

# ESB101

## Inrush Current Limiter, Inrush Current Protection

For capacitive loads, 115Vac/230Vac 16A, 16 ⅓ Hz – 440Hz, - 40°C...+70°C

### Short Specification:

- Peak- / R.M.S. current limiter
- 90-130Vac / 184-265Vac, 16A continuous
- DIN TS35mm DIN-Rail
- DIN-rail mount (universal housing)
- Springtype terminals 0,5-6mm<sup>2</sup> / 21-10AWG
- Integrated bypass relay
- Capacitive load 1.000uF bis 6.000uF
- Intergrated temperature protection
- IP20 UL94V-0 housing DIN43880 for DIN/VDE0603 cutout box

The ESB is an inrush peak current limiter for high loads in LED-applications, complex automation systems and in the machine building. The ESB101 offers high recommended and interference free operation of capacitive load. It is simple to integrate into existing equipment. The ESB101 is self-powering and does not require an external power supply.

## 16 ⅓ Hz – 440Hz

**No simple NTC-solution! It allows to reduce cabling sections and to install fast circuit breakers. 100% protection from tripping pre-installed circuit breakers or burning multiplexer relay**



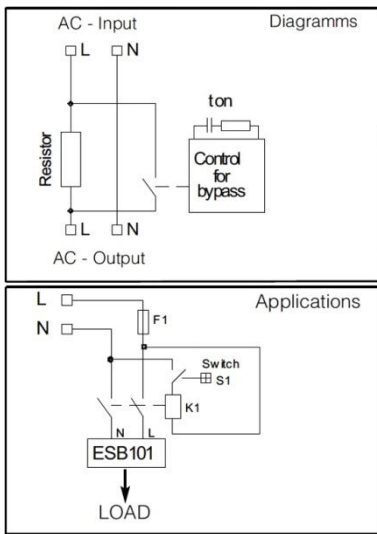
In accordance with IEC60950-1

## Technical Table

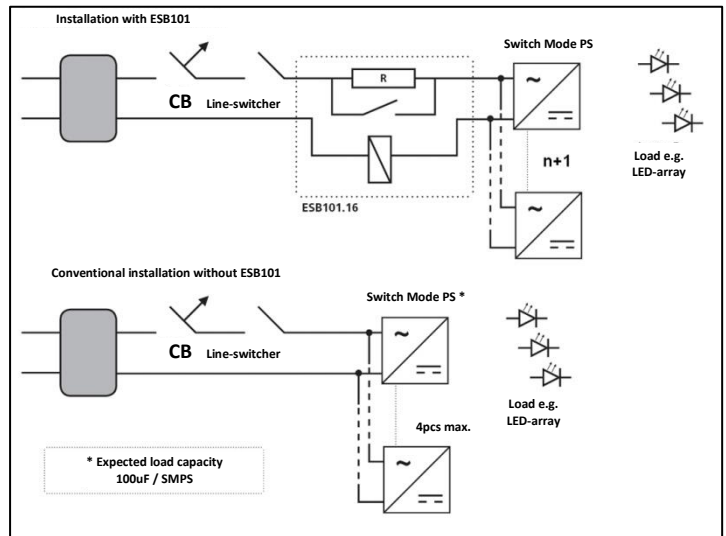
Model	ESB101.05	ESB101.16	ESB101.LED.230Vac
Article Number	AE-17045 3041081009	AE-17003 3041081001	AE-17013 3041081005
Peak Current Limiting $\pm 6\%$	5A	16A	48A
Allowed Capacitive Load (max.)	1.000 $\mu$ F	1.500 $\mu$ F	6.000 $\mu$ F
Limiting Time ( $T_{on}$ Power On)	900( $\pm 50$ )ms	300( $\pm 50$ )ms	300( $\pm 50$ )ms
Limiting Interval [ $T_{interval}$ for $A_{Ccont.}$ ]	$\geq 900$ ms	$\geq 900$ ms	$\geq 900$ ms
Smallest advisable Circuit Breaker at 30°C	B2 B5	B6 B10	B16
AC Input Range	184-265Vac		
AC Continuous Range	230Vac		
Line Frequency	16 2/3 Hz – 440Hz		
Switch-On Voltage	144Vac		
AC Lower Margin	52Vac (AC dump / drop)		
AC Continuous Current	16A continuous		
Power Supply	item is self-powering		
Current Consumption	19mA constant at continuous operation		
Limiting Cycles	3 cycles/minute		
Internal Protection	Thermal fuse protects overload & fire		
Cooling	Natural convection		
Operation Temp.	Ambient temperature -40°C...+70°C continuous / +75°C short time		
Storage Temp.	-40°C...+85°C for 2 years		
EMI	EN55022 class B		
EMS	EN61000-6-2,3		
Safety Norms	IEC/EN60950-1 in accordance with cUL60950		
Safety Class II	VDE0805, VDE0100/ÖVE8001		
ROHS conformity	ROHS Directive 2011/65/EU		
REACH conformity	REACH Directive 1907/2006		
MTBF Calculation	300.000h (IEC/EN61709, Siemens SN29500)		
MTTF Calculation	384.000h (+30°C) (IEC/EN61709, Siemens SN29500)		
Humidity	95% (+25°C) not condensing		
Pollution Degree	2 (IEC/EN50178)		
Environmental	thermal environment 3K3, mechanics 3M4 (IEC/EN60721)		
Altitude max.	4000m (13123 ft.) above sea level		
Dimensions (WxHxD)	(2TE)36,5x110x62mm		
Hausing Parameters	UL94V-0 ABS IP20 DIN/EN43880 universal housing for DIN/VDE0603 cutout box and for wall mount		
DIN-Rail	DIN-Rail TS35mm DIN/EN60715 (TS35/7,5 und TS35/15)		
Weight	121g / 0,27 lb		
Connections	Spring-type terminal with cable protection 0,5...6mm <sup>2</sup> 21...10AWG according with IEC/EN60664-1, IEC/EN61984		

### General Description:

The CAMTEC ESB101-series are the 2nd generation and cost effective inrush current limiters. The limiters are made for 115/230Vac 16A networks. The line frequency range is 16 2/3 Hz – 440Hz. The ESB101-Limiter shall be located between the line-switcher/contactator and the load (p.3/Fig.1). The ESB-models are designed for capacitive loads. In the moment of switching-on the system the inrush current of the installed load will be limited for the defined time  $T_{on}$  (p.4/Fig.5). Independent from the previous inrush level; the current limiting is always strict. After  $T_{on}$  elapses the current limiting circuit of the ESB101 will be bypassed. Then the load is directly connected to the AC. The electrical network can be stressed with current loads as normal (e.g. motors, pumps). If an AC dump overshoots the defined time  $T_{off}$ , it will be detected by the ESB101 (p.4/Fig.6). As soon as the AC recovers the inrush will be limited, again (p.3/Fig.3 & 4). The ESB101-models provide an internal temperature control. In case of a failure the device shuts down to safely prevent from overheating or burning.



(Fig.1)



(Fig.2)

**Field Applications:**

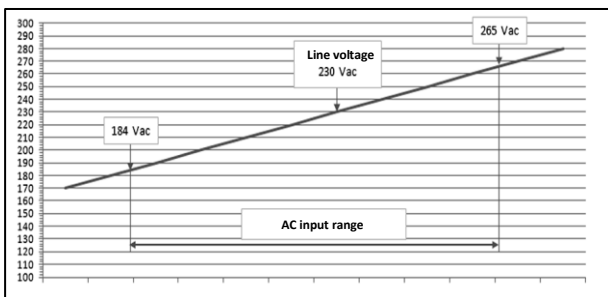
The ESB101 limiter allows connecting much more loads (e.g. LED-power supply / LED-driver) to a pre-installed circuit breaker CB (Fig.2). The ESB definitely avoids that the CB can be tripped. This occurs independent to the objective initial current. The result is that the number of A.C. branch lines and the pre-installed CB can be reduced dramatically. Installation cost exhibit a sustained decline.

Alternatively the cross section of the branch lines can be reduced when using smaller and faster responding circuit breakers. The cost saving from copper is essential. Sensitive AC networks can be fused safer (e.g. Traffic Control Systems, Street-Lighting, Parking Lots and Tunnels)

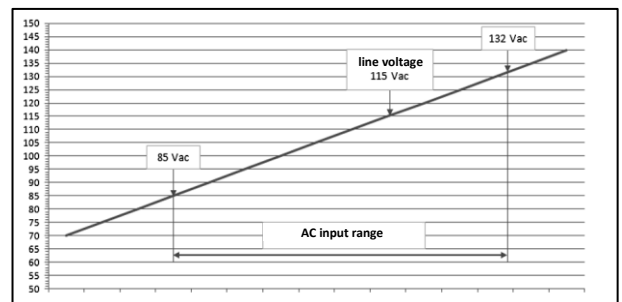
When the ESB101 is installed correctly, the neutral wire (N) is looped trough (Fig.1). The inrush protection circuit always acts to the line conductor. The load is connected with the AC in such a way that a circuit breaker or an earth-leakage-trip works within the limits of the legal rules. This fact is also applied while the limiting circuit acts.

**Special Models ESB101.LED with 115Vac or 230Vac**

Compared to all other ESB101-models the LED-types are the universal inrush current limiters. The concept design is made to construct optimized A.C. networks in the building automation and in the lighting sector. Tripping the installed circuit breaker will be effectively prevented. The inrush limiting time is adjusted to the values of a typical LED power supply or LED-drivers. The connectable load capacity is such as high, that even in the extremes cases it is rather impossible to exceed it in a 16A network. Installed contractors will be discharged and their lifetimes will considerable increase. As well, the ESB101 LED-models are made to support the conventional lighting technology.



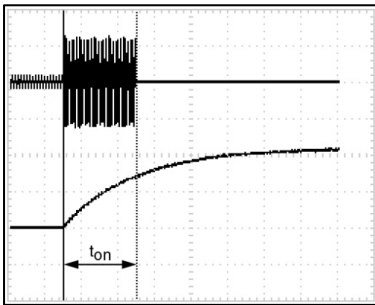
(Fig.3 operating range 230Vac)



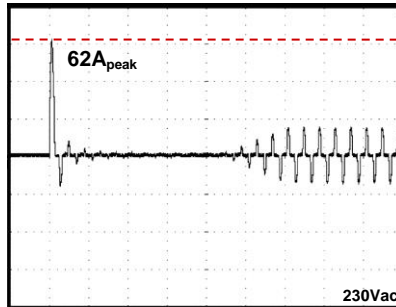
(Fig.4 operating range 115Vac)

**Design-In of the ESB101 into A.C. Networks**

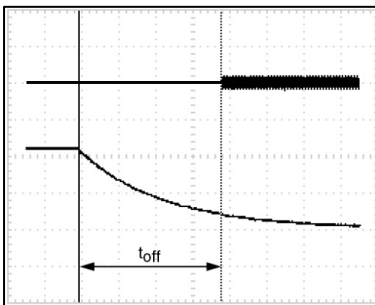
The ESB101 models are the precise inrush current limiter with an overall tolerance of ±6% of the face value. For the dimension of an upstream connected circuit breaker the R.M.S is the key value of the inrush current, not the peak current. The thermal trigger point will not be met, even while using an extreme fast CB. All-dominant is the magnetic trigger current. By using the empirical formula  $I_{(peak)} \times 0,707_{(factor)} = I_{(r.m.s.)}$  the tripping current can be defined fairly exact. Bear in mind that all the higher the inrush current is, all the faster the input capacitor of a number of connected switch mode power supplies will be loaded.



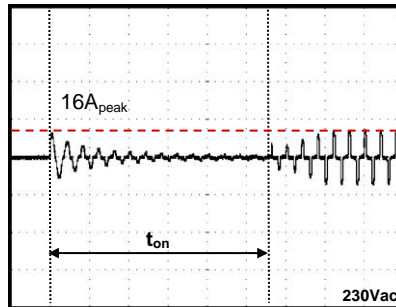
(Fig.5 limiting time T<sub>on</sub>)



(Fig.7 inrush without ESB101)



(Fig.6 AC dump detection T<sub>off</sub>)



(Fig.8 inrush with ESB101)

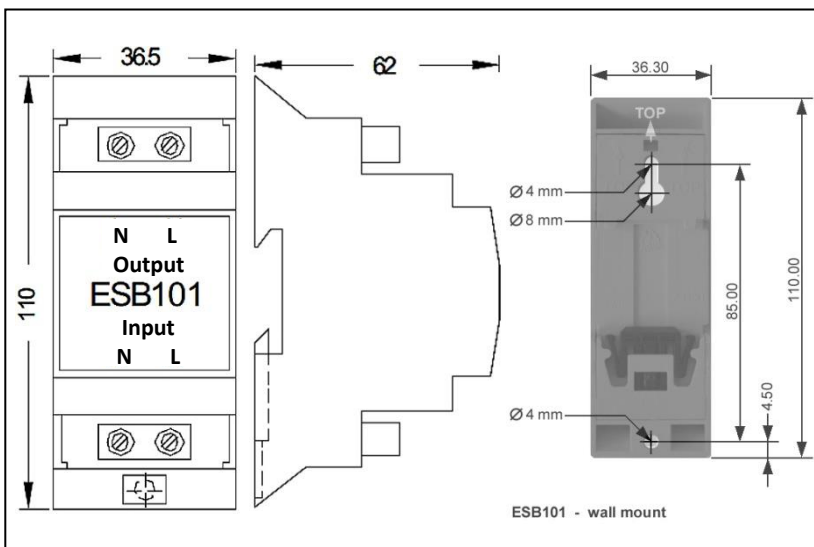
**Fig.7 and Fig.8**

Fig.7 and Fig.8 show the typical start behaviour of a NTC protected switch mode power supply. The used test item is a CAMTEC HSE10001.24T with an output of 24V/42A (1008W) on DIN-Rail.

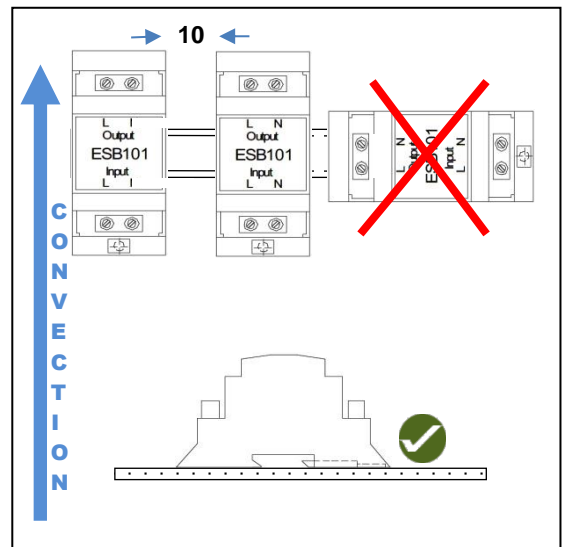
The peak current recordings show the precise limiting of the inrush from formerly 62A<sub>peak</sub> to 16A<sub>peak</sub>. The corresponding R.M.S level, that is responsible for the magnetic tripping of the CB, is mark down by factor 0,707. After the time T<sub>on</sub> elapsed it is identified that the power supply starts neatly into the continuous operation mode. Now the current is absorbed pulse-shaped from the AC. In detail the full load R.M.S. current consumption level of the HSE10001 hits 9A @ 230Vac.

**Mechanics:**

IP20 housing (ABS UL94V-0) DIN 43880 with IEC standardized ventilation slots. Save fix on DIN-Rail TS35mm DIN/EN60715. It is designed for building cabinets DIN/VDE0603. Easy to wall mount by multifunctional housing; remove the DIN-Rail latch and access the two mounting holes to screw the ESB101 to any surface.



(Fig.9 mechanical drawing)



(Fig.10 mounting restriction)