

## ESB201.LED IP40

**Inrush Current Limiter, Inrush Current Protection, active**  
**For LED Power Supplies and Electronic Ballast for the Lighting**  
**115Vac/230Vac 16A, 16 1/3 Hz – 440Hz, -20°C...+45(55)°C**

### Short Specification:

- Peak- / R.M.S. current limiter
- 90-130Vac / 184-265Vac, 16A continuous
- Flat 35mm housing IP40
- Springtype terminals 0,5-6mm<sup>2</sup> / 21-10AWG
- Integrated bypass relay
- Capacitive load 6000uF and 10.000uF
- Intergrated temperature protection
- IP40 UL94V-0 ABS-PA765 housing

The ESB is a budget-priced inrush peak current limiter for high loads in LED-applications. The ESB201 offers high recommended and interference free operation with both, the LED drivers & the electronic ballast. It is simple to integrate into existing equipment. The ESB101 is self- powering and does not require an external power supply.

### 16 1/3 Hz – 440Hz

**No simple NTC-solution! It allows to reduce cabling sections and to install fast circuit breakers in the lighting business. It offers 100% protection from tripping pre-installed circuit. It protects line switchers and contactors from wear.**

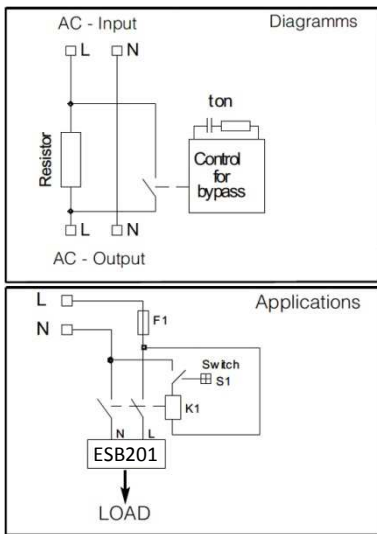


### Technical Specification

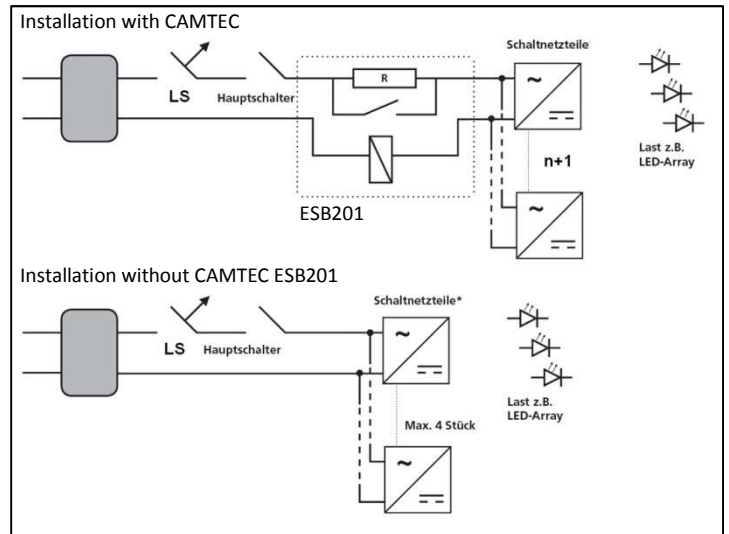
Model	ESB201.LED.230Vac	ESB201.LED.115Vac
Article Number	3041100101CA	3041100102CA
Peak Current Limiting $\pm 6\%$	48A	43A
R.M.S Current Limiting $\pm 6\%$	33,9A	30,4A
Allowed Capacitive Load (max.)	6.000uF	10.000uF
Limiting Time ( $T_{on}$ Power On)	300( $\pm 50$ )ms	300( $\pm 50$ )ms
Release Time ( $T_{off}$ Low Voltage)	550( $\pm 50$ )ms	550( $\pm 50$ )ms
Limiting Interval [ $T_{interval}$ for AC <sub>cont.</sub> ]	$\geq 900$ ms	$\geq 900$ ms
Smallest advisable Circuit Breaker at 30°C	$\geq B13A$	$\geq A16A$ $\geq B13A$ $\geq Z16A$
AC Input Range	184-265Vac	90-130Vac
AC Continuous Range	230Vac	115Vac
Line Frequency	16 ½ Hz – 440Hz	16 ½ Hz – 440Hz
Switch-On Voltage	144Vac	79Vac
AC Lower Margin	52Vac (AC dump / drop)	28Vac (AC dump / drop)
AC Continuous Current	16A continuous	
AC Peak Current	165A for 20ms / 800A for 200us (even while switching internal bypass relay)	
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 -20°C...+45°C continuous/ +55°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	
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)	260x35,4x23,5mm	
Housing	UL94V-0 IP40 ABS (PA765) plastic housing; IP40 must use the equipped grommets	
Weight	200g	
Connections	Spring-type terminal with cable protection 0,5...6mm <sup>2</sup> 21...10AWG according with IEC/EN60664-1, IEC/EN61984	
Cord grip	6...10mm integrated into the clamp covers	

### General Description:

The CAMTEC ESB201-series are cost effective inrush current limiters. The limiters are made for 115/230Vac 16A networks. The line frequency range is 16½Hz – 440Hz. The ESB201-Limiter shall be located between the line-switcher/contactator and the load (p.2/Fig.1). The ESB-models are designed for inductive and 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 ESB201 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 ESB201 (p.4/Fig.6). As soon as the AC recovers the inrush will be limited, again (p.2/Fig.3 & 4). The ESB201-models provide an internal temperature control. In case of a failure the device shuts down to safely prevent from overheating or burning.



(Fig.1)



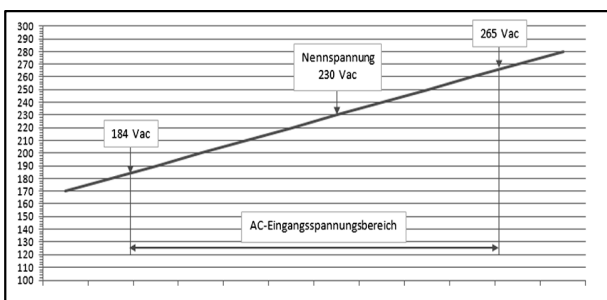
(Fig.2)

### Field Applications:

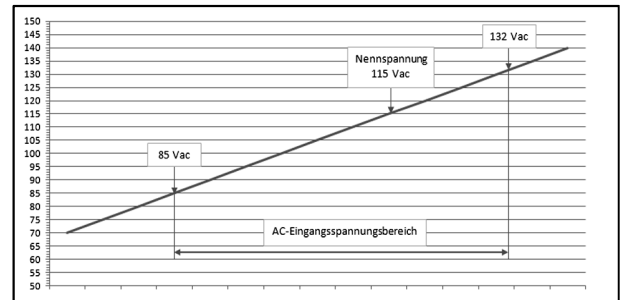
The ESB101 limiter allows connecting much more loads (e.g. LED-power supply / LED-driver) to a pre-installed circuit breaker CB (Fig.2). The ESB definitely avoids that the MCB can be tripped. This occurs independent to the objective initial current. The result is that the number of A.C. branch lines and the pre-installed MCB 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). 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. The operation of an ESB101 with an electronic ballast leads to the same repeatable results.

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.



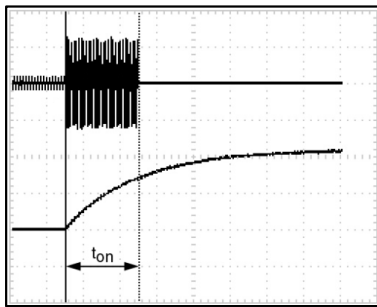
(Fig.3 operating range 230Vac)



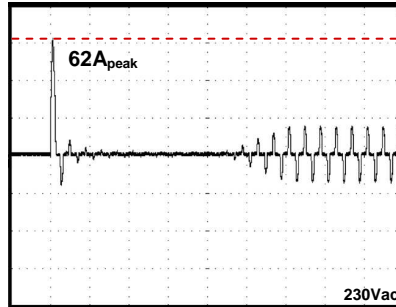
(Fig.4 operating range 115Vac)

### Design-In of the ESB201 into A.C. Networks

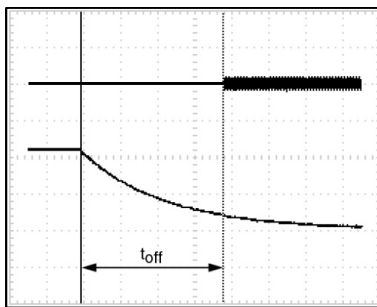
The ESB201 models are the precise inrush current limiter with an overall tolerance of  $\pm 6\%$  of the face value. For the dimension of an upstream connected circuit breaker the R.M.S is the key value of the inrush current, not the peak current. The thermal trigger point will not be met, even while using an extreme fast MCB. 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. The ESB201 are designed to achieve the best compromise between both values.



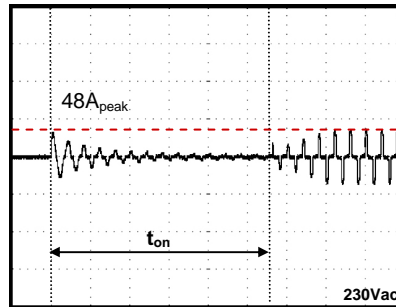
(Fig.5 limiting time  $T_{on}$ )



(Fig.7 inrush without ESB201)



(Fig.6 AC dump detection  $T_{off}$ )



(Fig.8 inrush with ESB201)

### 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  $62A_{peak}$  to  $48A_{peak}$ . 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  $T_{on}$  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:

IP40 housing (material ABS PA-765 with UL94V-0) and clamp covers contact protection. The dimensions of the ESB201 allow easy fir into lighting channels of LED-downlights. IP40 must use the equipped grommets at the cable entries.

