ESB00163

DIN Rail

Made in Germany

AC Electronic Inrush / Starting Current Limiter

3Phase 4 wire system, 200/400/500Vac 16A -20°C...+70°C

Short Specification:

- 3-phase continuous monitoring of: overvoltage, low voltage, asymmetry, sequence & phase loss
- Self powering over AC-Line
- Each single phase monitored independently
- Inrush current limitation 150ms standard
- Maintenance free
- Screw terminal plugs for AWG22...AWG9
- DIN-Rail TS35 mounting
- Metal housing

The ESB00163 is a starting current limiter for complex automation systems and machinery. It provides high recommended and trouble interference free operation.
It is simple to integrate into existing equipment.
Additionally it provides a full integrated phase monitoring (over/low-voltage, sequence, loss & asymmetry). All messages are galvanic insulated.

RoHS 2002/95/EC

EuP 2002/32/EC

In accordance with IEC60950-1

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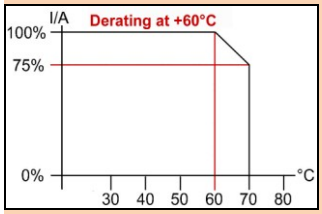
Technical data table:	
Maximum Operating Cycles	1cycle/min. (10000uF max. load)
AC-Input	200/400/500Vac (selectable)
Limiter Current to AC select	200V=8A, 400V=16A, 500V=20A
Limiter Time (response time)	Ton = 150ms standard limiting time [1])
Limiter Time (release interval)	Tout = 100ms standard fall time [1])
Asymmetry Monitoring	8-10s delayed message
Low Voltage Monitoring (tol. ±2%)	Selected AC-line -15%, delay 8..10s
Overvoltage Monitoring (tol. ±2%)	Selected AC-line +15%, delay 8..10s
Phase Loss Monitoring	30ms delayed message
Phase Sequence Monitoring	30ms delayed message
Monitoring Outputs Load (relays)	60V / 500mA each maximum
Galvanic Insulated Outputs	Yes all, see diagram page 3
Power Supply	Self powering, galvanic insulated
Creepage Distance	> 10,5mm
Safety class 1(A)	VDE0805, VDE0100
Safety	cUL(IEC)60950-1 classified
EMS	EN61000-6-2,3
EMI	EN55022 class B
Ambient Temperature	-20°C...+70°C (see derating curve)
Storage Temperature	-40°C...+85°C
MTBF at Full Load	350000h
Dimensions (HxWxD)	129,6x195x121,6mm
Weight	1100g
Terminal Connectors	22...9AWG (0,5...6,0 mm²)

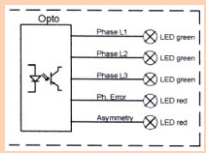


Monitoring Output Table

PIN	CTRL	o.k.	LED	Fail	LED
1,2	L1	Relais closed	ON	Relais open	OFF
3,4	L2	Relais closed	ON	Relais open	OFF
5,6	L3	Relais closed	ON	Relais open	OFF
7,8	Phase Error	Relais closed	OFF	Relais open	ON
9,10	Asymmetry	Relais closed	OFF	Relais open	ON

Line Inputs
PE = GND
L1 = Phase 1
L2 = Phase 2
L3 = Phase 3

Line Outputs
L1 = Phase 1
L2 = Phase 2
L3 = Phase 3



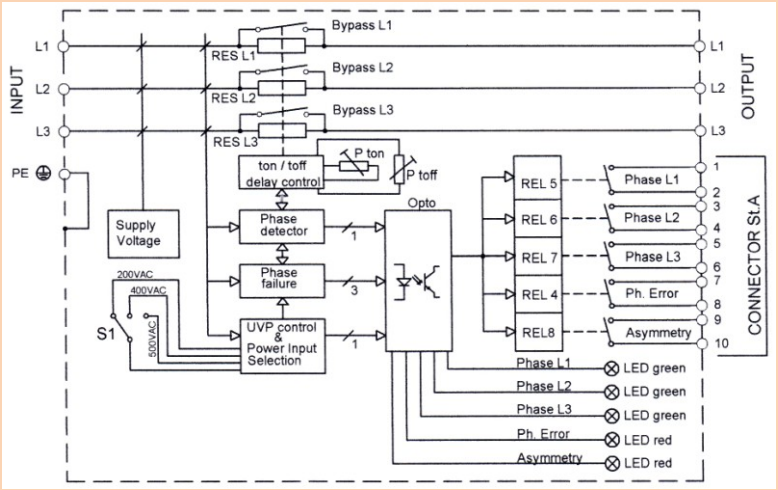
Specification:
The inrush current limiter ESB00163 is designed for optimal use in automation systems and machinery made for consistent availability. Extreme conditions occur on the AC-line while thunderstorms or mechanical damages are caused to the electricity network. When the mains supply returns indefinable stress peaks occur to the system loads as high that the automatic circuit breakers can be actuated. In decentral automation this often leads to services and high cost. Therefore the ESB is an accurate tool to reduce cost and prevent system break downs. The ESB limits all starting load peaks to 16A (inrush current) and provides continuous operation up to 16A.
Another application is to integrate the ESB into high capacitive loads like big AC-DC power supplies running in parallel operation mode. While causing stress peaks up to 300A all circuit breakers and electrical network installations will be overloaded. The ESB is a perfect and cost effective answer to prevent infringe upon rights and norms.
The ESB is a powerful tool to cut down cost of system current consumption for the operator/owner.
In accordance to the **European EuP directive 2005/32/EC**, the ESB provides accurate performance to the energy balance of an electrical system. Running as a real inrush current limiter the ESB cuts off all peak loads while starting consumer loads. Thus it can also reduce cabling section in accordance to international directives of machine cabeling.
In usage with remotable power supplies and other loads it is thereby possible to reduce energy consumption of a whole system.

Low Voltage and Overvoltage Monitoring
The AC line voltage is monitored with an intelligent built in logic. More than 85% of all AC line failures are caused by low voltage while relays, circuit breakers and asynchrony motors are exposed to thermal strain. The ESB00163 detects low voltage to shut down control units to avoid any damages caused to the equipment. The built in overvoltage monitoring protects the consumer load from disintegration by thermal overstress, too.

Phase Monitoring of Squence, Loss & Asymmetry
The ESB00163 monitors phase sequence, loss and asymmetry. While a wrong phase sequence causes a change of the driving rotation of a three phase motor it would immediately destroy a scroll-compressor. If a phase or more breaks down, a simple motor could be destroyed by the irregular load. Both operation modes are monitored by the ESB and will be reported with galvanic insulated signals. An often neglected point is that in case of a phase loss a motor acts as a generator: the asymmetry monitoring of our ESB00163 certainly notes such working conditions, too. An asymmetry can be caused by irregular load to the phases. Asymmetric load decreases the efficiency of a motor and a part of its energy will be changed into idle power. The motor itself will then be affected by increasingly thermal overstress and can be damaged. The built in monitoring of the ESB reports such conditions galvanic insulated.

[1]) ***Please ad desired limitation time to your order. If no limitation time is added, standard times will be adjusted by factory.***

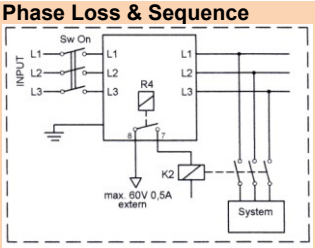
Order codes: ESB00163+mounting (T=DIN-Rail,W=Wallmount) example ESB00163T



Block Diagram and Function:
Switcher S1 will select 200, 400 and 500Vac. Low voltage and over-voltage if exceeds ±15% of the selected AC line (tolerance ± 2%) will be reported galvanic insulated with relays.
The ESB00163 is self powered by an integrated power supply that works as long as one arbitrary phase is present.
All inputs and all outputs are galvanic insulated. (see diagram Dielectric Strength).
When the AC line is switched on, the AC voltage will be distributed trough the resistors RES and the current is limted to 16A (400Vac). When the start up time Ton (150ms standard) is exceeded each single resistor will be bypassed. When a single phase breaks down (report signal delay time is 8-10s) and then recovers the effected phase will be current limted again while all present phases will stay uneffected from the limitation (bypass = normal operation mode).

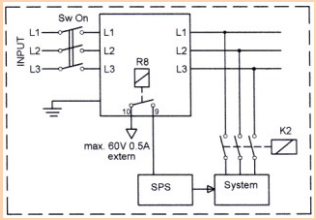
Limiter dependend on AC-line: 200Vac= 8A 400Vac=16A 500Vac=20A

Phase Loss & Sequence



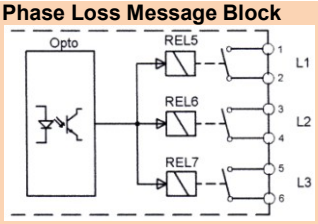
In case of phase loss relay 4 opens after a delay time of 30ms. Synchronistic the relay of the appropriate phase opens, too and its green LED extinguishes. When the phase sequence is incorrect, relay 4 opens after a delay time of 30ms. The Phase Error LED lights red. When the phase sequence is correct the LED is off and the relay 4 is closed.

Asymmetry, Over-/Low Voltage



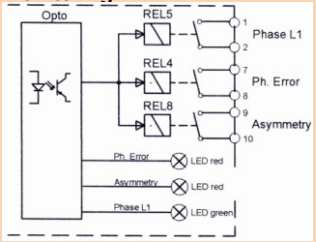
The asymmetry monitoring detects a voltage difference of the three phases to each other. This kind of measuring enables work without the N line (four wire system). If the voltage of the measured AC line drops or exceeds 15% of its nominal selected input relay 8 opens 8-10s delayed and the Asymmetry LED lights red. Measuring tolerances are ±2%.

Phase Loss Message Block



Relay 5 to 7 are galvanic insulated via opto couplers. If L1 to L3 are operating the relays are closed. If one phase drops its relay opens and the message can be used with an active signal (60V/500mA maximum load each relay).

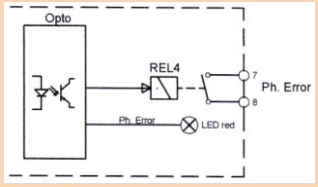
Monitoring L1



Phase Monitoring L1 O.K.:
REL4,5 closed, LED green on
Phase Error LED red off

Phase Monitoring L1 Loss:
REL4,5 open, LED green off
Phase Error LED red on
Asymmetry REL8 remain closed, LED off

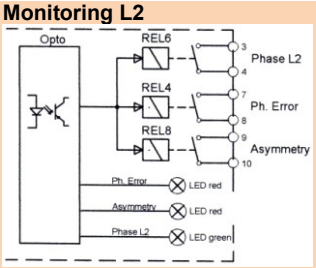
Phase Sequence Monitoring



Sequence o.k.:
L1,L2,L3 o.k. REL4 closed
Phase Error LED red off

Phase Reversal:
L1 failure
L2 o.k.
L3 failure (sum failure)
REL4 open
Phase Error LED red on

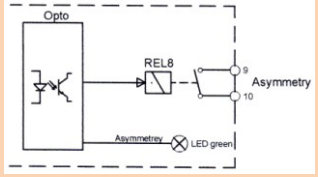
Monitoring L2



Phase Monitoring L2 O.K.:
REL4,6 closed, LED green on
Phase Error LED red off

Phase Monitoring L2 Loss:
REL4,6 open, LED green off
Phase Error LED red on
Asymmetry REL8 remain closed, LED off

Asymmetry, Over-/Low Voltage

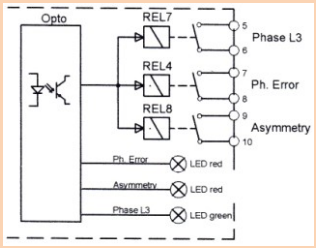


Low Voltage o.k.:
L1,L2,L3 sum o.k.
Asymmetry REL8 closed, LED off

Low Voltage failure (-15% drop):
L1 failure
L2 o.k.
L3 o.k. (but sum failure)
Asymmetry REL8 open, LED on

Overvoltage failure (+15% drop):
L1 failure
L2 o.k.
L3 o.k. (but sum failure)
Asymmetry REL8 open, LED on

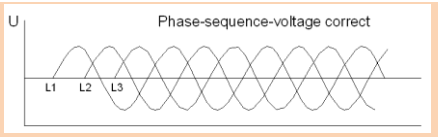
Monitoring L3



Phase Monitoring L3 O.K.:
REL4,7 closed, LED green on
Phase Error LED red off

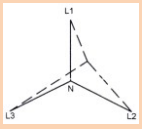
Phase Monitoring L3 Loss:
REL4,7 open, LED green off
Phase Error LED red on
Asymmetry REL8 remain closed, LED off

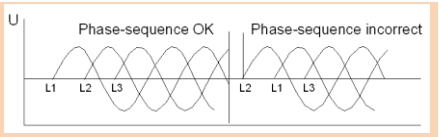
Line Diagram of Phase Monitoring



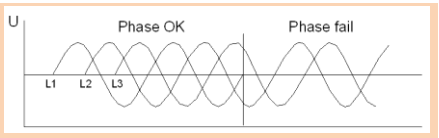
Sequence, Voltage and Asymmetry are o.k.:
No Failure:
All LEDs of L1, L2, L3 light green, all relays ore closed and all red Error LED are off

Assymetry in AC line 4 Wire Systems (no N wire): Dissimilar phase load exists, when one phase is overloaded in comparison to the other phases of the 4 Wire System.

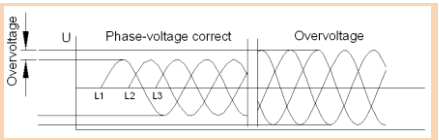




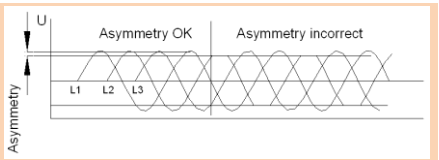
Sequence Monitoring:
Failure
Relay4 (Phase Error) opens after 30ms delay time and its error LED lights red



Phase Loss:
Failure
Relay4 (Phase Error) opens after 30ms delay time and its error LED lights red, belonging phase LEDs are off and its relays are open



Low Voltage, Overvoltage and Asymmetry:
Failure
If voltage under-runs or exceeds ±15% of the selected rated voltage, Relay8 (Asymmetry) opens after 8-10s delay time and its error LED lights red

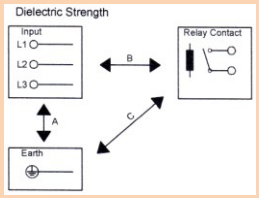


Rated Voltage	200(240)Vac	400Vac	500Vac
Low Voltage Operating Point	170Vac	340Vac	425Vac
Over Voltage Operating point	275Vac	460Vac	575Vac

Test	Time	A	B	C
Type Test	60s	2500Vac	3000Vac	500Vac
Factory Test	5s	2000Vac	2000Vac	500Vac
Field Test	2s	2000Vac	2000Vac	500Vac

Type and Factory Tests are executed by the manufacturer. Do not repeat these test in the field. To arrange the field test remain to the following rules:

a) Use approriate test equipment which apply the voltage with a slow ramp
b) For every Test L1, L2, L3 at the input and at the output must be connected, Earth must be connected
c) Use testing voltage with 50/60Hz frequency only. Note that the 3 Phase output is floating (exists no ohmic reference to Earth)



Safety Instructions:

Please read all warnings and advices carefully before installing or operating the ESB00163. Retain this operation manual always ready to hand.The ESB00163 must be installed by specialist staff only.

Installation:

1.) Before connecting the ESB00163 to the AC wire system make all wires free of voltage and assure accidently switch on
2.) Before installing the ESB00163 switch S1 to the appropriate AC input voltage. The AC voltage is low- and overvoltage monitorled ±15%
3.) Install the ESB00163 to the 35mm DIN-Rail or fix it to the device enclosure if you ordered a wallmount kit. Mind a firm seat
4.) Wire the Monitoring outputs of the message connector St.A
5.) Check again that the AC lines are free of voltage and then connect the ESB00163 inputs and Outputs to the AC line system. Assure that the phase sequence is correct. The Earth must be connected, never ever operate the ESB without the Earth wired!
6.) Switch the AC line system on and start up running the ESB00163: the control LEDs of L1, L2, L3 should light green, the red LEDs of the Phase Error and the Asymmetry should be off. All relay contacts of the monitoring outputs are closed.
7.) Note: the ESB00163 will limit the inrush current for Ton (factory standard is150ms) at for example 16A if your AC select is 400Vac. In case of any control LEDs do not light like described in step 6, switch off the AC wire system and check your cabling

Warnings:

Disregard these warnings can cause fire, electic shock, serious accident and death.

1. **Never operate the ESB00163 without Protective Earth Conductor**
2. **Before connecting the ESB00163 to the AC wire system make all wires free of voltage and assure accidently switch on**
3. **Allow neat and professionel cabeling**
4. **Never open nor try to repair the ESB00163 by yourself. Inside are dangerous voltages that can cause electric shock**
5. **Avoid metal pieces or other conductive material to fall into the ESB00163**
6. **Do not operate the ESB00163 und damp or wet conditions**
7. **The ESB00163 must not be operated under Ex conditions or in Ex-Area**

Mechanics:

Stable IP20 metal housing with VDE approved ventilation slots. Safe fit on DIN-Rail: although no tool is necessary to snap on or demount it from the TS35-Rail. A wall mount kit is optional available