



# ESB00351

## Inrush Current Limiter, Inrush Current Protection

For capacitive loads, 230Vac 30A, 47Hz – 63Hz, - 40°C ... +70°C

### Short Specification:

- Peak- / R.M.S. inrush current limiter
- 184-264Vac, 30A continuous
- DIN TS35mm DIN-Rail
- Spring-type terminals 16mm<sup>2</sup> / 6AWG
- Integrated bypass relay
- Capacitive load 10.000uF
- IP20 IP20 metal housing
- EN62368-1, EN55032 class B

The ESB00351 is an industrial grade inrush peak current limiter for high loads in LED-applications, complex automation systems and in the machine building. The ESB00351 offers effective and interference free operation with capacitive loads. It is simple to integrate into existing equipment. The ESB00351 is self-powering and does not require an external power supply.

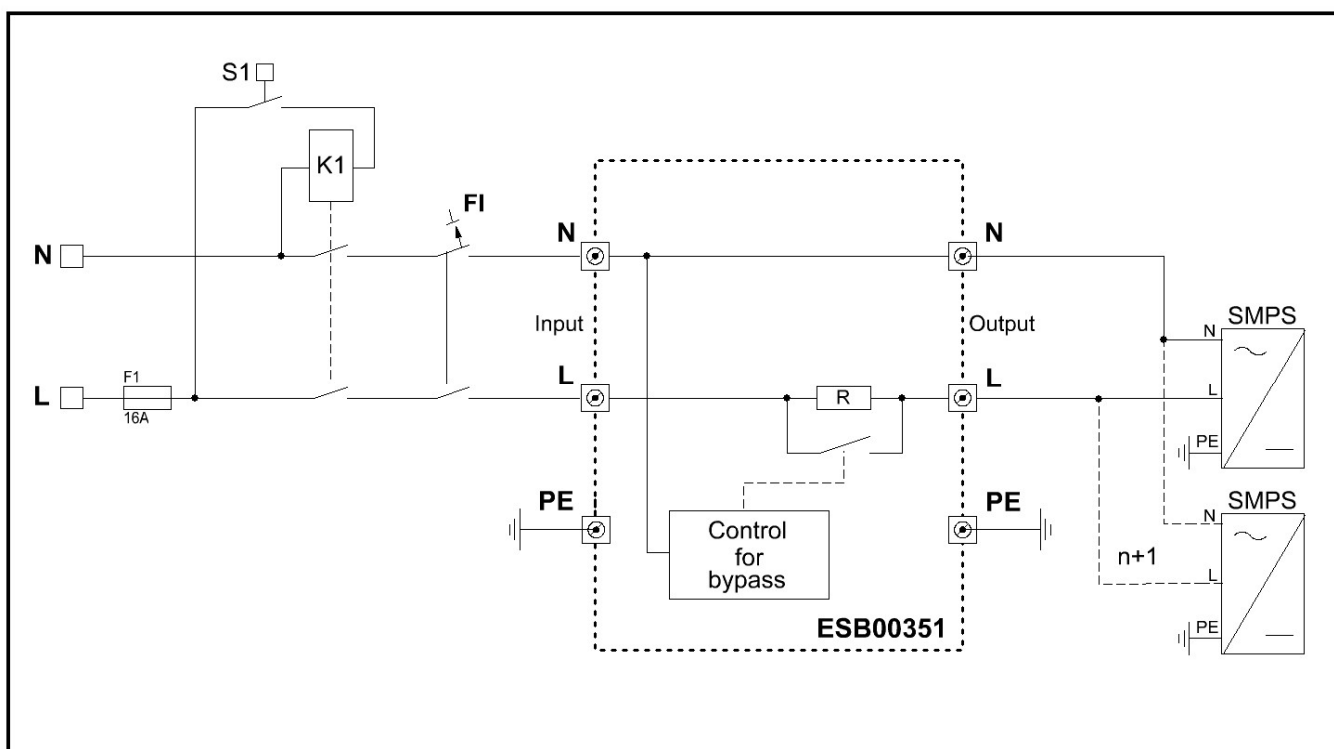
**No simple NTC-solution! It allows to reduce cabling sections and to install fast circuit breakers. 100% protection from tripping pre-installed circuit breakers or burning relay and line switch contacts.**



Technical Table	
Product Code	ESB00351(R2)
Article Number	3041047001CA
Peak Current Limiting $\pm 6\%$	35,0A
R.M.S Current Limiting $\pm 6\%$	24,8A
Maximum Allowed Capacitive Load	10.000uF
Limiting Time ( $T_{on}$ Power On)	150ms ( $\pm 50$ ms)
Release Time ( $T_{off}$ Low Voltage)	100ms ( $\pm 50$ ms)
Limiting Interval [ $T_{interval}$ for AC <sub>cont.</sub> ]	$\geq 900$ ms
Quickest Circuit breaker at 30°C	13A curve A
Largest allowed Circuit breaker	30A
AC Input Voltage Range	184-264Vac
AC Nominal Input Voltage	230Vac
Line Frequency	47Hz – 63Hz
Switch-On Voltage	144Vac
AC Current	30A continuous load current
Power Supply	No external power supply required, item is self-powering
Power consumption	typ. 6W@ 230Vac
Limiting Cycles	Between each limiting action shall be a break of 20 sec., to let the device cool down until the next limiting starts
Cooling	Natural convection
Operation Temp.	Ambient temperature -40°C ... 60°C continuous
Storage Temp.	-40°C ... +85°C for 2 years
EMI	EN55032 class B, EN61000-6-3
EMS	EN61000-6-2
Safety Norms	EN61010-1, EN61010-2-201, EN62368-1, EN60950-1, EN60204-1
Protection Class I	PE connection required
ROHS conformity	ROHS Directive 2011/65/EU
REACH conformity	REACH Directive 1907/2006
MTBF Calculation (IEC61709)	622.732h
MTTF Calculation (IEC61709)	148.512h
Humidity	95% (+25°C) not condensing
Pollution Degree	2 (IEC/EN50178)
Environmental	Thermal environment 3K3, mechanics 3M4 (IEC/EN60721)
Altitude max.	2000m (13123 ft.) above sea level
Dimensions (WxHxD)	65x124x96.6mm
DIN-Rail	DIN-Rail TS35mm DIN/EN60715
Weight	0,81kg / 1,8lbs
Connections	Spring-type terminal solid max. 0,5...16mm <sup>2</sup> 22...6AWG according with IEC/EN60664-1, IEC/EN61984. Use copper conductors only. Wire stripping length 12mm. Tightening torque per terminal block is 1.2 – 2.2 Nm / 10.6 – 19.5 lbf-in

### General Description

The CAMTEC ESB00351 is an industrial grade and cost-effective inrush current limiter. The limiter is designed for 230Vac 30A networks. The line frequency range is 47Hz – 63Hz. The ESB00351-Limiter shall be located between the line-switcher/contactor and the load (Fig.1). The ESB00351 is designed for capacitive loads (not for inductive loads like coils/transformers, not for AC-motors and not for DC-voltage application). In the moment of switching-on the system the inrush current of the installed load will be limited for the defined time  $T_{on}$  (Fig.3). Independent from the previous inrush level; the current limiting is always strict. After  $T_{on}$  elapses the current limiting circuit of the ESB00351 will be bypassed. Then the load is directly connected to the AC. If an AC dump overshoots the defined time  $T_{off}$ , it will be detected by the ESB00351 (Fig.5). As soon as the AC recovers the inrush will be limited, again (Fig.6).



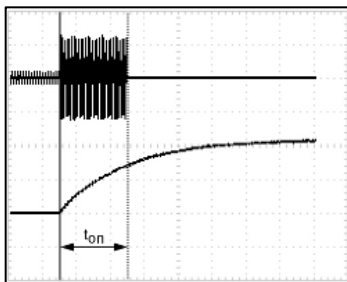
(Fig.1)

### Field Applications

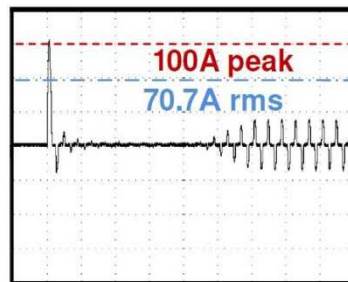
The ESB00351 limiter allows connecting much more capacitive loads (e.g. LED-power supply / LED-driver) to a pre-installed circuit breaker CB (Fig.1). The ESB avoids that the MCB will be tripped. This occurs independent to the objective initial current. The result is that the number of A.C. branch lines 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). When the ESB00351 is installed correctly, the neutral wire (N) is looped trough (Fig.1). The inrush protection circuit always acts to the line conductor. The load relates to 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. The ESB00351 is designed for capacitive loads, only. The ESB00351 cannot be used together with transformers, coils, AC-motors & drives, heaters, ohmic load, or with DC-voltage at all.

### Design-In of the ESB00351 into A/C networks

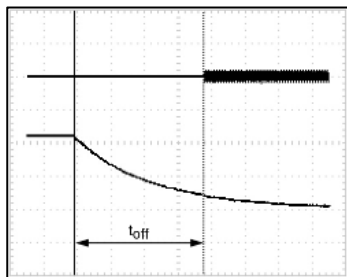
The ESB00351 is an industrial grade precision inrush current limiter with an overall tolerance of  $\pm 6\%$  of the face value. For the dimension of an upstream connected circuit breaker the R.M.S is the key value of the inrush current, not the peak current. The thermal trigger point will not be met, even while using an extreme fast CB. All-dominant is the magnetic trigger current. By using the empirical formula  $I_{(peak)} \times 0,707(\text{factor}) = I_{(r.m.s.)}$  the tripping current can be defined exact. Bear in mind that all the higher the inrush current is, all the faster the input capacitor of several connected switch mode power supplies will be loaded. The technical table on page 2 shows the R.M.S value the ESB00351.



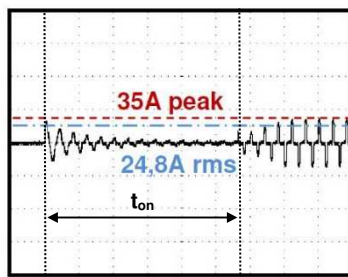
(Fig.3 limiting time  $T_{on}$ )



(Fig.4 inrush without ESB00351)



(Fig.5 AC dump detection  $T_{off}$ )

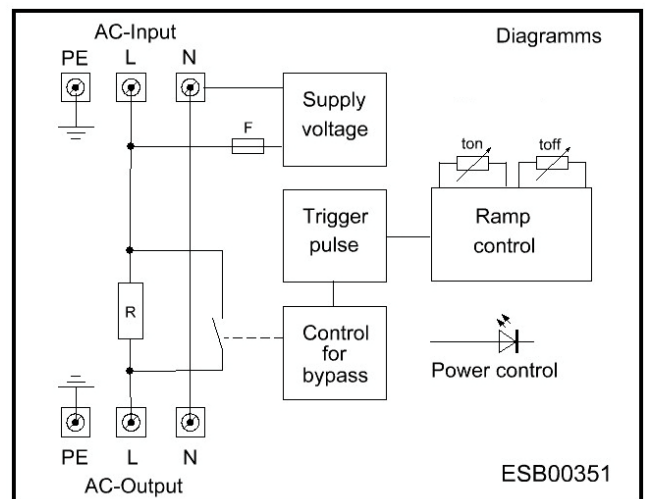
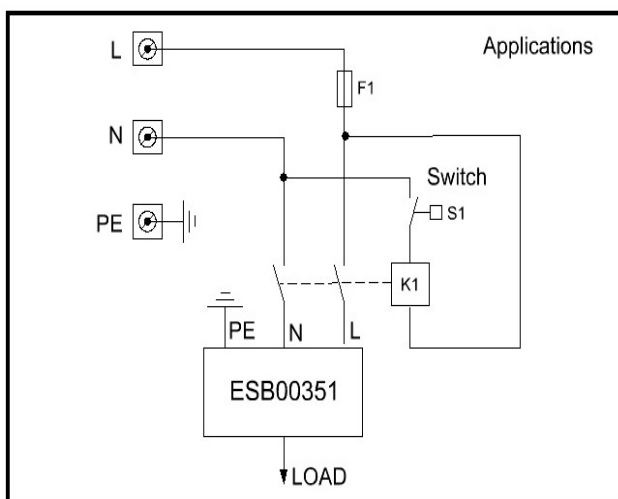


(Fig.6 inrush with ESB00351)

**Fig.4 and Fig.6**

Fig.6 and Fig.7 show the typical start behavior of a NTC protected sample switch mode power supply. The used test item is a switch mode power supply on DIN-Rail.

The peak current recordings show the precise limiting of the inrush from formerly  $100A_{peak}$  to  $35A_{peak}$ . The corresponding R.M.S level, that is responsible for the magnetic tripping of the circuit breaker (MCB), 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 supply. In detail the full load R.M.S. current consumption level of the sample power supply hits 30A @ 230Vac.

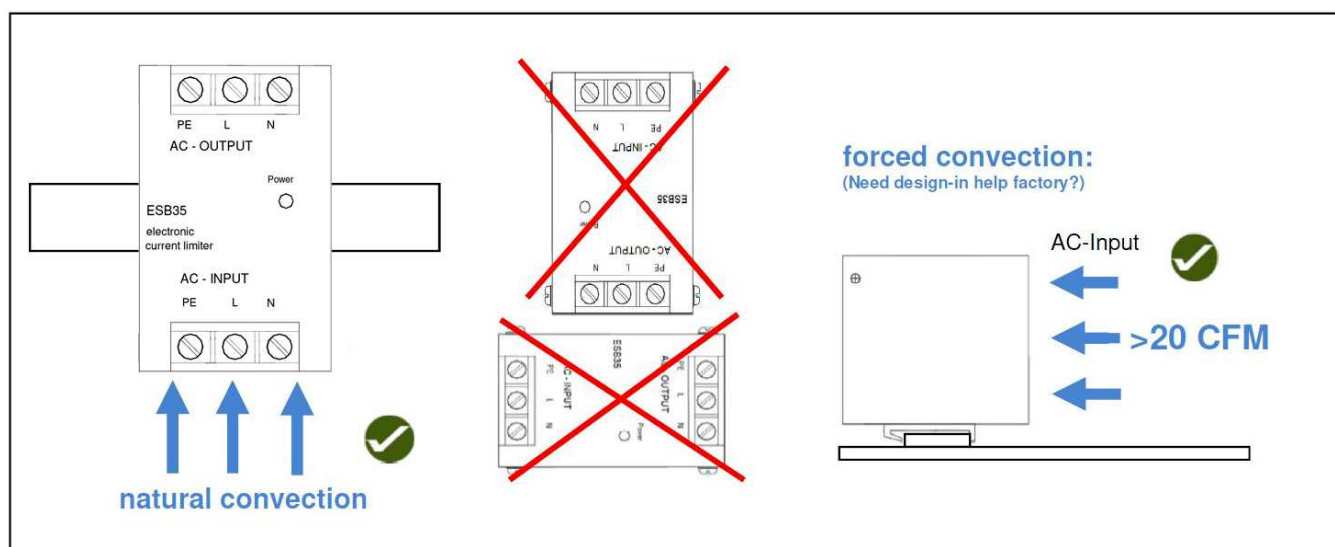
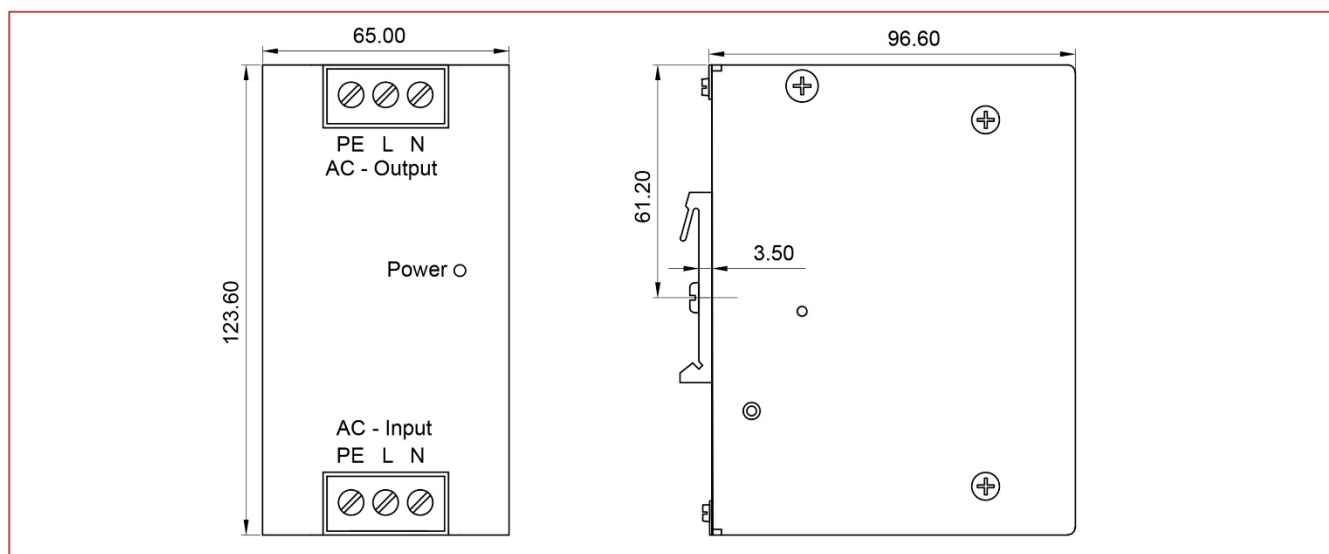


### Mechanics & Installation Instruction of the ESB00351

Stable metal/aluminium housing IP20. To allow adequate convection, a free air space of 50mm (top/bottom) and 10mm (sidewalls) is required; and for active devices 15mm space from the sidewalls. For proper air convection it is necessary to install the ESB00351.

One can use the DIN-Rail installation (equipped standard) with our patented 35mm DIN-Rail bracket according to EN60715. It is easy to mount/dismount while snapping it onto the 35mm DIN-Rail - no tools necessary.

**It is not allowed to install the ESB00351 in other mounting direction then below drawings.**



## Connections

### Clamping Yoke Connector Specifications

	Input / Output connections
Tightening torque min. – max.	1,2 – 2,2Nm (blade 1,0x5,5 DIN5264 )
Touch-safe protection acc. to DIN VDE 0470	IP20 plugged/ IP10 unplugged
Clamping range, min. – max.	0,5 – 16mm <sup>2</sup> / AWG26 – AWG6
Solid, H05(07) V-U min. – max.	0,5 – 16mm <sup>2</sup>
Stranded, H05(07) V-U min. – max.	6 – 16mm <sup>2</sup>
Flexible, H05(07) V-U min. – max.	0,5 – 16mm <sup>2</sup>
w. plastic collar ferrule, DIN 46228 pt 4 min. – max.	2,5 – 10mm <sup>2</sup>
w. wire end ferrule, DIN 46228 pt 1, min. – max.	2,5 – 10mm <sup>2</sup>
Plug gauge in accordance with EN 60999 a x b; ø	5,4 x 5,1mm; 5,3mm
Pitch (P)	10,16mm

### Wire Stripping Length (fine wired)

Nominal Cross Section	Wire End Ferrule	Stripping Length	Wire End Ferrule	Stripping Length
2,5mm <sup>2</sup>	H2,5/12	12mm	H2,5/19D BL	14mm
4,0mm <sup>2</sup>	H4,0/12	12mm	H4,0/20 GDR	14mm
6,0mm <sup>2</sup>	H6,0/20	12mm	H6,0/20 SW	14mm
10,0mm <sup>2</sup>	H10,0/12	12mm	H10,0/22 EB	15mm

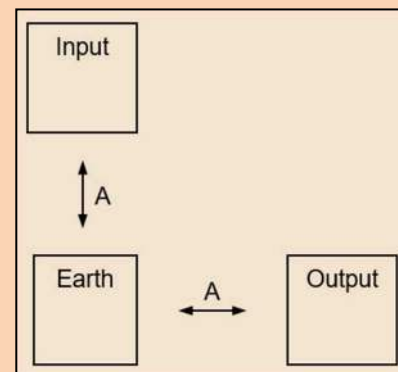
The length of ferrules is to be chosen depending on the rated voltage. The outside diameter of the plastic collar should not be larger than the pitch (P)

### Electrical Safety (Factory-Test / Field-Test Owner)

	T	A
Type Test	60s	2500Vac
Factory Test	5s	2000Vac
Field Test	2s	2000Vac
Cut-off current setting	>5mA	

Type and factory test are the manufacturer. While repeating damage can happen to the power supply unit. For the field test (owner) follow the below instruction:

- Use suitable test equipment, raising the voltage slowly
- Short circuit L1 and N
- Use only test voltages of 50/60Hz. The outputs are unearthed and therefore they have no resistance to GND/PE.
- Use only specially insulated screwdriver to trim the Ua/Ia.



**Safety regulations: Please read these instructions completely before using the equipment. Keep these instructions on to hand. The device may only be operated by trained specialist staff.**

**Installation:**

- 1) The device is designed for devices and systems that meet the standard requirements for hazardous voltages, power, and fire prevention.
- 2.) Installation and service only by trained persons. The AC power must be switched off. The work is to be labelled; accidental reconnection of the system must be prevented.
- 3.) Opening the device, its modification, loosening bolts, or operation outside the specified herein specification or in an unsuitable environment, has the immediate loss of warranty to follow. We disclaim any responsibility for any resulting damage to persons or things.
- 4.) Note: The device must be operated with an upstream circuit breaker (CB). The CB must not be larger than 30A. It is prohibited to use the unit without PE. It may be necessary upstream device has a power switch.

**Warning:**

**Non-compliance these warnings can result in fire and serious injury or death.**

1. Never operate device without PE connection.
2. Before connecting the device to the AC network, make wires free of voltage and assure accidentally switch on.
3. Allow neat and professional cabling.
4. Never open nor try to repair the unit. Inside are dangerous voltages that can cause electrical shock hazard.
5. Avoid metal pieces or other conductive material to fall into the item
6. Do not operate the device in damp or wet conditions
7. Do not operate the unit under EX-conditions

