

# 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>Rated currents</b>	25 to 2300 A @ 55 °C
<b>High potential test voltage</b>	P -> E 3600 VDC for 2 sec P -> P 3000 VDC for 2 sec
<b>Protection category</b>	IP20 (25 to 150 A types); IP00 (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>Operating frequency</b>	DC

## 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.

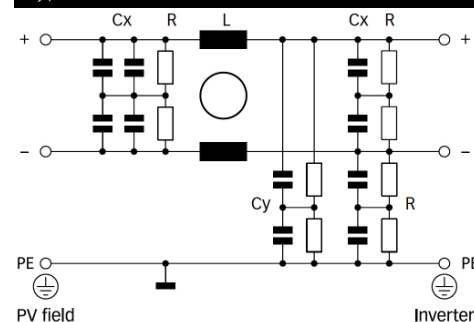
## Features and benefits

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

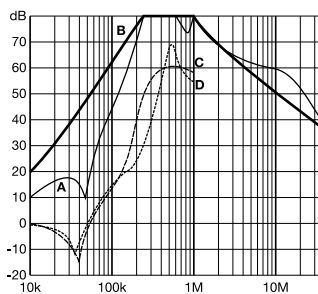
Filter	Rated current @ 55 °C (40 °C)	Typical inverter AC power rating*	Filter efficiency @ 25 °C/DC	Power loss @ 25 °C/DC	Input/Output connections	Weight [kg]
	[A]	[kW]	[%]	[W]	 	
<b>FN 2200-25-33</b>	25 (28)	10	> 99.9	8	-33	0.9
<b>FN 2200-50-34</b>	50 (57)	20	> 99.9	17	-34	1.6
<b>FN 2200-75-34</b>	75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

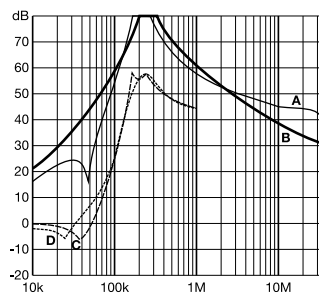
### Typical filter attenuation

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

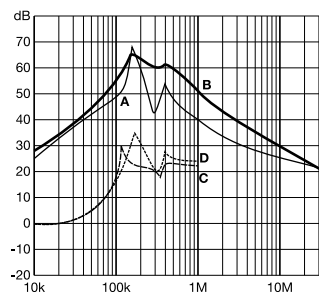
25 to 75 A types



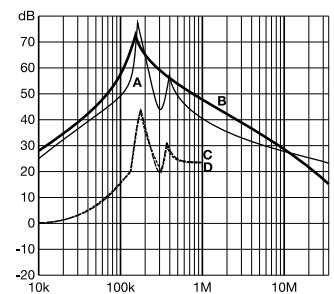
100 to 150 A types



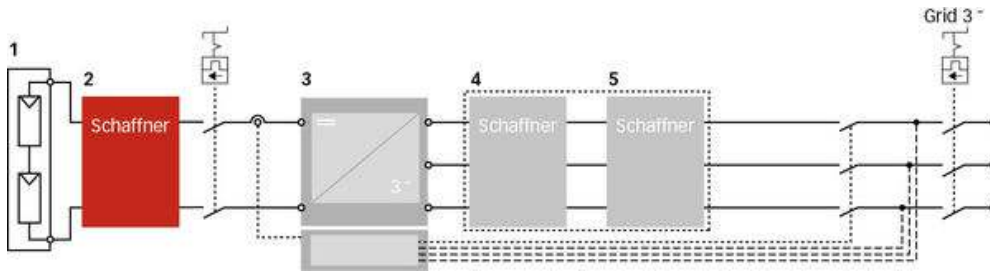
250 A types



400 to 2300 A types



### Typical block schematic

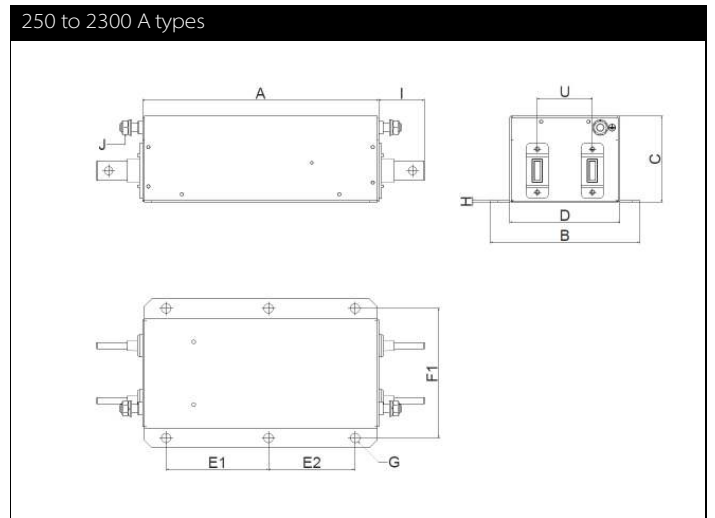
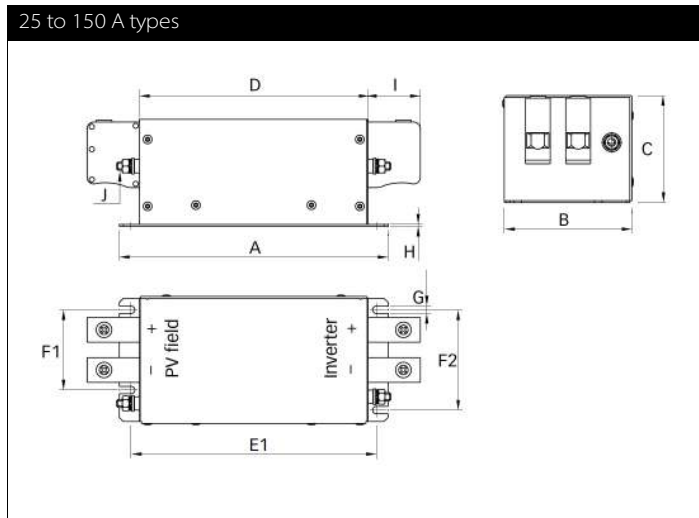


1 PV modules  
2 Schaffner FN 2200

3 Central Inverter  
4 Schaffner magnetic components

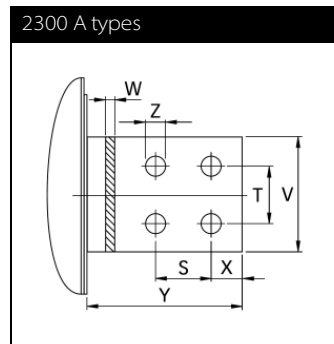
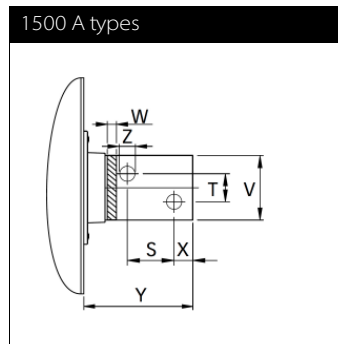
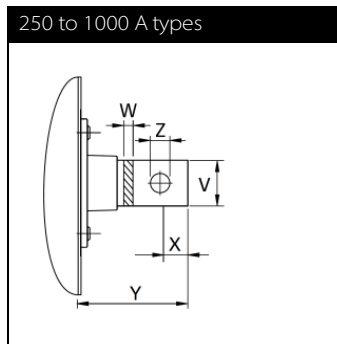
5 Schaffner AC EMC/EMI filter

### 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	Ø 12	Ø 12	Ø 12	Ø 12	Ø 12	Ø 12	Ø 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>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>						Ø 9	Ø 10.5	Ø 10.5	Ø 14	Ø 14	Ø 14	Ø 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 center

### Switzerland

#### Schaffner Group

Nordstrasse 11  
4542 Luterbach  
T +41 32 6816 626  
F +41 32 6816 630  
[info@schaffner.com](mailto:info@schaffner.com)  
<http://www.schaffner.com>



## Sales and application centers

### China

#### Schaffner EMC Ltd. Shanghai

T20-3, No 565 Chuangye Road  
Pudong New Area  
201201 Shanghai  
T +86 21 3813 9500  
F +86 21 3813 9501 / 02  
[cschina@schaffner.com](mailto:cschina@schaffner.com)  
<http://www.schaffner.com.cn/>

### Finland

#### Schaffner Oy

Sauvonrinne 19 H  
08500 Lohja  
T +358 19 35 72 71  
[finlandsales@schaffner.com](mailto:finlandsales@schaffner.com)

### France

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

112 Quai de Bezons  
Boîte postale 133  
95100 Argenteuil  
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)

### 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](mailto:italysales@schaffner.com)

### Japan

#### Schaffner EMC K.K.

1-32-12, Kamiyama, Setagaya-ku  
7F Mitsui-seimei Sangenjaya 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.

Blk 3015A Ubi Road 1  
05-09 Kampong Ubi Industrial 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,  
Alcobendas  
Miniparc III, Edificio E  
El Soto de la Moraleja  
Alcobendas  
28109 Madrid  
M +34 618 176 133  
T +34 917 912 900  
F +34 917 912 901  
[spainsales@schaffner.com](mailto: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](mailto:swedensales@schaffner.com)

### Switzerland

#### Schaffner EMV AG

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

### Taiwan R.O.C.

#### Schaffner EMV Ltd.

6 Floor, No. 413  
Rui Guang Road  
114 Neihu District Taipei City  
T +886 2 87525050  
F +886 2 87518086  
[taiwansales@schaffner.com](mailto:taiwansales@schaffner.com)

### Thailand

#### Schaffner EMC Co. Ltd.

Northern Region Industrial Estate  
67 Moo 4 Tambon Ban Klang  
Amphur Muang 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)

### UK

#### 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)  
<http://www.schaffner.uk.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.schaffner.com/us>

#### Schaffner MTC LLC

6722 Thirlane Road  
24019 Roanoke, Virginia  
T +1 276 228 7943  
F +1 276 228 7953  
<http://www.schaffner-mtc.com>

#### Schaffner Trencos LLC

2550 Brookpark Road  
44134 Cleveland, Ohio  
T +1 216 741 5282  
F +1 216 741 4860  
<http://schaffner-trencos.com>

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