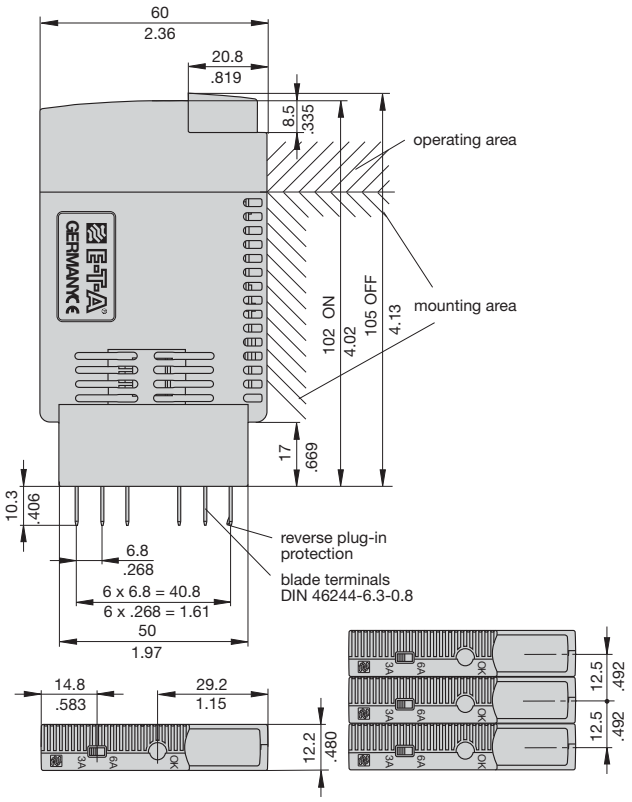


Basic circuit diagram ESS20-124 (e. g. switchable 3 A/6 A)

ESS20-124-...



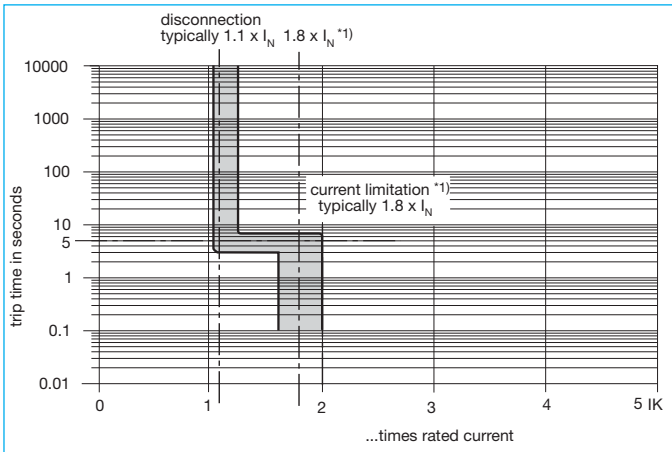
Dimensions



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

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 °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...10 A

- The trip time is typically 3 s in the range between 3 s.
- Electronic current limitation starts at 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 until disconnection will not exceed 1.8*1) times the current rating. Trip time depends on extent of overcurrent. In the event of an overload of 1.8 x 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 x I_N*1) a much higher overcurrent would occur in the event of overload or short circuit.

Table 2: Reliable trip of ESS20

Reliable trip of ESS20 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 % v. 24 V) — voltage drop of ESS20 and tolerance of trip point (typically 1.1 x I_N = 1.05...**1.35 x I_N**) have been taken into account.

ESS20-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	→ **ESS20 trips after 3 s**
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 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**

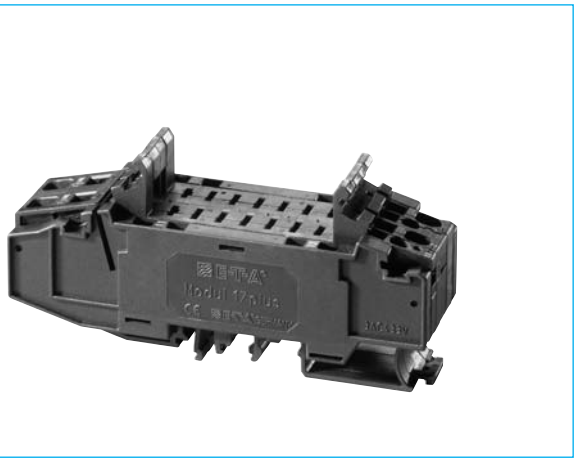
Example 2: max. length at 1.5 mm² and 6 A → **106 m**

Example 3: mixed wiring: R1 = 40 m in 1.5 mm² and R2 = 5 m in 0.25 mm²:
(Control cabinet – sensor/actuator level) R1 = 0.95 Ohm, R2 = 0.71 Ohm **Total (R1 + R2) = 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.



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..

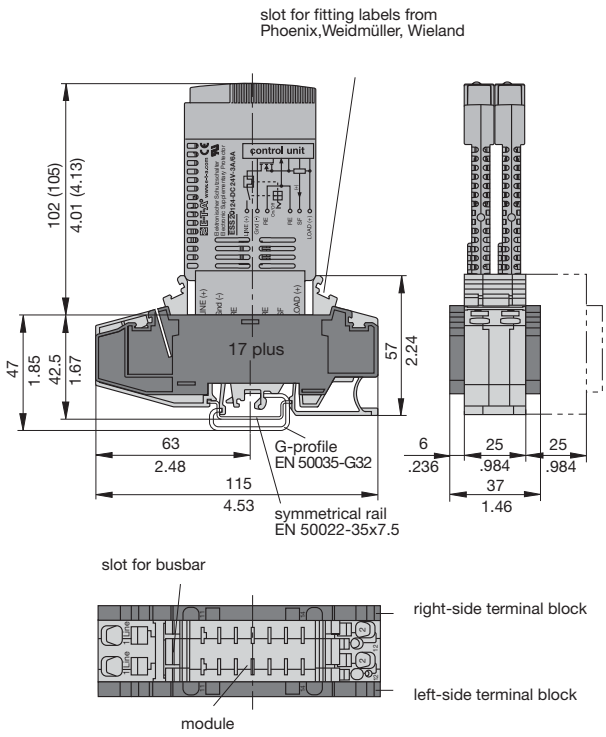
ESS20-124	Module 17 plus		
LINE (+)	(1)		operating voltage PLUS, DC 24 V
Gnd	(11)		operating voltage MINUS
RE	(13)		reset input RE
RE	(14)		reset input RE
SF	(12)		signal output SF
LOAD (+)	(2)		protected load output

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 mm² (AWG 10), SD 2 (0.8x4.0)
LOAD output (2)	spring-loaded terminals for 0.25-4 mm² (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 mm² (AWG 14), SD 1 (0.6x3.5)
individual signal terminal (12)	spring-loaded terminal for 0.25-1.5 mm² (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

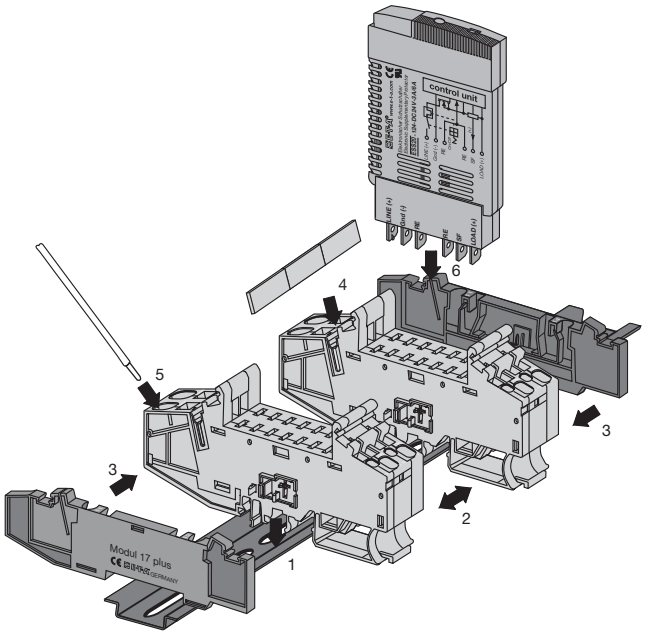
5

Dimensions



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

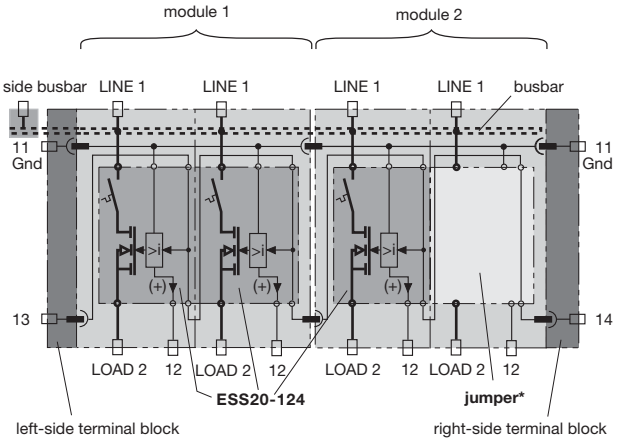
Installation example



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...

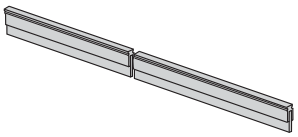
Connection diagram pour ESS20-124



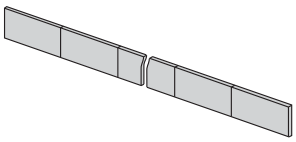
11 Gnd
12 terminal for signalisation SF (+DC 24 V)
13, 14 reset input RE
*Caution: unused slots have to be fitted with jumpers

Accessories

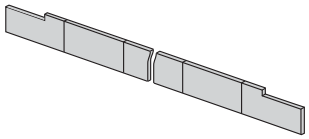
Busbar 32 A
X 222 005 01 blue insulation, 500 mm/19.68 in.
X 222 005 02 red insulation, 500 mm/19.68 in.
X 222 005 03 grey insulation, 500 mm/19.68 in.



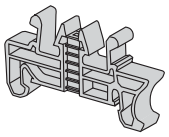
Busbar 50 A
Y 307 016 01 non-insulated, 500 mm/19.68 in.



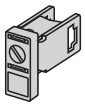
Busbar 50 A
Y 307 016 11 non-insulated, 500 mm/19.68 in.



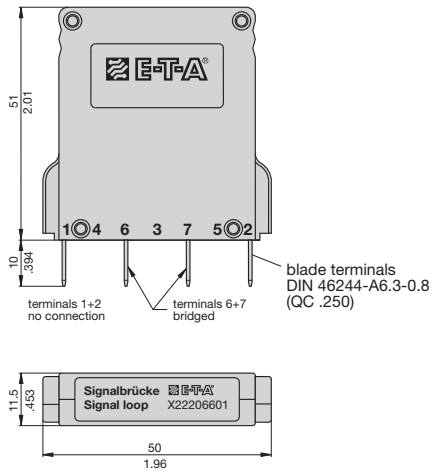
End bracket
X 222 004 01



Screw terminal for busbar
X 211 156 01 non insulated



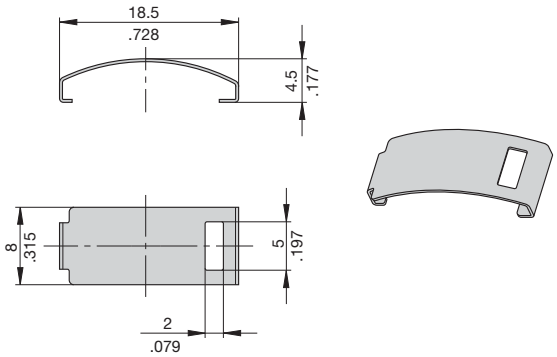
Jumper
X 222 066 01



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

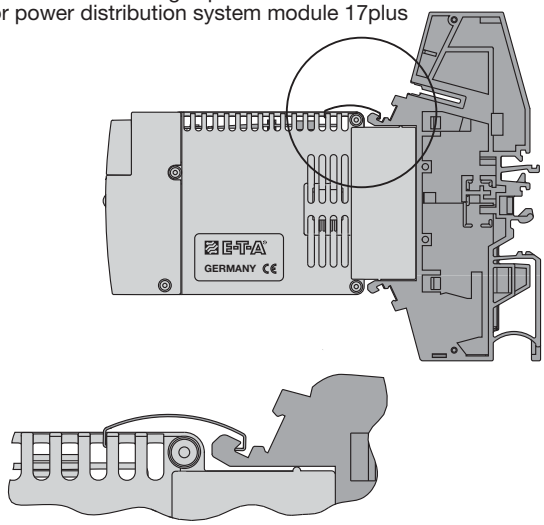
Accessories for ESS20-1..

Retaining clip Y 307 754 01

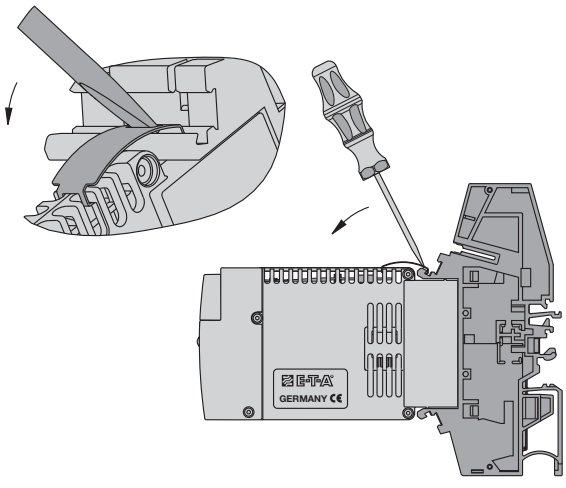


Accessories for ESS20-1..

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



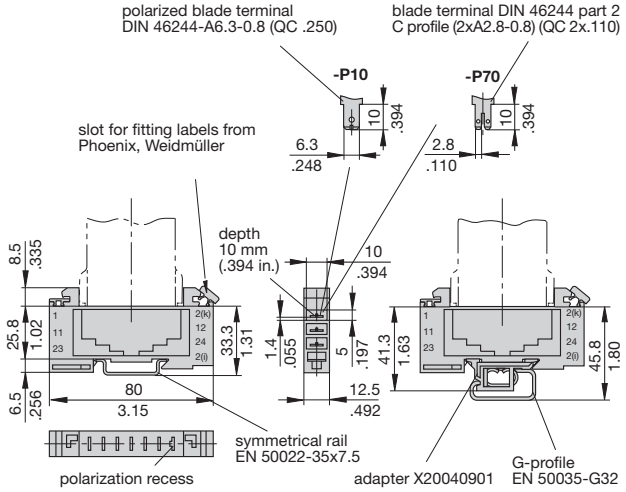
Removal of retaining clip Y 307 754 01



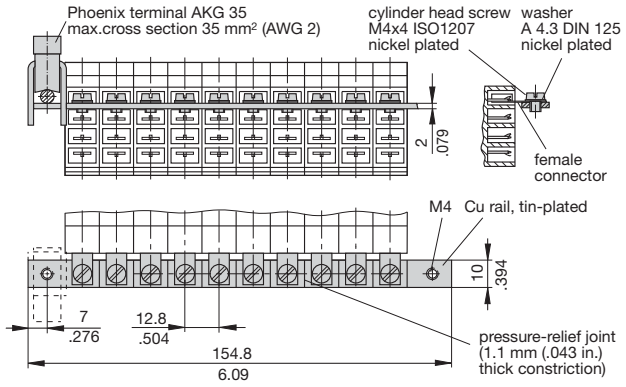
5

Accessories for ESS20-1..

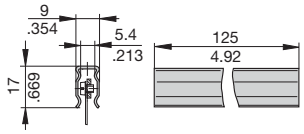
Single mounting sockets (with adapter)
(up to 16 A max. load)
17-P10-Si **17-P10-Si-20025**
17-P70-Si **17-P70-Si-20025**



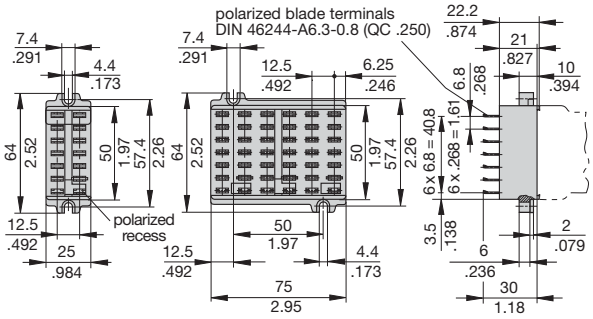
Bus bar (10-way) (supplied as a complete package)
for type 17 socket
(for max. 100 A continuous load),
more positions available on request
X 211 157 01 with terminal
X 211 157 02 without terminal



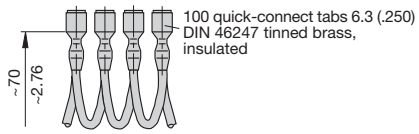
Insulating sleeving for bus bar (10-way)
Y 303 824 01



2-way mounting socket **6-way mounting socket**
23-P10-Si **63-P10-Si**
(retaining clip Y 300 581 03 available on request)



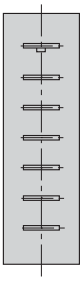
Connector bus links -P10
X 210 588 01/ 1.5 mm², (AWG 16), brown (up to 13 A max. load)
X 210 588 02/ 2.5 mm², (AWG 14), black (up to 20 A max. load)
X 210 588 03/ 2.5 mm², (AWG 14), red (up to 20 A max. load)
X 210 588 04/ 2.5 mm², (AWG 14), blue (up to 20 A max. load)



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]



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