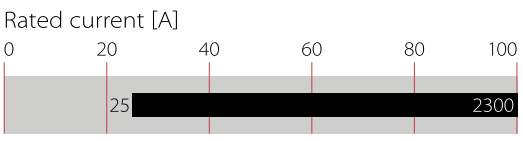
# EMC/EMI Filter for PV Inverters

- 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

| | |
|---|---|
| **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<br>P –> P 3000 VDC for 2 sec |
| **Protection category** | IP 20 (25 to 150 A types)<br>IP 00 (250 to 2300 A types) |
| **Overload capability** | 4x rated current at switch on,<br>1.5x rated current for 1 minute, once per hour |
| **Temperature range (operation and storage)** | -40°C to +100°C (40/100/21) |
| **Design corresponding to** | UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939 |
| **Flammability corresponding to** | UL 94 V-2 or better |

## Approvals & Compliances

(cURus:600 VDC) (ENEC14: 600 VDC)

FN2200 are very compact DC filters for PV inverters and therefore support the integration in shrinking frame sizes of power electronics. All FN2200 come in unsymmetrical housings, which help to prevent inverse installation and wrong electrical connection. Along with grid-side installed AC EMC/EMI filters, FN2200 are key to meet the international EMC standards like EN 61000-6-3 and -6-4 and help to ensure reliable operation of the system. FN2200 are designed for very low power loss, to support overall efficiency.

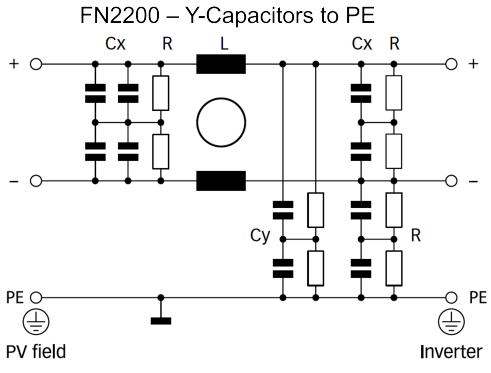
## Features and Benefits

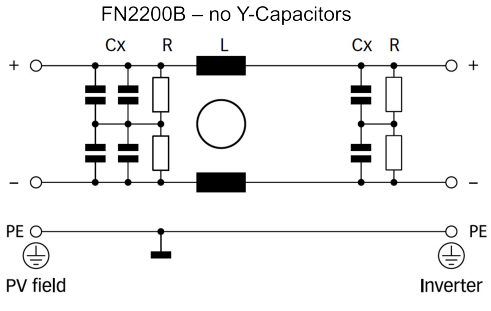
Installed between the PV inverter and the solar panel, FN2200 DC filters help to control conducted emissions on the panel side of the system and therefore reduce the potential for interference radiation off the panel. The filter also protects the solar panel from HF stray and leakage currents which can 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 | Buy | Rated current @ 55°C (40°C) [A] | Typical inverter AC power rating* [kW] | Filter efficiency @ 25°C/DC [%] | Power loss @ 25°C/DC [W] | Input/Output connections | | Weight [kg] |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **FN2200-25-33** | | 25 (28) | 10 | > 99.9 | 8 | -33 | | 0.9 |
| **FN2200-50-34** | | 50 (57) | 20 | > 99.9 | 17 | -34 | | 1.6 |
| **FN2200-75-34** | | 75 (86) | 30 | > 99.9 | 18 | -34 | | 1.7 |
| **FN2200-100-35** | | 100 (115) | 40 | > 99.9 | 22 | -35 | | 2.7 |
| **FN2200-150-40** | | 150 (173) | 60 | > 99.9 | 31 | -40 | | 4.9 |
| **FN2200-250-99** | | 250 (288) | 100 | > 99.9 | 10 | | -99 | 5.0 |
| **FN2200-400-99** | | 400 (460) | 150 | > 99.9 | 16 | | -99 | 6.1 |
| **FN2200-600-99** | | 600 (690) | 250 | > 99.9 | 29 | | -99 | 6.5 |
| **FN2200-800-99** | | 800 (920) | 350 | > 99.9 | 26 | | -99 | 9.3 |
| **FN2200-1000-99** | | 1000 (1150) | 400 | > 99.9 | 40 | | -99 | 9.4 |
| **FN2200-1500-99** | | 1500 (1600) | 500 | > 99.9 | 45 | | -99 | 14.6 |
| **FN2200-2300-99** | | 2300 (2500) | 800/1000 | > 99.9 | 84 | | -99 | 25.0 |
| | | | | | | | | |
| **FN2200B-25-33** | | 25 (28) | 10 | > 99.9 | 8 | -33 | | 0.9 |
| **FN2200B-50-34** | | 50 (57) | 20 | > 99.9 | 17 | -34 | | 1.6 |
| **FN2200B-75-34** | | 75 (86) | 30 | > 99.9 | 18 | -34 | | 1.7 |
| **FN2200B-100-35** | | 100 (115) | 40 | > 99.9 | 22 | -35 | | 2.7 |
| **FN2200B-150-40** | | 150 (173) | 60 | > 99.9 | 31 | -40 | | 4.9 |
| **FN2200B-250-99** | | 250 (288) | 100 | > 99.9 | 10 | | -99 | 5.0 |
| **FN2200B-400-99** | | 400 (460) | 150 | > 99.9 | 16 | | -99 | 6.1 |
| **FN2200B-600-99** | | 600 (690) | 250 | > 99.9 | 29 | | -99 | 6.5 |
| **FN2200B-800-99** | | 800 (920) | 350 | > 99.9 | 26 | | -99 | 9.3 |
| **FN2200B-1000-99** | | 1000 (1150) | 400 | > 99.9 | 40 | | -99 | 9.4 |
| **FN2200B-1500-99** | | 1500 (1600) | 500 | > 99.9 | 45 | | -99 | 14.6 |
| **FN2200B-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.

## Distribution Inventory

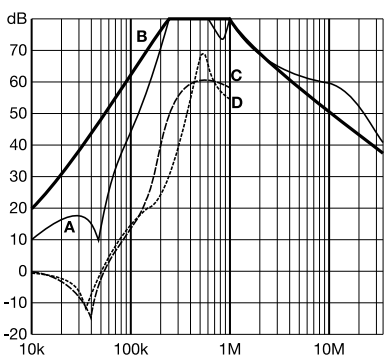
Up-to-date inventory levels for global distributors is available at

https://products.schaffner.com/stock

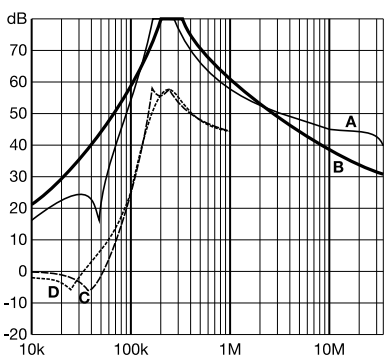
## Typical Filter Attenuation

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

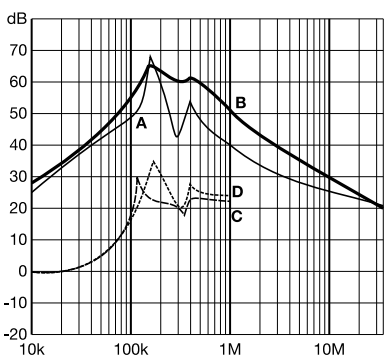
25 to 75 A types



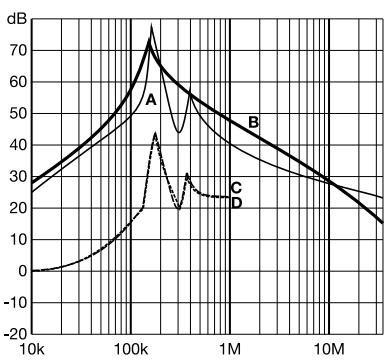

100 to 150 A types



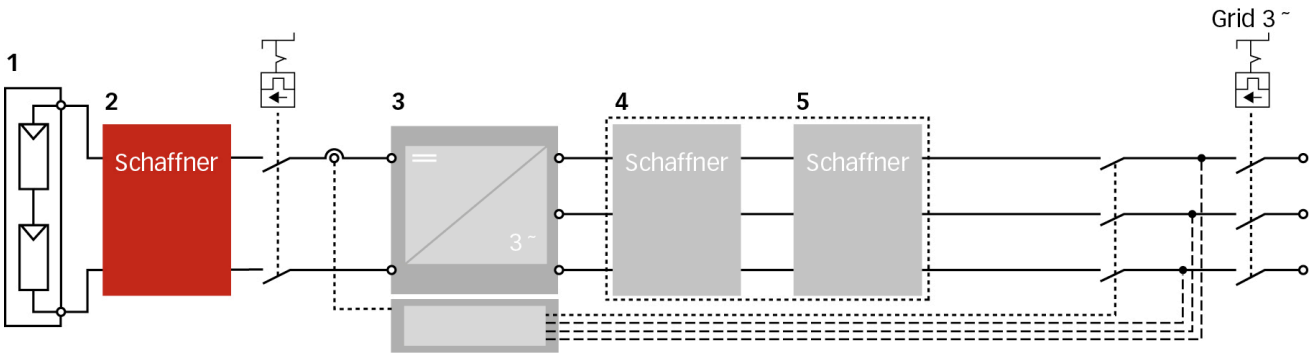

250 A types




400 to 2300 A types



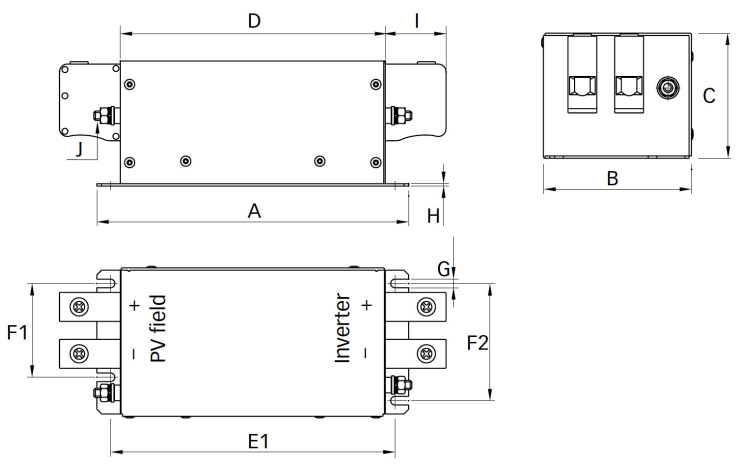
## Typical Block Schematic



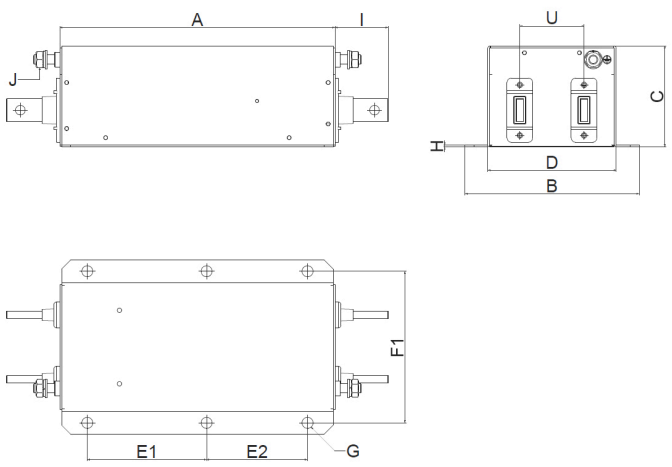

**1** PV modules
**2** Schaffner FN 2200
**3** Central Inverter
**4** Schaffner magnetic components
**5** Schaffner AC EMC/EMI filter

## Mechanical Data

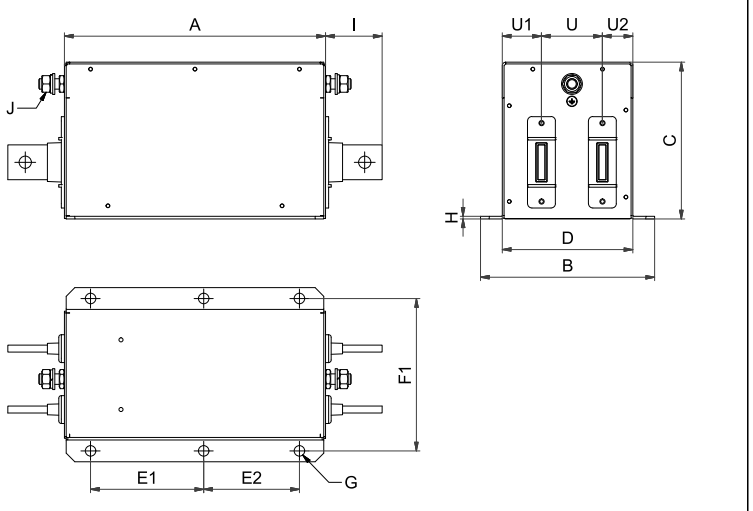
25 to 150 A types




250 to 600 A types



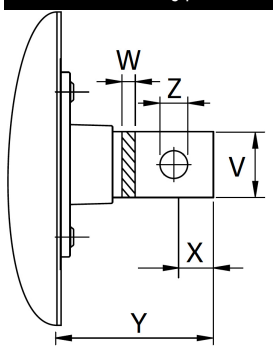

800 to 2300 A types



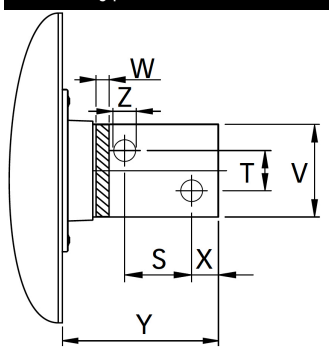

**Note:** all FN 2200 provide unsymmetrical mounting hole patterns to prevent inverse filter installation in the field. (Dimensions E1 E2 and F1/F2)

## Busbar Connections

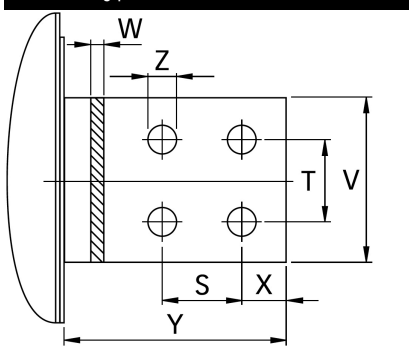
250 to 1000 A types




1500 A types




2300 A types




## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 | Ø 12 | Ø 12 | Ø 12 | Ø 12 | Ø 12 | Ø 12 | Ø 12 |
| **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 |
| **U1** | | | | | | | | | 45 | 45 | 55 | 61 |
| **U2** | | | | | | | | | 35 | 35 | 25 | 34 |
| **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** | | | | | | 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 |
|---|---|---|---|---|
| **Solid wire** | 16 $mm^2$ | 35 $mm^2$ | 50 $mm^2$ | 95 $mm^2$ |
| **Flex wire** | 10 $mm^2$ | 25 $mm^2$ | 50 $mm^2$ | 95 $mm^2$ |
| **AWG type wire** | AWG 6 | AWG 2 | AWG 1/0 | AWG 4/0 |
| **Recommended torque** | 1.5-1.8 NM | 4.0-4.5 NM | 7-8 NM | 17-20 NM |

Please visit www.schaffner.com to find more details on filter connectors.

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