

EMC filters

3-line active filter LeaXield
for leakage current compensation

Series/Type: B84233A1500R000

Date: January 2021

for leakage current compensation

Rated voltage V_R : 305/530 V AC

Rated current I_R : 50 A

Peak load side leakage current $I_{LK-LOAD}$: 1 A

U.S. Patent No. 10,069,480

Construction

- 3-line filters
- Metal case
- Book size

Features

- High leakage current compensation
- Optimization of the RCD¹⁾ compatibility
- Easy to install
- No external power supply needed
- Degree of protection: IP 20²⁾

Typical applications

- Drives
- Machine tools
- Pumps
- Compressors
- Transport systems
- Pluggable machines

Terminals

- Finger-safe terminals

Marking

Marking on component:

Manufacturer's logo, ordering code, rated voltage, rated current, rated temperature, climatic category, date code

Minimum data on packaging:

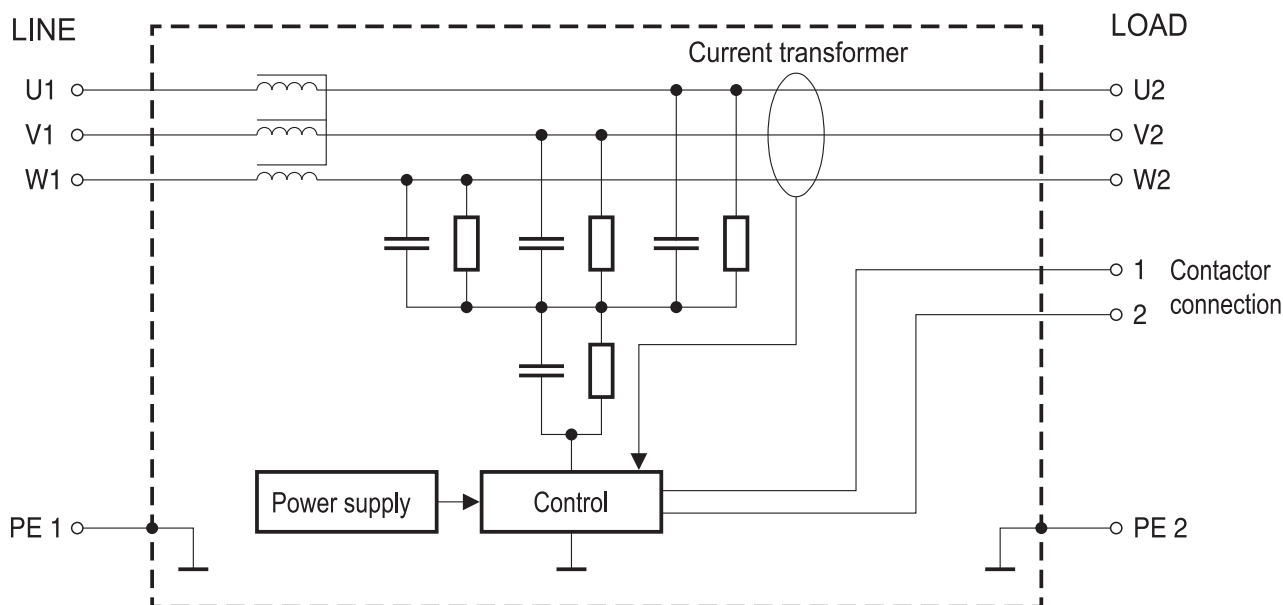
Manufacturer's logo, ordering code, quantity, date code



Schematic picture

1) RCD = Residual current device

2) According to IEC 60529

Typical circuit diagram


SSB3287-O-E

Technical data and measuring conditions

Rated voltage V_R	305/530 V AC (50 Hz)
Minimum operating voltage V_{min}	208/360 V AC (50 Hz)
Rated current I_R	Referred to 50 °C rated temperature
Test voltage V_{test}	1770 V DC, 2 s (line/line) 1500 V DC, 2 s (lines/case)
Overload capability (thermal)	1.5 · I_R for 3 min per hour or 2.5 · I_R for 30 s per hour
Peak load side leakage current $I_{LK-LOAD}$	1 A
Contactor connection:	
– Maximum voltage V_{max}	24 V DC / 250 V AC
– Maximum current I_{max}	2 A
Climatic category (IEC 60068-1)	25/100/21 (–25 °C/+100 °C/21 days damp heat test)

Characteristics and ordering code

I_R	Terminal cross section line	Contactor connection	R_{typ}	Approx. weight	Ordering code
A	mm ²	mm ²	mΩ	kg	
50	16	4	1.0	1.63	B84233A1500R000

V_R	Minimal operating current	Frequency range	Max. leakage current $I_{LK-Load}$ (peak)
AC	V		A
530	360	150 Hz ... 30 kHz	1

Functional description

LeaXield™ was developed to significantly reduce the earth leakage currents that are produced in variable-speed drive systems. It enables the operation of systems with high earth leakage currents together with the use of residual current devices (RCDs). LeaXield thus plays a valuable role in industrial applications with variable-speed drives such as those in machine tools, pumps, compressors, conveyance systems, and other pluggable devices.

LeaXield is inserted in the power line and requires no additional power supply. In order for LeaXield to be ready for operation before leakage currents flow, there must be a contactor in the power line.

The contactor must be on the load side of the LeaXield and have a minimum time delay of 2 s. If this is not possible, the built-in contactor connection on the LeaXield can be used. This ensures that the contactor is switched with a delay when the mains is switched on. Refer to the subsequent diagram for installation.

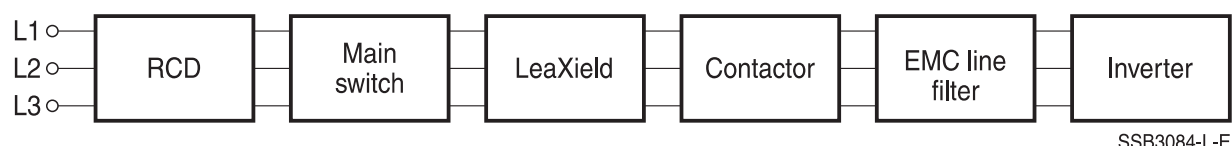
LeaXield is an active leakage current filter that does not need any additional power supply. Attenuation of more than 35 dB is possible within a frequency range of 150 Hz up to 30 kHz.

LeaXield can improve EMC performance of existing systems. For example, other EMC measures within the system can be reduced.

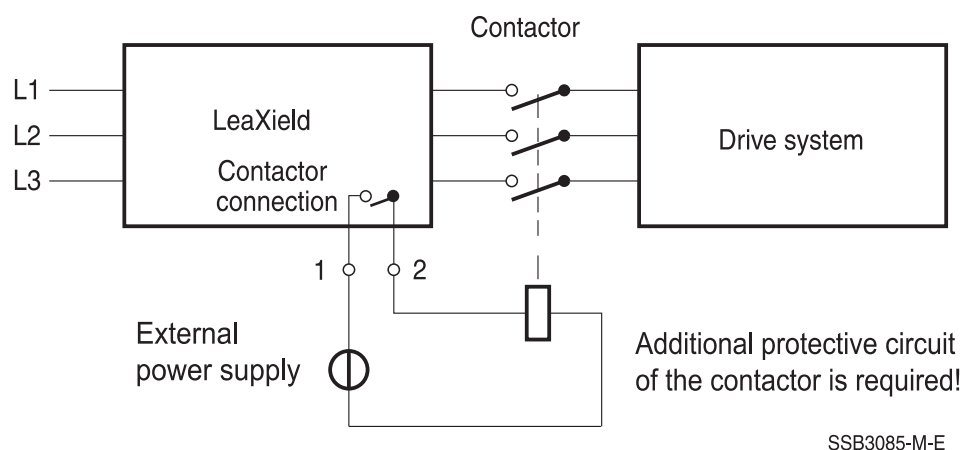
Note:

According to EN 50178 / VDE 0160, only type B/B+ RCDs are allowed in variable-speed drive systems!

Recommended system configuration

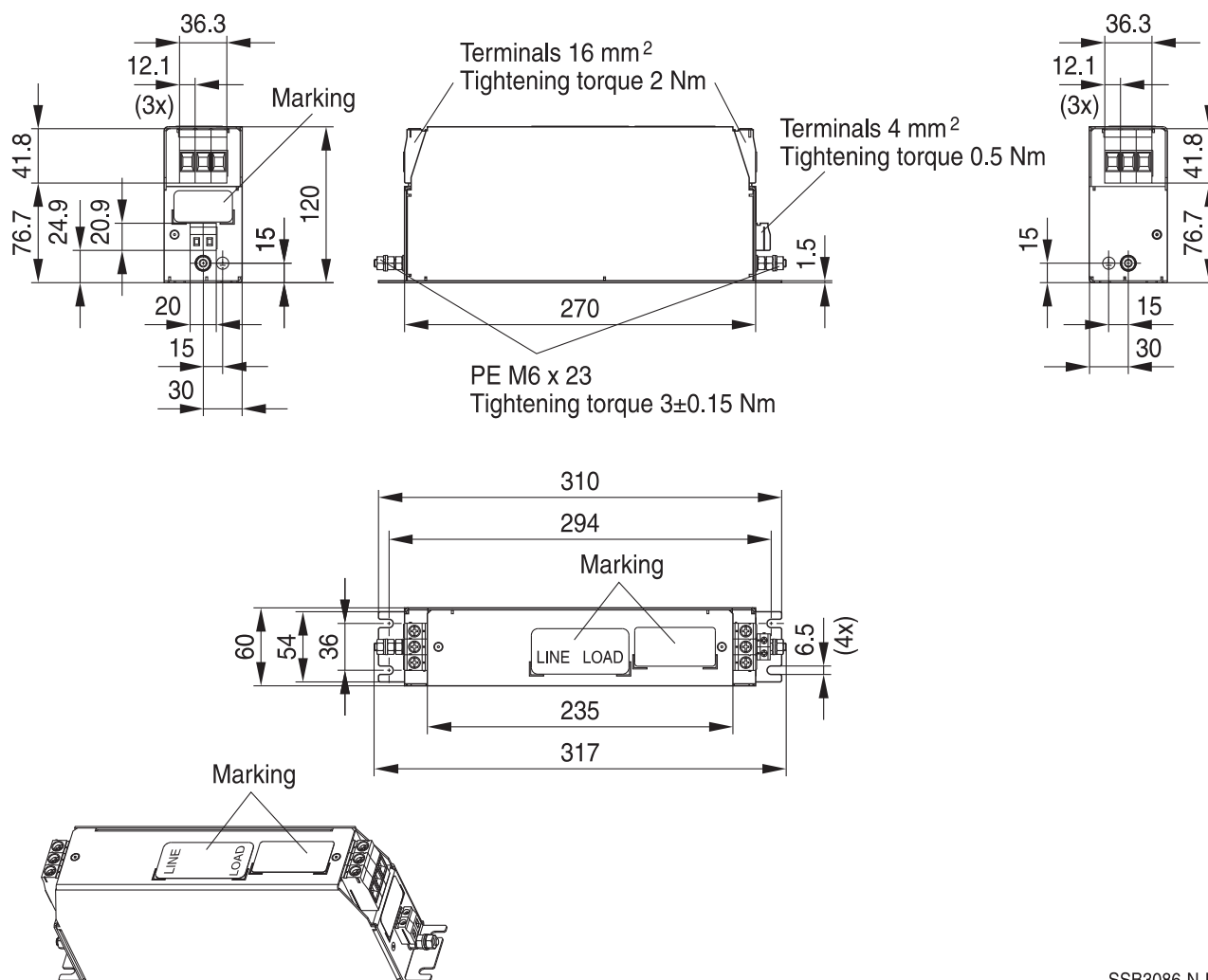


Wiring of contactor connection



Dimensional drawings


B84233A1500R000 (50 A)



SSB3086-N-E

General tolerances according to ISO 2768–cL
Dimensions in mm

Cautions and warnings

Please read all warning and safety notes carefully before installing the filter and putting it into operation (see ). The same applies to the warning signs on the filter. Please ensure that the signs are not removed nor their legibility impaired by external influences.

Death, serious bodily injury and substantial material damage to equipment may occur if the appropriate safety measures are not carried out or the warnings in the text are not observed.

Using according to the terms

The filters may be used only for their intended application within the specified values in low-voltage networks in compliance with the instructions given in the data sheets and the data book. The conditions at the place of application must comply with all specifications for the filter used.

Warning

- It shall be ensured that only qualified persons (electricity specialists) are engaged on work such as planning, assembly, installation, operation, repair and maintenance. They must be provided with the corresponding documentation.
- Danger of electric shock. Filters contain components that store an electric charge. Dangerous voltages can continue to exist at the filter terminals for longer than five minutes even after the power has been switched off.
- The protective earth connections shall be the first to be made when the filter is installed and the last to be disconnected. Depending on the magnitude of the leakage currents, the particular specifications for making the protective earth connection must be observed.
- Impermissible overloading of the filter or filter, such as with circuits able to cause resonances, impermissible voltages at higher frequencies etc. can lead to bodily injury and death as well as cause substantial material damages (e.g. destruction of the filter housing).
- Filters must be protected in the application against impermissible exceeding of the rated currents by overcurrent protective devices.
- In case of leakage currents >3.5 mA you shall mount the PE conductor stationary with the required cross section before beginning of operation and save it against disconnecting. For leakage currents $I_L^{1)} \leq 10$ mA the PE conductor must have a KU value²⁾ of 4.5³⁾; for leakage currents $I_L > 10$ mA the PE conductor must have a KU value of 6⁴⁾.
- Output chokes and output filters must be protected in the application against impermissible exceeding of the component temperature.
- The converter output frequency must be within the specified range to avoid resonances and uncontrolled warming of the output chokes and output filters.
- Because the product can become very hot during operation, there is the risk of burns if touched. The product can remain hot for some time after the power is switched off!

1) I_L = leakage current let-go

2) The KU value (symbol KU) is a classification parameter of safety-referred failure types designed to ensure protection against hazardous body currents and excessive heating.

3) A value of KU = 4.5 with respect to interruptions is attained with: a) permanently connected protective earth connection ≥ 1.5 mm² and b) a protective earth connection ≥ 2.5 mm² via connectors for industrial equipment (IEC 60309-2)

4) KU = 6 with respect to interruptions is achieved for fixed-connection lines ≥ 10 mm² where the type of connection and installation correspond to the requirements for PEN conductors as specified in relevant standards.

for leakage current compensation

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant chapters of the databook.

Topic	Instructions	Reference chapter (data book), paragraph
Selecting a filter	When selecting a filter, it is mandatory to observe the rated data of the equipment (such as its rated input current, rated voltage, harmonic content etc.) as well as the derating instructions in Chapters 9 and 10.	Selection guide for converter filters
Rated voltage	When power distribution systems deviating from the symmetric TN-S system is to check the suitability of the filters and the allowed voltages including the fault cases.	Power distribution systems, 7
Protection from residual voltages Discharge resistors	Active parts must be discharged within 5 s to a voltage of less than 60 V (or 50 μ C). If this limit cannot be observed due to the operating mode, the hazardous point must be permanently marked in a clearly visible way. Filters which are not permanently connected (e.g. when the test voltage is applied to the filter at the incoming goods inspection) must be discharged after the voltage has been switched off.	Safety regulations, 6.1 Safety regulations, 6.2
Installing and removing of filters Installation	When installing and removing our filters, a voltage-free state must be set up and secured with observance of the five safety rules described in EN 50110-1.	Safety regulations, 6.4
Use in IT systems	The special features of the IT system ("first fault case" and other fault cases) shall be observed.	Power distribution system (network types), 7.6
Safety notes on leakage currents	The filter leakage currents specified in the data book are intended for user information only. The maximum leakage current of the entire electrical equipment or appliance has to be limited for safety reasons. Please obtain the applicable limits for your application from the relevant regulations, provisions and standards.	Leakage current, 8.4 Leakage current, 8.6
Voltage derating Hazards caused by overloading the filters	If the permissible limits for the higher-frequency voltages at the filter are exceeded, the filter may be damaged or destroyed.	Voltage derating, 9.8
Current derating at elevated ambient temperatures	Non-observance of the current derating may lead to overheating and consequently represents a fire hazard.	Current derating, 10.1

Topic	Instructions	Reference chapter (data book), paragraph
Protective earth connection at operating currents >250 A	For operating currents greater than 250 A, we recommend the PE connection to be set up between the feed (filter: line) and output (filter: load) not via the PE terminal bolt in the filter housing.	Mounting instructions, point 2
Mounting position	Note the mounting position of the filters! It must always be ensured that natural convection is not impaired.	Mounting instructions, point 13
Long motor cables	Long motor cables cause parasitic currents in the installation. The cable lengths indicated for the output chokes and output filters serve for orientation. The user must check the technical parameters and especially the choke temperatures for the respective application.	Mounting instructions, point 15

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Symbols and terms

Symbol	English	German
α	Insertion loss	Einfügungsdämpfung
C_R	Rated capacitance	Bemessungskapazität
C_X	Capacitance X capacitor	Kapazität X-Kondensator
C_Y	Capacitance Y capacitor	Kapazität Y-Kondensator
ΔV	Voltage drop (input to output)	Spannungsabfall (Eingang zu Ausgang)
dv/dt	Rate of voltage rise	Spannungsanstiegsgeschwindigkeit
f	Frequency	Frequenz
f_M	Converter output frequency	Motorfrequenz
f_P	Pulse frequency	Pulsfrequenz
f_R	Rated frequency	Bemessungsfrequenz
f_{res}	Resonant frequency	Resonanzfrequenz
I_C	Current through capacitor	Strom durch Kondensator
I_{LK}	Filter leakage current	Filter-Ableitstrom
I_{max}	Maximum current	Maximalstrom
I_N	Nominal current	Nennstrom
I_{op}	Operating current (design current)	Betriebsstrom
I_{pk}	Rated peak withstand current	Bemessungs-Stoßstromfestigkeit
I_q	Capacitive reactive current	Kapazitiver Blindstrom
I_R	Rated current	Bemessungsstrom
I_S	Interference current	Störstrom
L	Inductance	Induktivität
L_R	Rated inductance	Bemessungsinduktivität
L_{stray}	Stray inductance	Streuinduktivität
P_L	Power loss	Verlustleistung
R	Resistance	Widerstand
R_{is}	Insulation resistance	Isolationswiderstand
R_{typ}	DC resistance, typical value	Gleichstromwiderstand typisch
T_A	Ambient temperature	Umgebungstemperatur
T_{max}	Upper category temperature	Obere Kategorietemperatur
T_{min}	Lower category temperature	Untere Kategorietemperatur
T_R	Rated temperature	Bemessungstemperatur
u_k	Referred voltage drop in %	Bezogener Spannungsabfall in %
V_{eff}	RMS voltage	Effektivspannung
V_K	Voltage drop	Spannungsabfall
V_{LE}	Voltage line to earth; voltage line to ground	Spannung Phase zu Erdpotential
V_N	Nominal voltage	Nennspannung
V_R	Rated voltage	Bemessungsspannung
V_{peak}	Peak voltage	Spitzenspannung
V_{test}	Test voltage	Prüfspannung
V_X	Voltage over X capacitor	Spannung über X-Kondensator
V_Y	Voltage over Y capacitor	Spannung über Y-Kondensator
X_L	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
$ Z $	Impedance, absolute value	Scheinwiderstand (Betragswert)

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