

EMC filters

2-line filters IEC inlet filters

Series/Type: B84776 Date: January 2021

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IEC inlet filters

Power line filters for 1-phase systems Rated voltage V_R : 250 V AC/DC Rated current I_R : 1 A to 10 A

Construction

- 2-line filters with IEC connector, fuse holder and switch
- Appliance connector according to IEC 60320-1
- Fuse holder for 2 fuses Ø 5 × 20 mm (delivery without fuse)
- Metal case
- 2-pole rocker switch

Versions

- Standard version (B84776A*)
- Medical version with negligibly low leakage current (B84776M*)

Features

- Easy to install
- Compact design
- Cost optimized construction
- Degree of protection from front side IP 40¹)
- ENEC, UL and cUL approval R cAL

Typical applications

- Switch-mode power supplies
 - industrial electronics
 - telecom systems
 - data systems
- DC applications
- Measuring instruments
- Medical equipment

Terminals

- Line side: IEC connectors C14 according to IEC 60320-1
- Load side: Tab connectors

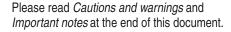
Marking

Marking on component:

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

Minimum data on packaging: Manufacturer's logo, ordering code, quantity, date code

1) According to IEC 60529





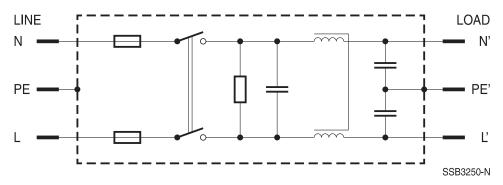
Schematic picture





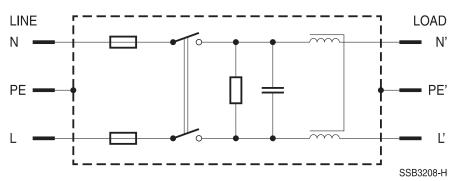
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Typical circuit diagram of B84776A* (standard version)

Typical circuit diagram of B84776M* (medical version)



Technical data and measuring conditions

Rated voltage V _R	250 V AC (50/60 Hz)		
Rated current I _R	Referred to 40 °C rated temperature		
Test voltage V _{test}	760 V AC, 2 s (line/line)		
	B84776A*: 2000 V AC, 2 s	(lines/case)	
	B84776M*: 2500 V AC, 2 s	(lines/case)	
Rocker switch	Rating	10 A (4 A), 250 V AC, T105	
	according to IEC 61058-1		
	Rating	250 V AC 1/2 HP,	
	according to UL 1054	10 A 250 V AC	
		10 A 125 V AC	
	Inrush current	82 A	
	Electrical life time	10000 cycles	
	ON – OFF		
	Mechanical life time	50000 cycles	
	ON – OFF		
Leakage current I _{LK}	At V_{R} and 50 Hz		
Climatic category (IEC 60068-1)	25/085/21 (-25 °C/+85 °C/21 days damp heat test)		
Approvals	IEC 60939, UL 1283, CSA C22.2 No.8 granted		
	•		



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Characteristics	and	ordering	codes
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I_{R}	C _R	C _R	L _R	I _{LK} ¹⁾	R_{bleed}	Approx.	Ordering code	App	rovals	;
	X2	Y2				weight				
А	μF	pF	mH	mA	MΩ	g		Æ 10	71	c 91
V _R =	= 250 V A(C								
1	1 × 0.22	2×2200	2×7.6	0.173	1	90	B84776A0001A000	×	×	×
1	1 × 0.22	_	2×7.6	0	1	90	B84776M0001A000	×	×	×
2	1 × 0.22	2 × 2200	2×2.0	0.173	1	90	B84776A0002A000	×	×	×
2	1 × 0.22	_	2×2.0	0	1	90	B84776M0002A000	×	×	×
4	1 × 0.22	2 × 2200	2×1.0	0.173	1	90	B84776A0004A000	×	×	×
4	1 × 0.22	_	2×1.0	0	1	90	B84776M0004A000	×	×	×
6	1 × 0.22	2 × 2200	2×0.46	0.173	1	90	B84776A0006A000	×	×	×
6	1 × 0.22	_	2×0.46	0	1	90	B84776M0006A000	×	×	×
10	1 × 0.22	2 × 2200	2×0.33	0.173	1	130	B84776A0010A000	×	×	×
10	1×0.22	_	2 imes 0.33	0	1	130	B84776M0010A000	\times	×	×

 \times = Approval granted

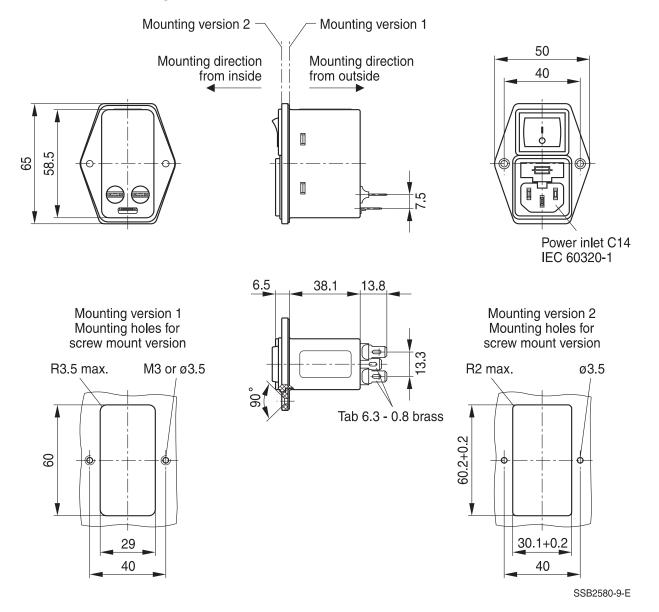
 Calculation according to IEC 60939-1, annex A, at rated voltage and 50 Hz.In practice are up to double values to be expected due to the insulation resistance values of the used ceramic capacitors. For the medical version results computationally the value 0. In practice are values 1 ... 2 μA to be expected due to the insulation resistance values of the used materials.



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Dimensional drawing



General tolerances according to ISO 2768-cL Dimensions in mm

▲ Safety Notices – fuses

- All safety rules for working with electricity must be observed.
- Fuses may only be changed when they are not under voltage and by a qualified electrician or technician.
- The fuse holder must be closed before connecting the device to the mains.
- The person responsible for the system must select a suitable fuse (not included with the original product shipment), taking into account the specifications of both the filter and the systems.



IEC inlet filters

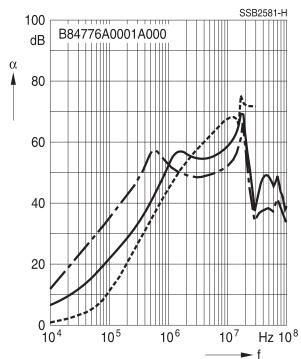
Insertion loss for standard version (typical values at $Z = 50 \Omega$)

- _____
 - common mode, all branches in parallel (asymmetrical)

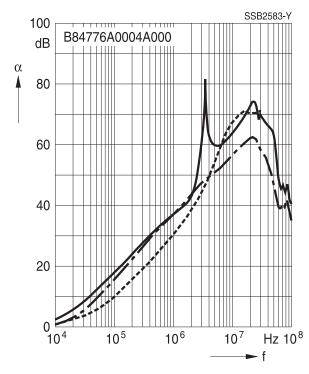
unsymmetrical, adjacent branches terminated

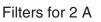
- – differential mode (symmetrical)

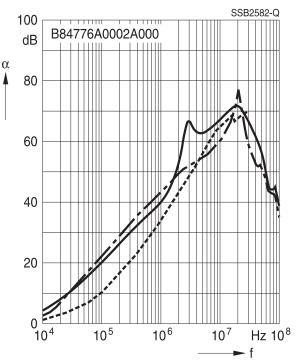
Filters for 1 A



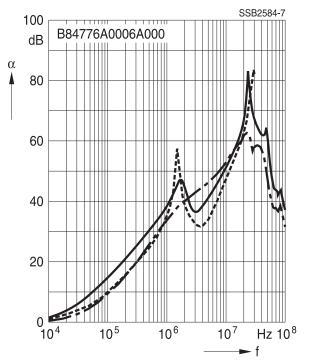
Filters for 4 A











Please read *Cautions and warnings* and *Important notes* at the end of this document.



2-line filters

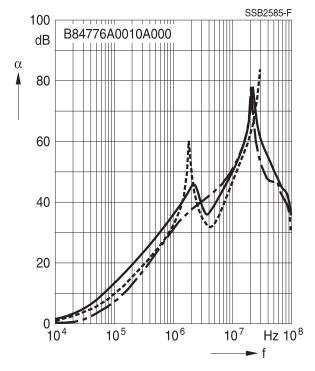
IEC inlet filters

Insertion loss for standard version (typical values at $Z = 50 \Omega$)

 unsymmetrical, adjacent branches terminated
 common mode, all branches in parallel (asymm
 differential mode (symmetrical)

- non mode, all branches in parallel (asymmetrical)
- differential mode (symmetrical)

Filters for 10 A





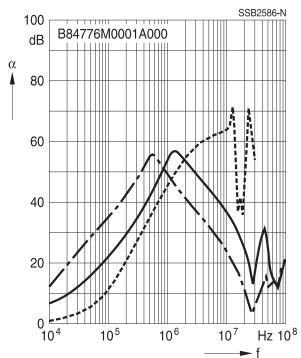
2-line filters

IEC inlet filters

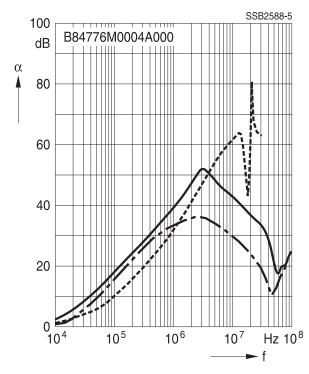
Insertion loss for medical version (typical values at $Z = 50 \Omega$)

- _____
- unsymmetrical, adjacent branches terminated common mode, all branches in parallel (asymmetrical)
 - differential mode (symmetrical)

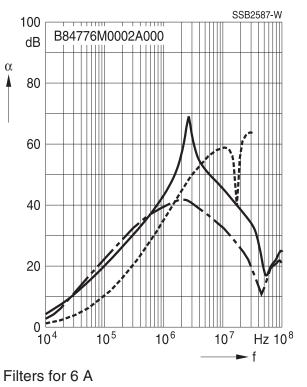
Filters for 1 A

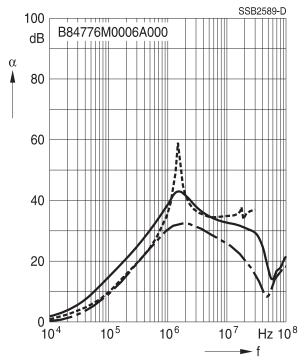


Filters for 4 A



Filters for 2 A







2-line filters

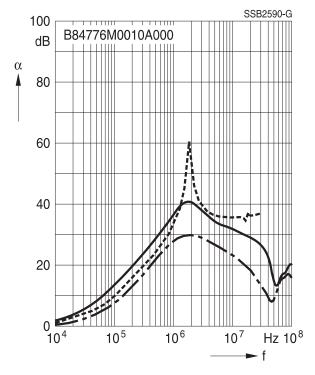
IEC inlet filters

Insertion loss for medical version (typical values at $Z = 50 \Omega$)

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 di

- unsymmetrical, adjacent branches terminated common mode, all branches in parallel (asymmetrical)
- differential mode (symmetrical)

Filters for 10 A





IEC inlet filters

Cautions and warnings

Please read all warning and safety notes carefully before installing the filter and putting it into operation (see $\underline{\mathbb{A}}$). 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 lowvoltage 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.

Marning

- 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_L¹ ≤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!

- 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 $\geq 10 \text{ mm}^2$ where the type of connection and installation correspond to the requirements for PEN conductors as specified in relevant standards.

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.



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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.

Торіс	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, 6.2
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.	, ,
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.	8.4 Leakage current,
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.	0
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



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Торіс	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.	instructions,
Mounting position	Note the mounting position of the filters! It must always be ensured that natural convection is not impaired.	•
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
l _{pk}	Rated peak withstand current	Bemessungs-Stoßstromfestigkeit
l _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 Prüfspannung
V _{test}	Test voltage	
V _X	Voltage over X capacitor Voltage over Y capacitor	Spannung über X-Kondensator Spannung über Y-Kondensator
V _Y X _L	Inductive reactance	Induktiver Blindwiderstand
∧∟ Z	Impedance	Scheinwiderstand
Z Z		Scheinwiderstand (Betragswert)
	Impedance, absolute value	



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