

## Description

Electronic circuit breaker type ESS20-0.. is designed to ensure **selective** disconnection of individual loads in systems which are powered by a DC 24 V switch-mode power supply.

DC 24 V 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. As well as an unidentified failure this also means stoppage of the whole system.

Through **selective** disconnection the ESS20-0.. responds much faster to overload or short circuit conditions than the switch-mode power supply. This is achieved by a combination of active current limitation and well-proven circuit breaker technology including physical isolation. The ESS20-0.. limits the highest possible current to 1.8 or 1.5 times the selected rated current of the circuit breaker. Thus it is possible to switch on capacitive loads of up to 20,000 µF lamp loads, 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 ESS20-0.. can be selected in fixed values from 0.5 A...10 A and in adjustable variants 1 A/2 A or 3 A/6 A. Failure and status indication are provided by a bicolour LED and an integral signal contact.

The ESS20-0.. features a width of only 12.5 mm and can be plugged into the E-T-A power distribution socket Module 17plus and SVS02 (for ESS20-003) ensuring ease of installation and saving space in control cabinets.

## Features

- Selective load protection with physical isolation in the event of a fault.
- All types of loads can be connected (small DC motors etc. on request).
- Active current limitation (1.8 or 1.5 times rated current  $I_N = 8$  A or 10 A) for safe connection of capacitive loads up to 20,000 µF and on overload/short circuit.
- Electronic trip characteristic.
- 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).
- Clear status and failure indication.
- Width per unit only 12.5 mm.
- Plug-in mounting utilising power distribution system Module 17plus and SVS02 (for ESS20-003).

## 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.**



## Technical data ( $T_{\text{ambient}} = 25^\circ\text{C}$ , operating voltage $U_B = \text{DC } 24 \text{ V}$ )

### 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
Power consumption	typically 13 mA
Trip current (bimetal)	typically 0,3 A (only in the event of a failure, before physical isolation)
Status indication by means of	<b>bicolour LED:</b> GREEN: unit is ON, power-MOSFET is switched on ORANGE: in the event of overload or short circuit until physical isolation LED not lighted: push button in OFF position <b>potential-free signal contact</b> (change-over contact) <b>OFF-position of push button</b>

Reverse polarity protection of $U_B$	internal bimetal (fail-safe element) trips, push button moves into OFF position
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### Load circuit

Load output	Power-MOSFET switching output (high side switch)
Max. data of load with side-by-side mounting	see table 1
Voltage drop at $I_N$	see table 1
Overload disconnection	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
Trip time	see time/current characteristics
for physical isolation	typically 5 sec at $I_{\text{load}} > 1.1 \times I_N$
for electronic disconnection	typically 5 sec...100 ms at $I_{\text{load}} > 1.8 \times I_N$ or $1.5 \times I_N$
Temperature disconnection	internal temperature monitoring with physical isolation
Low voltage monitoring load output	ON at $U_B > 16 \text{ V}$ OFF at $U_B < 8 \text{ V}$
Starting delay $t_{\text{start}}$	typically 0.3 sec after every switch-on and after applying $U_B$
Disconnection of load circuit	single pole (switch contact) - by push-push actuation of the blue push button - upon electronic fault disconnection (overload, short circuit) - with reverse polarity
Free-wheeling circuit	external free-wheeling diode recommended with inductive load
Several load outputs must not be connected in parallel.	

## Technical data (T<sub>ambient</sub> = 25°C, operating voltage U<sub>B</sub> = DC 24 V)

### Fault indication, signal output

Fault indications	potential-free auxiliary contact change-over (SC-SO / SC-SI) simultaneously with physical isolation max. DC 30 V / 0.5 A, min. 10 V / 10 mA
Signal output ESS20-001 (single signalisation N/O)	blue push button in ON position: signal contact SC-SI is closed blue push button in OFF position: signal contact SC-SI is open
Signal output ESS20-003 (group signalisation N/C)	blue push button in ON position: signal contact SC-SO is closed (SC-SI is open) blue push button in OFF position: signal contact SC-SO is open (SC-SI is closed)
Visual indication	LED lighted in ORANGE (until physical isolation)

### General data

Backup fuse for ESS20-0..	not required because of the integral redundant fail-safe element (thermal E-T-A circuit breaker) push button in OFF position when fail-safe element has tripped.
Blade terminals	6.3 mm to DIN 46244-A6.3-0.8
Housing material	plastics material
Mounting of housing	plug-in mounting utilising power distribution system Module 17plus or SVS02
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: IP30 DIN 40050 terminals: IP00 DIN 40050
EMC (EMC directive, CE logo)	emission: EN 50081-1 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 (see dimensions)	operating area: test voltage AC 1000 V installation area: test voltage AC 500 V load circuit-signal contact: test voltage AC 500 V
Insulation resistance (OFF condition)	>100 MΩ (DC 500 V) [LINE (+) – LOAD (+)]
Approvals	UL 1077
Dimensions (W x H x D)	12.5 x 105 x 60 mm
Mass	approx. 65 g

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

current rating I <sub>N</sub>	typically voltage drop U <sub>ON</sub> at I <sub>N</sub>	active current limitation (typically)	max. load current at 100 % ON duty	
			T <sub>U</sub> = 40 °C	T <sub>U</sub> = 50 °C
0.5 A	100 mV	1.8 x I <sub>N</sub>	0.5 A	0.5 A
1 A	140 mV	1.8 x I <sub>N</sub>	1 A	1 A
2 A	180 mV	1.8 x I <sub>N</sub>	2 A	2 A
3 A	140 mV	1.8 x I <sub>N</sub>	3 A	3 A
4 A	190 mV	1.8 x I <sub>N</sub>	4 A	4 A
6 A	280 mV	1.8 x I <sub>N</sub>	6 A	5 A
8 A	220 mV	1.5 x I <sub>N</sub>	8 A	7 A
10 A	280 mV	1.5 x I <sub>N</sub>	10 A	9 A
1 A/2 A	140 mV/280 mV	1.8 x I <sub>N</sub>	1 A/2 A	1 A/2 A
3 A/6 A	140 mV/280 mV	1.8 x I <sub>N</sub>	3 A/6 A	3 A/5 A

Attention: when mounted side-by-side without convection the ESS20-0.. should not carry more than 80 % of its rated load with 100 % ON duty because of the integral thermal circuit breaker.

## Ordering information

### Type No.

ESS20 Electronic Circuit Breaker with current limitation (e.g. typically 1.8 times rated current or 1.5 x I<sub>N</sub>, see table 1)

### Version

0 with physical isolation in the event of a failure

### Control input

0 without control input

### Signal output

1 signal contact N/O (single signalisation)

2 signal contact N/C (single signalisation)

3 signal contact changeover (group signalisation)

### 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

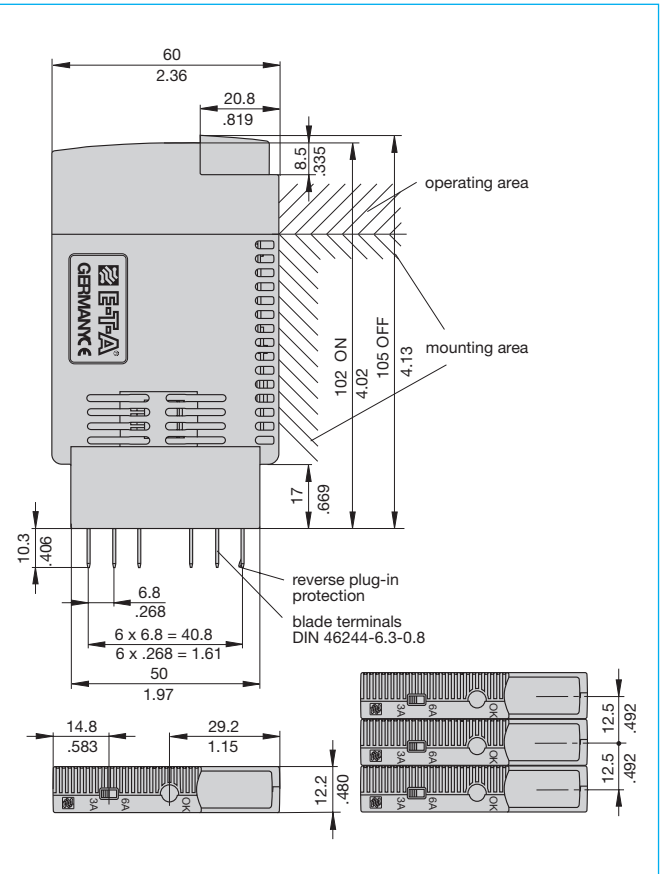
1 A/2 A (selectable)

3 A/6 A (selectable)

ESS20 - 0 0 3 - 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.**

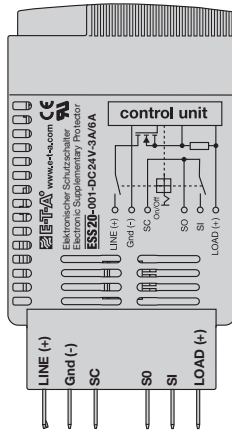
## Dimensions



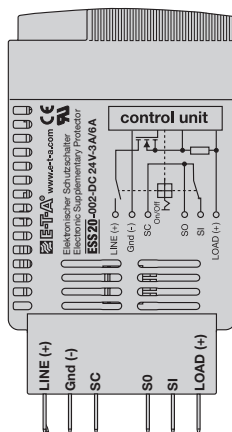
This is a metric design and millimeter dimensions take precedence (mm / inch)

## Terminal wiring diagrams (e. g. adjustable 3 A/6 A)

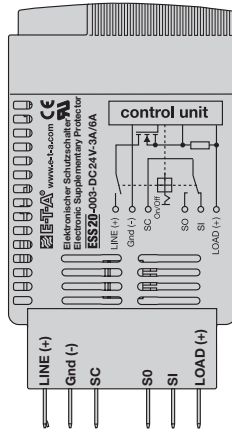
ESS20-001-...



ESS20-002-...

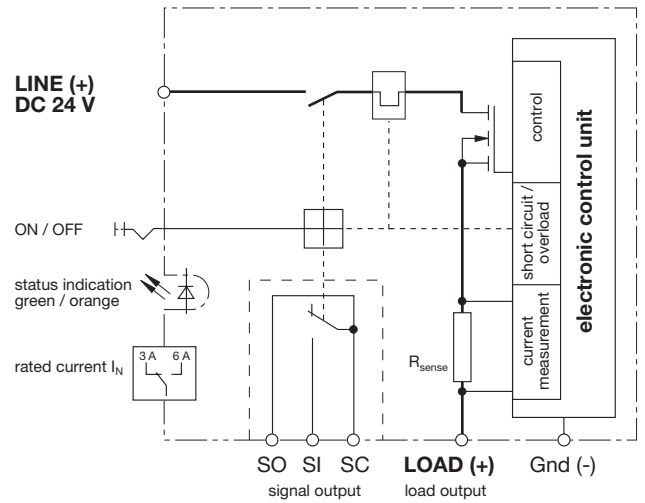


ESS20-003- ...

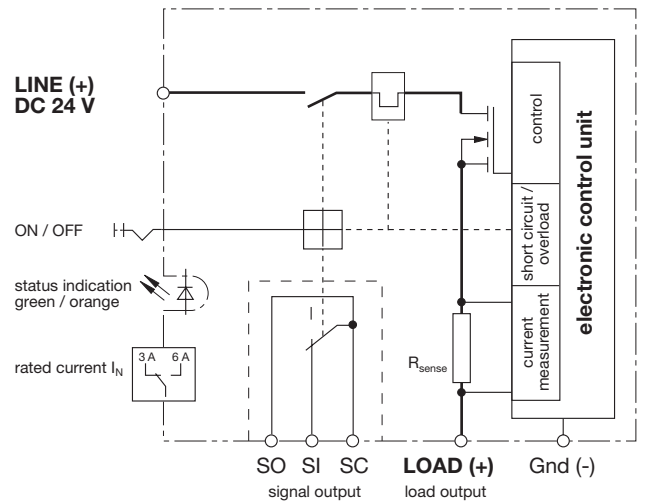


## Basic circuit diagrams (e. g. adjustable 3 A/6 A)

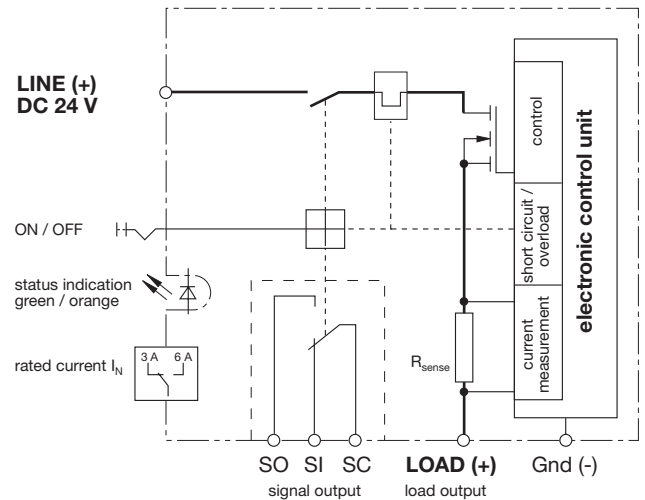
ESS20-001-... (single signalisation N/O)



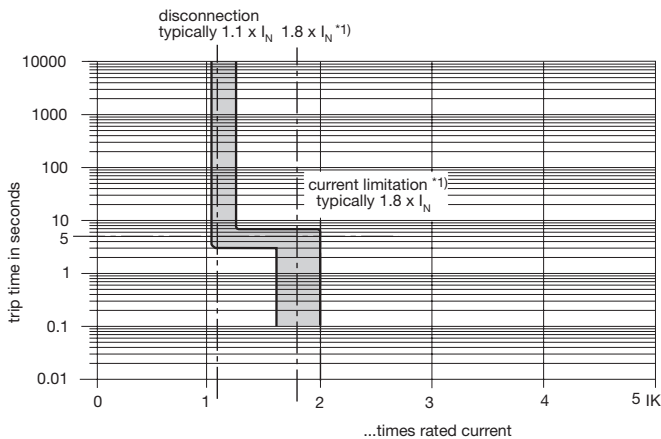
ESS20-002-... (single signalisation N/C)



ESS20-003- ... (group signalisation with change over)



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



- The trip time is typically 5 s in the range between 1.1 and 1.8 x  $I_N$  \*1).
- Electronic current limitation starts 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 until disconnection will not exceed 1.8 x  $I_N$  \*1) times the current rating. Trip time is between 100 ms (short circuit current  $I_K$ ) and 5 sec (at overload with high line attenuation).
- Without the current limitation activated at typically 1.8 x  $I_N$  \*1) a considerably higher overload current would flow in the event of an overload or short circuit.
- After detection of an overload or short circuit the LED changes colour from GREEN to ORANGE. The LED will no longer be lighted after the circuit breaker has tripped.
- Resetting the circuit breaker is not possible before the integral bimetal has cooled down (approx. 10 sec).

\*1) current limitation typically 1.8 x  $I_N$  times rated current at  $I_N = 0.5\text{ A} \dots 6\text{ A}$   
 current limitation typically 1.5 x  $I_N$  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 <sup>2</sup> ) / 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 x $I_N = 1.05 \dots 1.35$ x $I_N$ ) have been taken into account.		
ESS20-selected rating $I_N$ (in A) →	<b>3</b>	<b>6</b>	→ <b>ESS20 trips after 3...5 s</b>
e. g. trip current $I_{ab} = 1.25$ x $I_N$ (in A) →	3.75	7.5	
$R_{max}$ in Ohm = $(U_B / I_{ab}) - 0.050$ →	<b>5.07</b>	<b>2.51</b>	

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

Cable cross section A in mm <sup>2</sup> →	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 mm<sup>2</sup> and 3 A → **214 m**
- Example 2:** max. length at 1.5 mm<sup>2</sup> and 6 A → **106 m**
- Example 3:** mixed wiring: R1 = 40 m in 1.5 mm<sup>2</sup> and R2 = 5 m in 0.25 mm<sup>2</sup>:  
 (Control cabinet – sensor/actuator level) R1 = 0.95 Ohm, R2 = 0.71 Ohm **Total (R1 + R2) = 1.66 Ohm**

## Accessories for ESS20-0..

### Description

Module 17plus is a power distribution system for use with electronic circuit breaker ESS20-0..

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 ESS20-0.. (Gnd pin 11) is also looped through and connected to the terminals at the sides.

The integral make contact of the ESS20-001 (SC-SI) can be tapped at terminal 12 of the relevant channel (individual signalisation).

The integral make contact of the ESS20-002 (SC-SI) can be tapped at terminal 12 of the relevant channel (individual signalisation).

The ESS20-003 has an integral signal contact (change-over contact). The contact SC-SO is used for group fault signalisation. For this purpose the contacts for signalisation are connected in series in the Module 17plus and are connected to the terminal blocks via two terminals (13,14). It is possible with a test probe to contact the series connection in each module and detect possible interruptions.

All internal wirings for the ground potential and the group signal are established by the modular mounting of the individual Modules 17plus.



### 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 <sup>2</sup> (AWG 10), SD 2 (0.8x4.0)
LOAD output (2)	spring-loaded terminals for 0.25-4 mm <sup>2</sup> (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 <sup>2</sup> (AWG 14), SD 1 (0.6x3.5)
individual signal terminal (12)	spring-loaded terminal for 0.25-1.5 mm <sup>2</sup> (AWG 16), SD 0 (0.4x2.5)

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

Voltage rating  
(without ESS20-0..): AC 433 V; DC 65 V

Current rating (without ESS20-0..)	
LINE feed (1)	50 A
LOAD output (2)	25 A
Reference potential Gnd (11)	10 A
Individual signal (12)	1 A (with ESS20-0..: 0.5 A)
Group signal /(13-14)	1 A (with ESS20-0..: 0.5 A)

Internal resistance values (without ESS20-0..)	
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 ESS20-0..)  
between main circuits (without busbar): 1,500 V  
main circuit to auxiliary circuit: 1,500 V  
between auxiliary circuits: 1,500 V

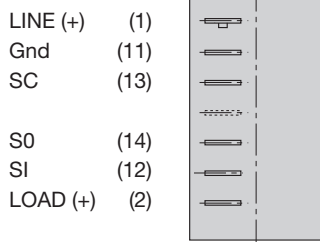
Mass: Module 17plus (centre piece) approx. 85 g  
terminal blocks (pair) approx. 30 g

### 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 ESS20-0..

#### ESS20-0.. Module 17 plus



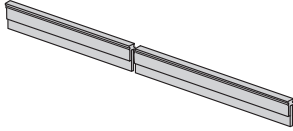




## Accessories

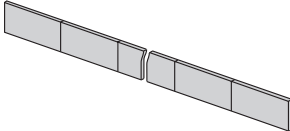
### Busbar 32 A

- 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.



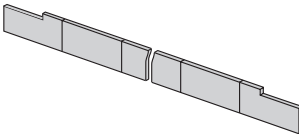
### Busbar 50 A

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

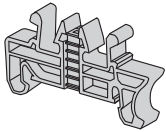


### Busbar 50 A

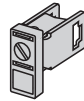
- Y 307 016 11 non-insulated, 500 mm/19.68 in.



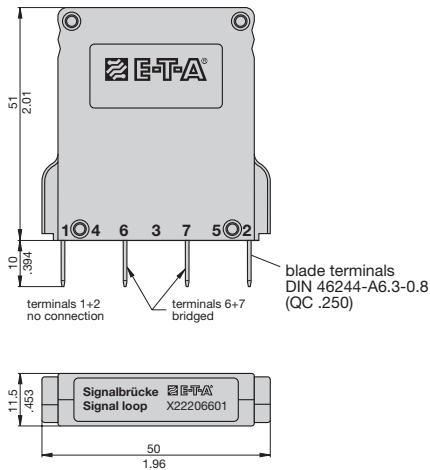
### End bracket X 222 004 01



### Screw terminal for busbar X 211 156 01 non insulated



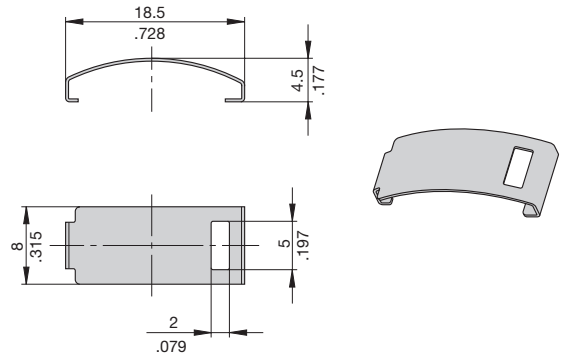
### Jumper X 222 066 01



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

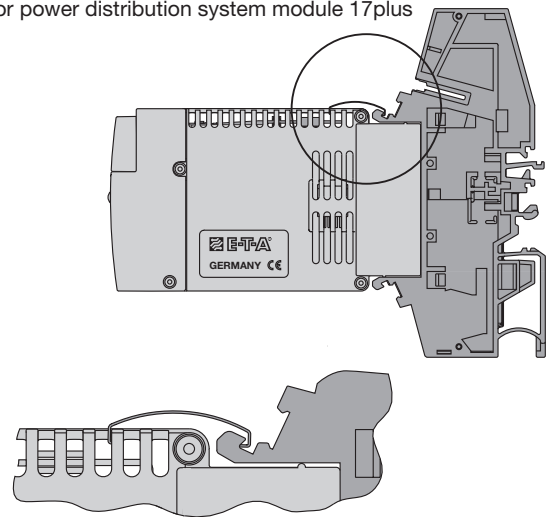
## Accessories for ESS20-0..

### Retaining clip Y 307 754 01



## Mounting of retaining clip

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



Removal of retaining clip Y 307 754 01

