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Inrush current limiting for LED applications

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 0,5-6mm² / 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 ⅓ 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.





ESB201 SERIES

Inrush current limiting for LED applications



ModelESB201.LED.230VacESB201.LED.115VacArticle Number3041100101CA3041100102CAPeak Current43A43ALimiting 16%3,9A30,4ALimiting 16%010.000 uFLoad (max.)010.000 uFLoad (max.)010.000 uFLimiting Time300(±50)ms300(±50)ms(Ton Power On)550(±50)ms550(±50)msRelease Time550(±50)ms550(±50)ms(Ton Voltage)2900ms2900msLimiting Interval≥ 900ms2900ms(Tontowafor Acont.)2900ms216AAC Continous Range184-265Vac90-130VacAC Continous Range184-265Vac115VacAC Continous Range16 % Hz - 440Hz16 % Hz - 440HzSwitch-On Voltage144Vac79VacAC Continous Current165A for 20ms / 800A for 200us (even while switching internal bypass relay)AC Continous Current165A for 20ms / 800A for 200us (even while switching internal bypass relay)Power Supplyitem is self-poweringCurrent Consumption19mA constant at continuous operationLimiting Cycles19mA constant at continuous operation
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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 Temp40°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 0,56mm ² 2110AWG according with IEC/EN60664-1, IEC/EN61984
Cord grip 610mm integrated into the clamp covers

General Description:

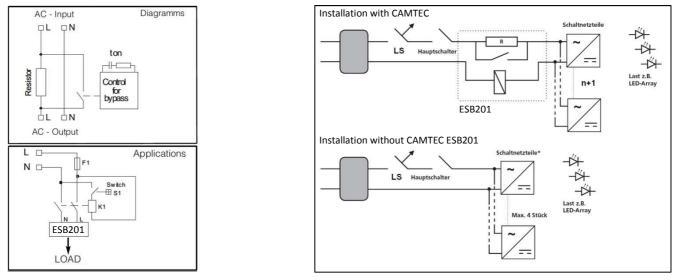
The CAMTEC ESB201-series are cost effective inrush current limiters. The limiters are made for 115/230Vac 16A networks. The line frequency range is $16\frac{1}{3}$ Hz - 440Hz. The ESB201-Limiter shall be located between the line-switcher/contactor and the load (p.2/Fig.1). The ESB-models are designed 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.



ESB201 SERIES

Inrush current limiting for LED applications







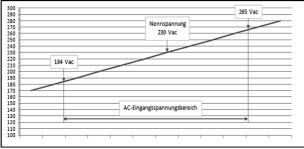
Field Applications:

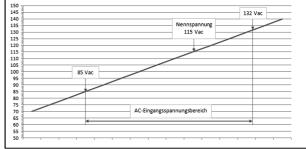
The ESB101 limiter allows connecting much more loads (e.g. LED-power supply / LED-driver) to a pre-installed circuit breaker CB (Fig.2). The ESB definitely avoids that the MCB can be tripped. This occurs independent to the objective initial current. The result is that the number of A.C. branch lines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

(Fig.2)

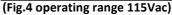
Alternatively the cross section of the branch lines can be reduced when using smaller and faster responding circuit breakers. The cost saving from copper is essential. Sensitive AC networks can be fused safer (e.g. Traffic Control Systems, Street-Lighting, Parking Lots and Tunnels). The inrush limiting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



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

The ESB201 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 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.

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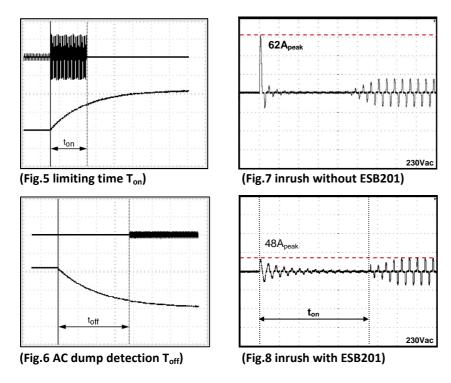


Fig.7 and Fig.8

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.

