

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 |

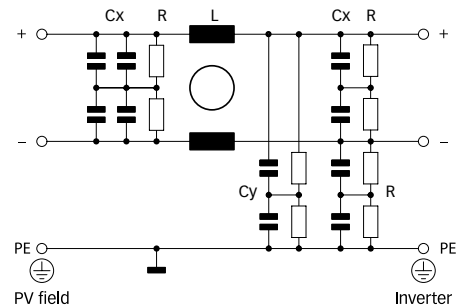
Features and benefits

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 61000-6-3 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.

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

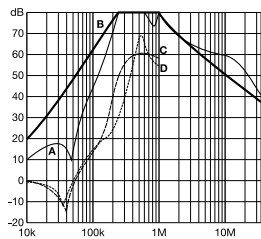
| Filter | Rated current @ 55°C (40°C) | Typical inverter AC power rating* | Filter efficiency @ 25°C / DC | Power loss @ 25°C/DC | Input/Output connections | Weight [kg] |
|------------------|--------------------------------|--------------------------------------|----------------------------------|-------------------------|-----------------------------|----------------|
| | [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.

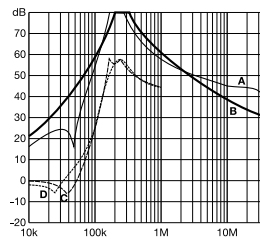
Typical filter attenuation

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

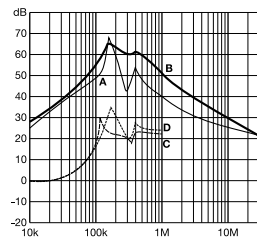
25 to 75A types



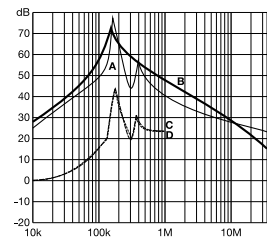
100 to 150A types



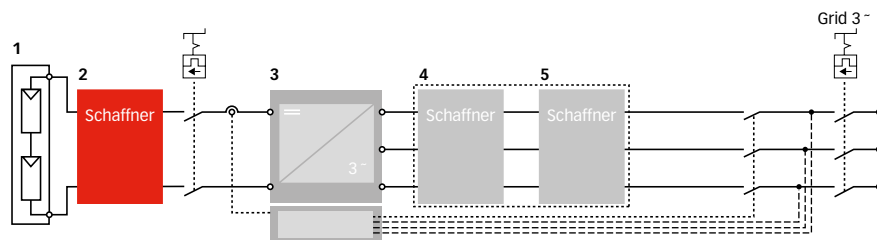
250A types



400 to 2300A types



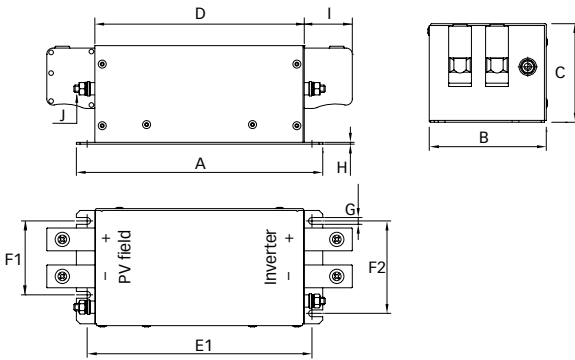
Typical block schematic



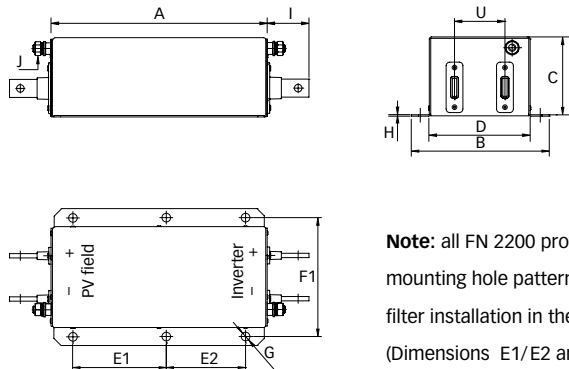
- 1 PV modules
- 2 Schaffner FN 2200
- 3 Central inverter
- 4 Schaffner magnetic components
- 5 Schaffner AC EMC/EMI filter

Mechanical data

25 to 150A types



250 to 2300A types



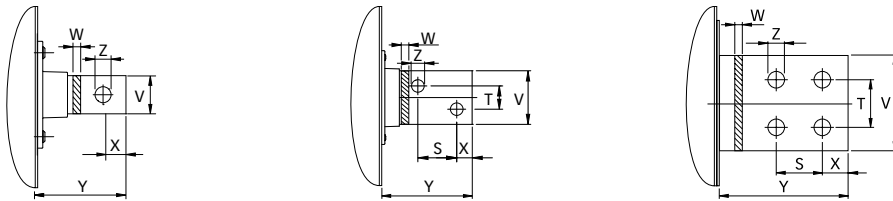
Note: all FN 2200 provide unsymmetrical mounting hole patterns to prevent inverse filter installation in the field.
(Dimensions E1/E2 and F1/F2)

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 |
|---------------------------|-------------------|-------------------|-------------------|-------------------|
| Solid wire | 16mm ² | 35mm ² | 50mm ² | 95mm ² |
| Flex wire | 10mm ² | 25mm ² | 50mm ² | 95mm ² |
| AWG type wire | AWG 6 | AWG 2 | AWG 1/0 | AWG 4/0 |
| Recommended torque | 1.5 - 1.8Nm | 4.0 - 4.5Nm | 7 - 8Nm | 17 - 20Nm |

Please visit 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

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

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

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

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

To find your local partner within
Schaffner's global network, please go to
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.