

# 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)
- New: up to 2300 A



### Performance indicators

Attenuation performance



Rated current [A]



## Technical specifications

<b>Maximum continuous operating voltage</b>	Max. 1200 VDC
<b>Operating frequency</b>	DC
<b>High potential test voltage</b>	P → E 3600 VDC for 2 sec P → P 3000 VDC for 2 sec
<b>Protection category</b>	IP 20 (25 to 150 A types); IP 00 (250 to 2300 A types)
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-40°C to +100°C (40/100/21)
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>MTBF @ 55°C/1200 V (Mil-HB-217F)</b>	min. 223,000 hours
<b>Rated currents</b>	25 to 2300 A @ 55°C

### Approvals



(600 VDC) (850 VDC)

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 61000-6-3 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.

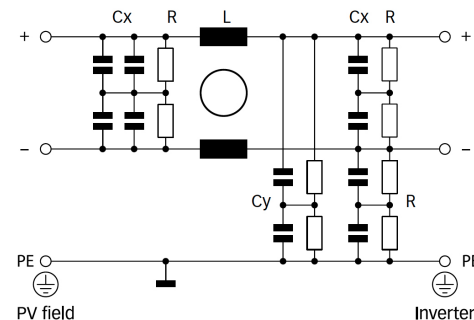
## Features and benefits

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.

## 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.

### Typical electrical schematic



### Filter selection table

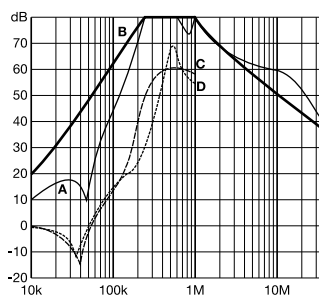
Filter	Rated current @ 55°C (40°C)	Typical inverter AC power rating*	Filter efficiency @ 25°C/DC	Power loss @ 25°C/DC	Input/Output connections		Weight
	[A]	[kW]	[%]	[W]			[kg]
FN 2200-25-33	25 (28)	10	> 99.9	8	-33		0.9
FN 2200-50-34	50 (57)	20	> 99.9	17	-34		1.6
FN 2200-75-34	75 (86)	30	> 99.9	18	-34		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	400		-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 900 VDC 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.

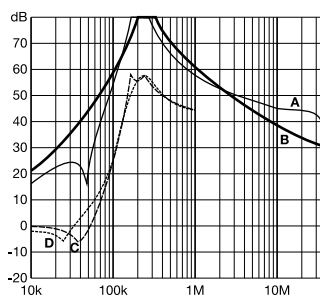
### Typical filter attenuation

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

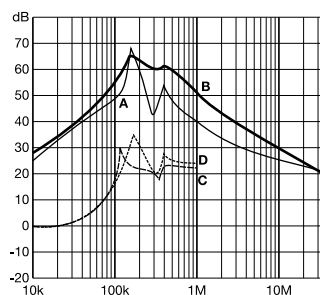
25 to 75 A types



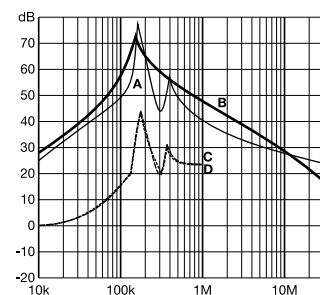
100 to 150 A types



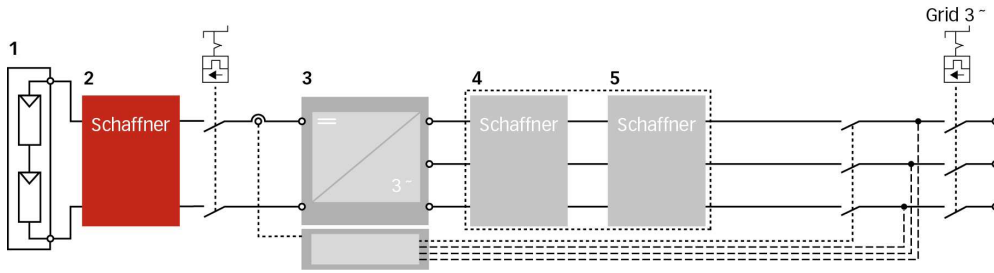
250 A types



400 to 2300 A types



### Typical block schematic

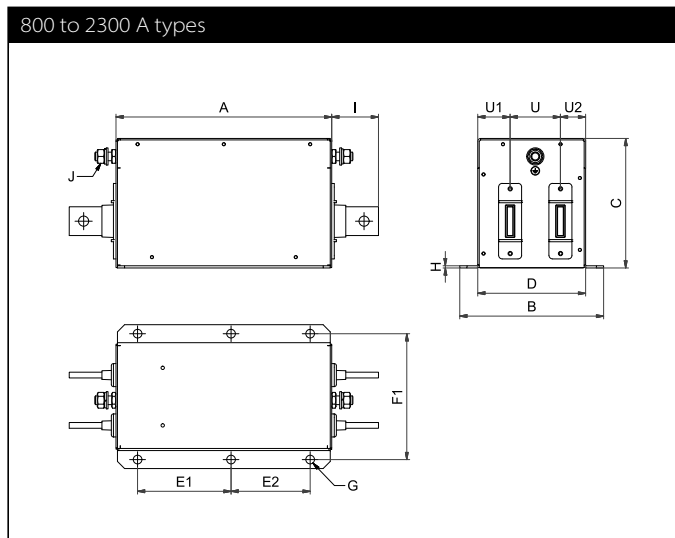
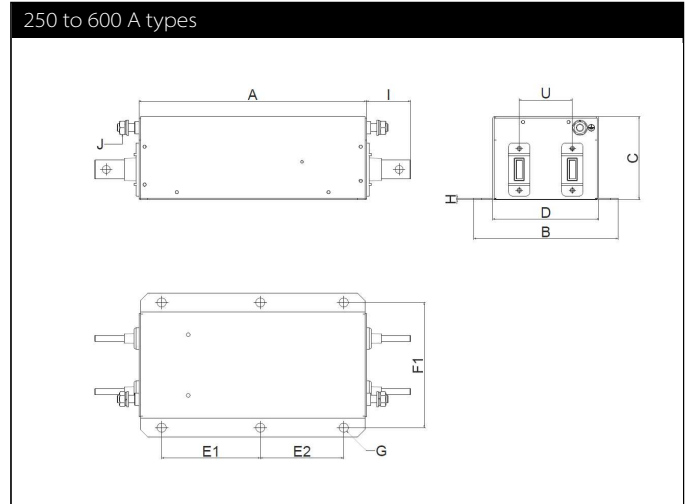
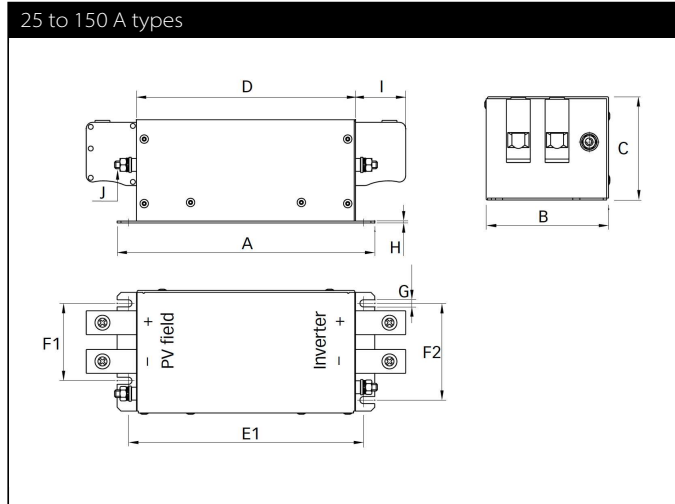


1 PV modules  
2 Schaffner FN 2200

3 Central Inverter  
4 Schaffner magnetic components

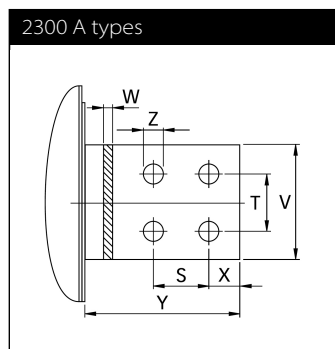
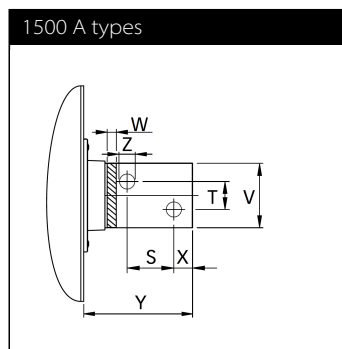
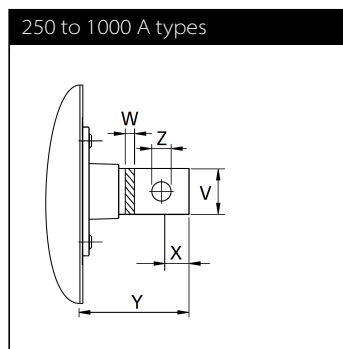
5 Schaffner AC EMC/EMI filter

### Mechanical data



**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



## Dimensions

	25 A	50 A	75 A	100 A	150 A	250 A	400 A	600 A	800 A	1000 A	1500 A	2300 A
<b>A</b>	170	200	200	220	250	300	300	300	300	300	300	400
<b>B</b>	80	95	95	125	140	180	190	190	200	200	200	250
<b>C</b>	65	80	80	95	115	110	110	110	140	140	150	180
<b>D</b>	140	170	170	190	220	130	140	140	150	150	150	195
<b>E1</b>	152.5	182.5	182.5	202.5	232.5	130	130	130	130	130	130	190
<b>E2</b>						110	110	110	110	110	110	150
<b>F1</b>	45	60	60	80	100	155	165	165	175	175	175	225
<b>F2</b>	60	75	75	100	120							
<b>G</b>	5.5	5.5	5.5	5.5	5.5	∅ 12	∅ 12	∅ 12	∅ 12	∅ 12	∅ 12	∅ 12
<b>H</b>	1	1.5	1.5	1.5	2	2	2	2	3	3	3	3
<b>I</b>	25	39	39	45	51	58	58	58	65	65	110	100
<b>J</b>	M5	M6	M6	M8	M10	M10	M10	M10	M12	M12	M12	M16
<b>S</b>											43	35
<b>T</b>											26	35
<b>U</b>						70	70	70	70	70	70	100
<b>U1</b>									45	45	55	61
<b>U2</b>									35	35	25	34
<b>V</b>						20	25	25	40	40	60	70
<b>W</b>						5	6	8	8	8	10	15
<b>X</b>						15	15	15	20	20	17	20
<b>Y</b>						58	58	58	65	65	110	100
<b>Z</b>						∅ 9	∅ 10.5	∅ 10.5	∅ 14	∅ 14	∅ 14	∅ 14

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

## Filter input/output connector cross sections

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

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



## Headquarters, global innovation and development

### Switzerland

#### Schaffner Group

Nordstrasse 11  
4542 Luterbach  
T +41 32 681 66 26  
[info@schaffner.com](mailto:info@schaffner.com)  
<http://www.schaffner.com>



## Sales and application centers

### China

#### Schaffner EMC Ltd. Shanghai

T20-3 C, No 565 Chuangye Road,  
Pudong district  
201201 Shanghai  
T +86 21 3813 9500  
[cschina@schaffner.com](mailto:cschina@schaffner.com)  
<http://www.schaffner.com.cn>

### Finland

#### Schaffner Oy

Sauvonrinne 19 H  
08500 Lohja  
T +358 50 468 7284  
[finlandsales@schaffner.com](mailto:finlandsales@schaffner.com)

### France

#### Schaffner EMC S.A.S.

16-20 Rue Louis Rameau  
95875 Bezons  
T +33 1 34 34 30 60  
F +33 1 39 47 02 28  
[francesales@schaffner.com](mailto:francesales@schaffner.com)

### Germany

#### Schaffner Deutschland GmbH

Schoemperlenstrasse 12B  
76185 Karlsruhe  
T +49 721 56910  
F +49 721 569110  
[germanysales@schaffner.com](mailto:germanysales@schaffner.com)

### India

#### Schaffner India Pvt. Ltd

Unit 59, Level, Mfar Greenheart 7  
Manyata Tech Park, Hebbal Outer Ring Road  
560045 Bangalore  
T +91 80 6781 9805  
F +91 80 6781 9998  
[indiasales@schaffner.com](mailto:indiasales@schaffner.com)

### Italy

#### Schaffner EMC S.r.l.

Via Ticino, 30  
20900 Monza (MB)  
T +39 039 21 41 070  
[italysales@schaffner.com](mailto:italysales@schaffner.com)

### Japan

#### Schaffner EMC K.K.

1-32-12, Kamiyama, Setagaya-ku  
7F Mitsui-seimei Sengenjaya Bldg.  
154-0011 Tokyo  
T +81 3 5712 3650  
F +81 3 5712 3651  
[japansales@schaffner.com](mailto:japansales@schaffner.com)  
<http://www.schaffner.jp>

### Singapore

#### Schaffner EMC Pte Ltd.

#05-09, Kg Ubi Ind. Estate  
408705 Singapore  
T +65 6377 3283  
F +65 6377 3281  
[singaporesales@schaffner.com](mailto:singaporesales@schaffner.com)

### Spain

#### Schaffner EMC España

Calle Caléndula 93, Miniparc III, Edificio E  
El Soto de Moraleja, Alcobendas  
28109 Madrid  
T +34 917 912 900  
F +34 917 912 901  
[spainsales@schaffner.com](mailto:spainsales@schaffner.com)

### Sweden

#### Schaffner EMC AB

Tegeluddsvägen 76, 2tr  
115 28 Stockholm  
T +46 8 5050 2425  
[swedensales@schaffner.com](mailto:swedensales@schaffner.com)  
<http://www.schaffner.com>

### Switzerland

#### Schaffner EMV AG

Nordstrasse 11  
4542 Luterbach  
T +41 32 681 66 26  
[switzerlandsales@schaffner.com](mailto:switzerlandsales@schaffner.com)

### Taiwan R.O.C.

#### Schaffner EMV Ltd.

20 Floor-2, No 97, Section 1, XinTai 5th Road  
22175 XiZhi District New Taipei City 22175  
T +886 2 2697 5500  
F +886 2 2697 5533  
[taiwansales@schaffner.com](mailto:taiwansales@schaffner.com)  
<http://www.schaffner.com.tw>

### Thailand

#### Schaffner EMC Co. Ltd.

Northern Region Industrial Estate  
67 Moo 4 Tambon Ban Klang  
Amphur Muangng P.O. Box 14  
51000 Lamphun  
T +66 53 58 11 04  
F +66 53 58 10 19  
[thailandsales@schaffner.com](mailto:thailandsales@schaffner.com)

### United Kingdom

#### Schaffner Ltd.

5 Ashville Way, Molly Millars Lane  
Wokingham  
RG41 2PL Berkshire  
T +44 118 9770070  
F +44 118 9792969  
[uksales@schaffner.com](mailto:uksales@schaffner.com)

### USA

#### Schaffner EMC Inc.

52 Mayfield Avenue  
08837 Edison, New Jersey  
T +1 800 367 5566  
T +1 732 225 9533  
F +1 732 225 4789  
[usasales@schaffner.com](mailto:usasales@schaffner.com)  
<http://www.schaffnerusa.com>

#### Schaffner North America

6722 Thirlane Road  
24019 Roanoke, Virginia  
T +1 276 228 7943  
F +1 276 228 7953

#### Schaffner North America

823 Fairview Road  
24382 Wytheville, Virginia  
T +1 276 228 7943  
F +1 276 228 7258

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

© 2017 Schaffner Group

The content of this document has been carefully checked and understood. However, neither Schaffner nor its subsidiaries assume any liability whatsoever for any errors or inaccuracies of this document and the consequences thereof. Published specifications are subject to change without notice. Product suitability for any area of application must ultimately be determined by the customer. In all cases, products must never be operated outside their published specifications. Schaffner does not guarantee the availability of all published products. This disclaimer shall be governed by substantive Swiss law and resulting disputes shall be settled by the courts at the place of business of Schaffner Holding AG. Latest publications and a complete disclaimer can be downloaded from the Schaffner website. All trademarks recognized.