

## DC EMC/EMI Filter for PV Inverters



- Reduces conducted emissions towards the solar panel
- Reduces the probability of EMI radiation off the solar panel
- Helps to prevent pre-mature panel aging because of HF leakage currents
- Helps to meet international EMC regulations for the entire PV system
- Most compact standard solution in the industry, optionally available without capacitors to ground (B types)

### Approvals



### Technical specifications

Maximum continuous operating voltage:	Max. 1200VDC
Operating frequency:	DC
Rated currents:	25 to 2300A @ 55°C
High potential test voltage:	P → E 3600VDC for 5 sec P → P 3000VDC for 5 sec
Protection category:	IP20 (25 to 150A types); IP00 (250 to 2300A types)
Overload capability:	4× rated current at switch on, 1.5× rated current for 1 minute, once per hour
Temperature range (operation and storage):	-40°C to +100°C (40/100/21)
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 55°C/1200V (Mil-HB-217F):	min. 223,000 hours

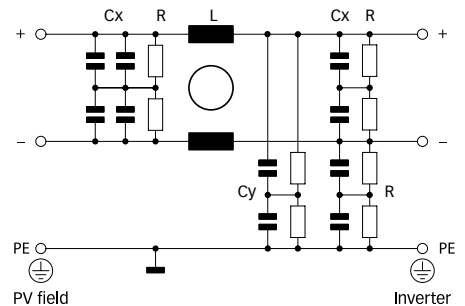
### Features and benefits

FN 2200 range of standard EMC/EMI filters is based on Schaffner's years of experience in custom filter design for the global photovoltaic (PV) inverter industry. Installed between the PV inverter and the solar panel, FN 2200 DC filters help to control conducted emissions on the panel side of the system and therefore significantly reduce the potential for high-frequency (HF) interference radiation off the panel. The filter also protects the solar panel from HF stray and leakage currents which can cause pre-mature aging in the PV modules.

FN 2200 are the most compact dedicated DC filters for PV inverters in the industry and therefore support the integration in the ever shrinking frame sizes of today's power electronics. All FN 2200 come in unsymmetrical housings, which help to prevent inverse installation and wrong electrical connection. Along with grid-side installed Schaffner AC EMC/EMI filters, FN 2200 are key to meet the stringent international standards for electromagnetic compatibility (EMC) like EN 61000-6-5 and -6-4 and help to ensure a reliable and fault-free operation of the entire PV system.

FN 2200 are designed for very low power loss, to support overall PV system efficiency.

### Typical electrical schematic



### Typical applications

FN 2200 are primarily designed for PV inverters. However, they can potentially also be used in other DC applications within published specifications, like UPS, DC motor drives, or DC quick chargers.

Filter selection table

Filter	Rated current @ 55°C (40°C)	Typical inverter AC power rating*	Filter efficiency @ 25°C / DC	Power loss @ 25°C/DC	Input/Output connections	Weight [kg]
	[A]	[kW]	[%]	[W]		
FN 2200-25-33	25 (28)	10	> 99.9	8	-33	0.9
FN 2200-50-34	50 (57)	20	> 99.9	17	-34	1.6
FN 2200-75-34	75 (86)	30	> 99.9	18	-34	1.7
FN 2200-100-35	100 (115)	40	> 99.9	22	-35	2.7
FN 2200-150-40	150 (173)	60	> 99.9	31	-40	4.9
FN 2200-250-99	250 (288)	100	> 99.9	10	-99	5.0
FN 2200-400-99	400 (460)	150	> 99.9	16	-99	6.1
FN 2200-600-99	600 (690)	250	> 99.9	29	-99	6.5
FN 2200-800-99	800 (920)	350	> 99.9	26	-99	9.3
FN 2200-1000-99	1000 (1150)	400	> 99.9	40	-99	9.4
FN 2200-1500-99	1500 (1600)	500	> 99.9	45	-99	14.6
FN 2200-2300-99	2300 (2500)	800/1000	> 99.9	84	-99	25.0

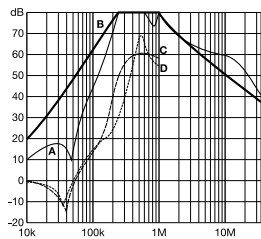
FN 2200B-25-33	25 (28)	10	> 99.9	8	-33	0.9
FN 2200B-50-34	50 (57)	20	> 99.9	17	-34	1.6
FN 2200B-75-34	75 (86)	30	> 99.9	18	-34	1.7
FN 2200B-100-35	100 (115)	40	> 99.9	22	-35	2.7
FN 2200B-150-40	150 (173)	60	> 99.9	31	-40	4.9
FN 2200B-250-99	250 (288)	100	> 99.9	10	-99	5.0
FN 2200B-400-99	400 (460)	150	> 99.9	16	-99	6.1
FN 2200B-600-99	600 (690)	250	> 99.9	29	-99	6.5
FN 2200B-800-99	800 (920)	350	> 99.9	26	-99	9.3
FN 2200B-1000-99	1000 (1150)	400	> 99.9	40	-99	9.4
FN 2200B-1500-99	1500 (1600)	500	> 99.9	45	-99	14.6
FN 2200B-2300-99	2300 (2500)	800/1000	> 99.9	84	-99	25.0

\* Based on rated DC current of typical 3-phase PV inverters with 900VDC input. Note: depending upon manufacturer and model, DC currents for a given PV inverter power can differ significantly. Filters with higher current ratings for large central inverters up to the MW range are available upon request.

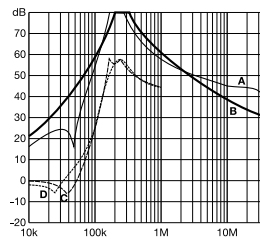
Typical filter attenuation

Per CISPR 17; A = 50Ω/50Ω sym; B = 50Ω/50Ω asym; C = 0.1Ω/100Ω sym; D = 100Ω/0.1Ω sym

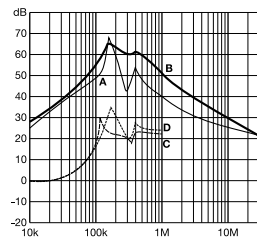
25 to 75A types



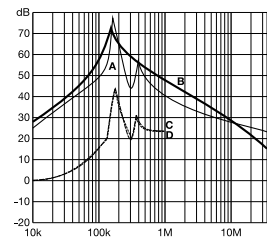
100 to 150A types



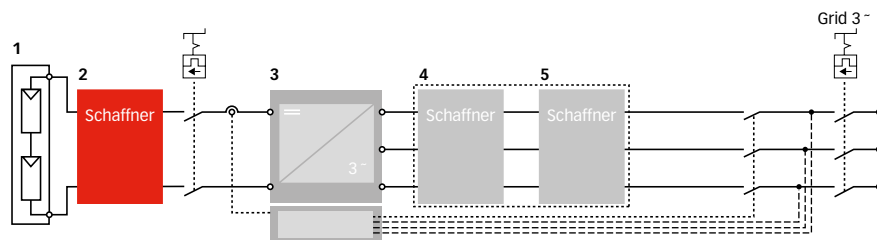
250A types



400 to 2300A types



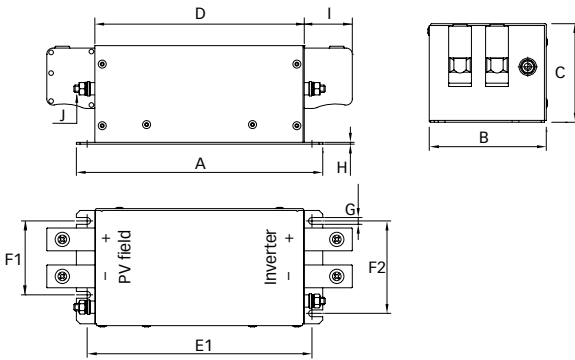
Typical block schematic



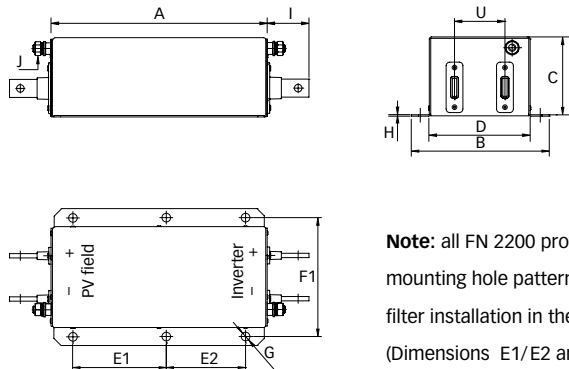
- 1 PV modules
- 2 Schaffner FN 2200
- 3 Central inverter
- 4 Schaffner magnetic components
- 5 Schaffner AC EMC/EMI filter

**Mechanical data**

25 to 150A types



250 to 2300A types



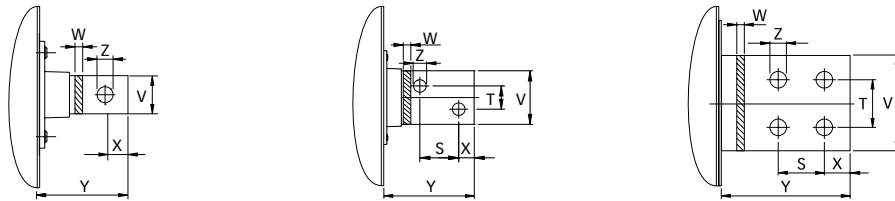
**Note:** all FN 2200 provide unsymmetrical mounting hole patterns to prevent inverse filter installation in the field.  
(Dimensions E1/E2 and F1/F2)

**Busbar connections**

250 to 1000A types

1500A types

2300A types



**Dimensions**

	25A	50A	75A	100A	150A	250A	400A	600A	800A	1000A	1500A	2300A
A	170	200	200	220	250	300	300	300	300	300	300	400
B	80	95	95	125	140	180	190	190	200	200	200	250
C	65	80	80	95	115	110	110	110	140	140	150	180
D	140	170	170	190	220	130	140	140	150	150	150	195
E1	152.5	182.5	182.5	202.5	232.5	130	130	130	130	130	130	190
E2						110	110	110	110	110	110	150
F1	45	60	60	80	100	155	165	165	175	175	175	225
F2	60	75	75	100	120							
G	5.5	5.5	5.5	5.5	5.5	Ø12	Ø12	Ø12	Ø12	Ø12	Ø12	Ø12
H	1	1.5	1.5	1.5	2	2	2	2	3	3	3	3
I	25	39	39	45	51	58	58	58	65	65	110	100
J	M5	M6	M6	M8	M10	M10	M10	M10	M12	M12	M12	M16
S											43	35
T											26	35
U						70	70	70	70	70	70	100
V						20	25	25	40	40	60	70
W						5	6	8	8	8	10	15
X						15	15	15	20	20	17	20
Y						58	58	58	65	65	110	100
Z						Ø9	Ø10.5	Ø10.5	Ø14	Ø14	Ø14	Ø14

All dimensions in mm; 1 inch = 25.4mm  
Tolerances according: ISO 2768-m / EN 22768-m

**Filter input/output connector cross sections**

	-33	-34	-35	-40
<b>Solid wire</b>	16mm <sup>2</sup>	35mm <sup>2</sup>	50mm <sup>2</sup>	95mm <sup>2</sup>
<b>Flex wire</b>	10mm <sup>2</sup>	25mm <sup>2</sup>	50mm <sup>2</sup>	95mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 4/0
<b>Recommended torque</b>	1.5 - 1.8Nm	4.0 - 4.5Nm	7 - 8Nm	17 - 20Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

**Headquarters and  
global innovation and  
development center**

**Schaffner Group**  
Nordstrasse 11  
4542 Luterbach  
Switzerland  
T +41 32 681 66 26  
F +41 32 681 66 30  
info@schaffner.ch  
[www.schaffner.com](http://www.schaffner.com)

**Sales and application centers**

**China**  
**Schaffner EMC Ltd. Shanghai**  
T20-3, No 565 Chuangye Road  
Pudong New Area  
Shanghai 201201/China  
T +86 21 3813 9500  
F +86 21 3813 9501/02  
cschina@schaffner.com  
[www.schaffner.com](http://www.schaffner.com)

**Finland**  
**Schaffner Oy**  
Tynninkuja 7  
08700 Lohja  
T +358 19 35 72 71  
F +358 19 32 66 10  
finlandsales@schaffner.com

**France**  
**Schaffner EMC S.A.S.**  
112, Quai de Bezons  
95103 Argenteuil  
T +33 1 34 34 30 60  
F +33 1 39 47 02 28  
francesales@schaffner.com

**Germany**  
**Schaffner Deutschland GmbH**  
Schoemperlenstrasse 12B  
76185 Karlsruhe  
T +49 721 56910  
F +49 721 569110  
germanysales@schaffner.com

**Italy**  
**Schaffner EMC S.r.l.**  
Via Galileo Galilei, 47  
20092 Cinisello Balsamo (MI)  
T +39 02 66 04 30 45/47  
F +39 02 61 23 943  
italysales@schaffner.com

**Japan**  
**Schaffner EMC K.K.**  
Mitsui-Seimei Sangenjaya Bldg. 7F  
1-32-12, Kamiyama, Setagaya-ku  
Tokyo 154-0011  
T +81 3 5712 3650  
F +81 3 5712 3651  
japansales@schaffner.com  
[www.schaffner.jp](http://www.schaffner.jp)

**Singapore**  
**Schaffner EMC Pte Ltd.**  
Blk 3015A Ubi Road 1  
05-09 Kampong Ubi Industrial  
Estate  
T +65 6377 3283  
F +65 6377 3281  
singaporesales@schaffner.com

**Spain**  
**Schaffner EMC España**  
Calle Caléndula 93,  
Miniparc III, Edificio E  
El Soto de la Moraleja,  
Alcobendas  
28109 Madrid  
T +34 618 176 133  
spainsales@schaffner.com

**Sweden**  
**Schaffner EMC AB**  
Turebergstorg 1, 6  
19147 Sollentuna  
T +46 8 5792 1121/22  
F +46 8 92 96 90  
swedensales@schaffner.com

**Switzerland**  
**Schaffner EMV AG**  
Nordstrasse 11  
4542 Luterbach  
T +41 32 681 66 26  
F +41 32 681 66 41  
sales@schaffner.ch

**Taiwan**  
**Schaffner EMV Ltd.**  
6th Floor, No 413  
Rui Guang Road  
Neihu District  
Taipei City 114  
T +886 2 87525050  
F +886 2 87518086  
taiwansales@schaffner.com

**Thailand**  
**Schaffner EMC Co. Ltd.**  
Northern Region Industrial Estate  
67 Moo 4 Tambon Ban Klang  
Amphur Muang P.O. Box 14  
Lamphun 51000  
T +66 53 58 11 04  
F +66 53 58 10 19  
thailandsales@schaffner.com

**UK**  
**Schaffner Ltd.**  
5 Ashville Way  
Molly Millars Lane  
Wokingham  
Berkshire RG41 2PL  
T +44 118 9770070  
F +44 118 9792969  
uksales@schaffner.com  
[www.schaffner.uk.com](http://www.schaffner.uk.com)

**USA**  
**Schaffner EMC Inc.**  
52 Mayfield Avenue  
Edison, New Jersey 08837  
T +1 732 225 9533  
F +1 732 225 4789  
usasales@schaffner.com  
[www.schaffner.com/us](http://www.schaffner.com/us)

To find your local partner within  
Schaffner's global network, please go to  
[www.schaffner.com](http://www.schaffner.com)

February 2012

© 2012 Schaffner Group  
Specifications are subject to change  
without notice. The latest version of the  
data sheets can be obtained from the  
website. All trademarks recognized.

Schaffner is an ISO-registered company.  
Its products are designed and manufac-  
tured under the strict quality and environ-  
mental requirements of the ISO 9001 and  
ISO 14001 standards.

This document has been carefully checked.  
However, Schaffner does not assume any  
liability for errors or inaccuracies.