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

<table>
<thead>
<tr>
<th></th>
<th>standard</th>
<th>High</th>
<th>very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current [A]</td>
<td>25</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

### Technical specifications

- **Maximum continuous operating voltage**: Max. 1200 VDC
- **Operating frequency**: DC
- **Rated currents**: 25 to 2300 A @ 55°C
- **High potential test voltage**: P -> E 3600 VDC for 2 sec; P -> P 3000 VDC for 2 sec
- **Protection category**: IP 20 (25 to 150 A types); IP 00 (250 to 2300 A types)
- **Overload capability**: 4x rated current at switch on, 1.5x 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 1283, CSA 22.2 No. B 1986, IEC/EN 60939
- **MTBF @ 55°C/1200 V (Mil-HB-217F)**: min. 223,000 hours

### Approvals & Compliances

(cULus:600 VDC) (ENEC14: 600 VDC)

FN 2200 are the most compact dedicated DC filters for PV inverters in the industry and therefore support the integration in shrinking frame sizes of power electronics. All FN 2200 come in unsymmetrical housings, which help to prevent reverse installation and wrong electrical connection. Along with grid-side installed AC EMC/EMI filters, FN 2200 are key to meet the 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 system. FN 2200 are designed for very low power loss, to support overall efficiency.

### Features and benefits

FN 2200 range is based on experience in custom filter design for the 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.
## Filter selection table

<table>
<thead>
<tr>
<th>Filter</th>
<th>Buy</th>
<th>Rated current @ 55°C (40°C)</th>
<th>Typical inverter AC power rating*</th>
<th>Filter efficiency @ 25°C/DC</th>
<th>Power loss @ 25°C/DC</th>
<th>Input/Output connections</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN2200-25-33</td>
<td></td>
<td>25 (28)</td>
<td>10</td>
<td>&gt; 99.9</td>
<td>8</td>
<td>-33</td>
<td>0.9</td>
</tr>
<tr>
<td>FN2200-50-34</td>
<td></td>
<td>50 (57)</td>
<td>20</td>
<td>&gt; 99.9</td>
<td>17</td>
<td>-34</td>
<td>1.6</td>
</tr>
<tr>
<td>FN2200-75-34</td>
<td></td>
<td>75 (86)</td>
<td>30</td>
<td>&gt; 99.9</td>
<td>18</td>
<td>-34</td>
<td>1.7</td>
</tr>
<tr>
<td>FN2200-100-35</td>
<td></td>
<td>100 (115)</td>
<td>40</td>
<td>&gt; 99.9</td>
<td>22</td>
<td>-35</td>
<td>2.7</td>
</tr>
<tr>
<td>FN2200-150-40</td>
<td></td>
<td>150 (173)</td>
<td>60</td>
<td>&gt; 99.9</td>
<td>31</td>
<td>-40</td>
<td>4.9</td>
</tr>
<tr>
<td>FN2200-250-99</td>
<td></td>
<td>250 (288)</td>
<td>100</td>
<td>&gt; 99.9</td>
<td>10</td>
<td>-99</td>
<td>5.0</td>
</tr>
<tr>
<td>FN2200-400-99</td>
<td></td>
<td>400 (460)</td>
<td>150</td>
<td>&gt; 99.9</td>
<td>16</td>
<td>-99</td>
<td>6.1</td>
</tr>
<tr>
<td>FN2200-600-99</td>
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<td>600 (690)</td>
<td>250</td>
<td>&gt; 99.9</td>
<td>29</td>
<td>-99</td>
<td>6.5</td>
</tr>
<tr>
<td>FN2200-800-99</td>
<td></td>
<td>800 (920)</td>
<td>350</td>
<td>&gt; 99.9</td>
<td>45</td>
<td>-99</td>
<td>9.3</td>
</tr>
<tr>
<td>FN2200-1000-99</td>
<td></td>
<td>1000 (1150)</td>
<td>400</td>
<td>&gt; 99.9</td>
<td>40</td>
<td>-99</td>
<td>9.4</td>
</tr>
<tr>
<td>FN2200-1500-99</td>
<td></td>
<td>1500 (1600)</td>
<td>500</td>
<td>&gt; 99.9</td>
<td>45</td>
<td>-99</td>
<td>14.6</td>
</tr>
<tr>
<td>FN2200-2300-99</td>
<td></td>
<td>2300 (2500)</td>
<td>800/1000</td>
<td>&gt; 99.9</td>
<td>84</td>
<td>-99</td>
<td>25.0</td>
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<td>FN2200B-25-33</td>
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<td>25 (28)</td>
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<td>&gt; 99.9</td>
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<td>0.9</td>
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<td>FN2200B-50-34</td>
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</table>

* 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.

### Distribution inventory

Up-to-date inventory levels for global distributors is available at https://products.schaffner.com/stock

### 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

![Typical filter attenuation 25 to 75 A types](image1)

100 to 150 A types

![Typical filter attenuation 100 to 150 A types](image2)

250 A types

![Typical filter attenuation 250 A types](image3)

400 to 2300 A types

![Typical filter attenuation 400 to 2300 A types](image4)
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 150 A types**

![Diagram 25 to 150 A types]

**250 to 600 A types**

![Diagram 250 to 600 A types]

**800 to 2300 A types**

![Diagram 800 to 2300 A 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

<table>
<thead>
<tr>
<th>250 to 1000 A types</th>
<th>1500 A types</th>
<th>2300 A types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 25 A</td>
<td>B 50 A</td>
<td>C 75 A</td>
</tr>
<tr>
<td>170</td>
<td>80</td>
<td>65</td>
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<td>200</td>
<td>95</td>
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<td>250</td>
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<td>1500</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>2300</td>
<td>200</td>
<td>150</td>
</tr>
</tbody>
</table>

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

Filter input/output connector cross sections

<table>
<thead>
<tr>
<th>Solid wire</th>
<th>Flex wire</th>
<th>AWG type wire</th>
<th>Recommended torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>-33</td>
<td>-34</td>
<td>-35</td>
<td>-40</td>
</tr>
<tr>
<td>16 mm²</td>
<td>35 mm²</td>
<td>50 mm²</td>
<td>95 mm²</td>
</tr>
<tr>
<td>10 mm²</td>
<td>25 mm²</td>
<td>50 mm²</td>
<td>95 mm²</td>
</tr>
<tr>
<td>AWG 6</td>
<td>AWG 2</td>
<td>AWG 1/0</td>
<td>AWG 4/0</td>
</tr>
<tr>
<td>1.5-1.8 NM</td>
<td>4.0-4.5 NM</td>
<td>7-8 NM</td>
<td>17-20 NM</td>
</tr>
</tbody>
</table>

Please visit www.schaffner.com to find more details on filter connectors.
Headquarters, global innovation and development

Schaffner Group
Industrie Nord
Nordstrasse 11e
4542 Luterbach
T +41 32 681 66 26
info@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
csschina@schaffner.com
www.schaffner.com.cn

Finland
Schaffner Oy
Sauvonrinne 19 H
08500 Lohja
T +358 50 468 7284
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

Germany
Schaffner Deutschland GmbH
Schoemperlenstrasse 128
76185 Karlsruhe
T +49 721 56910
F +49 721 569110
germansales@schaffner.com

India
Schaffner India Pvt. Ltd
REGUS WORLD TRADE CENTRE
WTC, 22nd Floor Unit No 2238, Brigade Gateway Campus, 26/1, Dr. Rajkumar Road
Malleswaram (W)
560055 Bangalore
T +91 80 67935355
indiasales@schaffner.com

Italy
Schaffner EMC S.r.l.
Via Ticino, 30
20900 Monza (MI)
T +39 039 21 41 070
italysales@schaffner.com

Japan
Schaffner EMC K.K.
Taju-Seimei Sangenjaya Bldg.
1-32-12, Kansuma, Setagaya-ku
154-0011 Tokyo
T +81 3 5712 3650
F +81 3 5712 3651
japansales@schaffner.com
www.schaffner.jp

Singapore
Schaffner EMC Pte Ltd.
#05-09, Kg Ubhi Ind. Estate
408705 Singapore
T +65 6377 3283
F +65 6377 3281
singaporesales@schaffner.com

Spain
Schaffner EMC España
Calle Calendula 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

Switzerland
Schaffner EMV AG
Industrie Nord
Nordstrasse 11e
4542 Luterbach
T +41 32 681 66 26
switzerlandsales@schaffner.com

Taiwan
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
www.schaffner.com.tw

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

USA
Schaffner EMC Inc.
52 Mayfield Avenue
Edison, New Jersey
T +1 732 225 9533
F +1 732 225 4789
usasales@schaffner.com
www.schaffnerusa.com

To find your local partner within Schaffner’s global network: www.schaffner.com

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