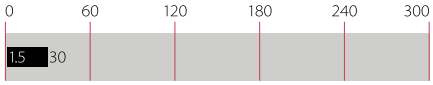
schaffner
shaping electrical power

Output Filter for Motor Drives

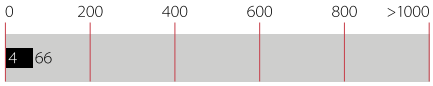
- Reduction of drive output voltage dv/dt
- Restriction of overvoltages on motor cables
- Reduction of motor temperature
- Increase of motor service life
- Improvement of system reliability

Performance indicators

Typical motor power [kW]



Rated current [A]



Technical specifications

Nominal operating voltage	3x 500/288 VAC
Motor frequency	0 to 400 Hz (4 to 24 A) 0 to 200 Hz (33 to 66 A)
Switching frequency	2 to 16 kHz
Rated currents	4 to 66 A @ 50°C
Motor cable length	80 m max. @ 16 kHz
Voltage drop	≤10 V @ 50 Hz
Typical dv/dt reduction	Factor 8 to 12
Typical reduction of overvoltages	≤1000 V
High potential test voltage	P –> E 2500 VDC for 2 sec P –> P 1100 VDC for 2 sec
Protection category	IP 20, if temperature auxiliary contact is connected with IP 20 faston connector
Overload capability	1.4x rated current for 1 minute, every 15 minutes
Temperature range (operation and storage)	-25°C to +70°C (25/070/21)
Flammability corresponding to	UL 94 V-2 or better
Design corresponding to	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 50°C/400 V (Mil-HB-217F)	>100,000 hours

Approvals

RoHS

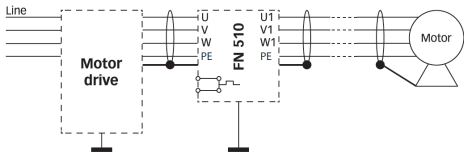
Features and benefits

- Efficient reduction of high output voltage dv/dt from IGBT motor drives (as per DIN VDE 0530)
- Restriction of overvoltages caused by line reflections on motor cables (as per DIN VDE 0530)
- Protection of motor coil insulation from premature aging and destruction
- Significant increase of service life of electric motors
- High reliability and production up time for mission critical applications
- Less interference propagation towards neighboring equipment or lines
- Output filter with low impedance, ideal for processes requiring exceptional precision and reproducibility of movements
- IP 20 housing and touch-safe terminal blocks contribute to overall equipment safety
- Temperature monitoring and internal fan cooling protect the filter from thermal overload

Typical applications

- Servo drives
- Close loop vector drives
- Motor drive applications with short to medium motor cable length
- Machinery comprising servo or torque motors
- Robots
- Pick and place machines
- Applications where sine wave filters are not applicable

Typical electrical schematic



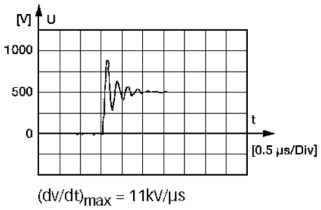
Filter selection table

Filter	Rated current @ 50°C [A]	Typical motor power rating* [kW]	Typical power loss** [W]	Input/Output connections	Weight [kg]
FN 510-4-29	4	1.5	90	-29	2.1
FN 510-8-29	8	3.7	90	-29	2.1
FN 510-12-29	12	5.5	90	-29	4
FN 510-16-29	16	7.5	90	-29	4.8
FN 510-24-33	24	11	100	-33	7.7
FN 510-33-33	33	15	110	-33	10
FN 510-50-34	50	22	130	-34	21
FN 510-66-34	66	30	130	-34	22

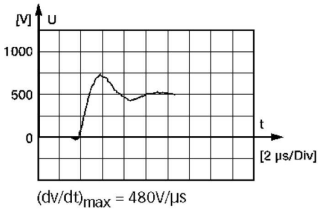
* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.
**Power loss at 16 kHz switching frequency/80m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

Typical measurement results

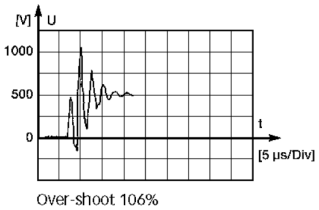
dv/dt without FN 510



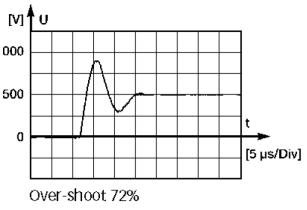
dv/dt with FN 510



Overvoltages without FN 510



Overvoltages with FN 510



dv/dt reduction: maximum dv/dt at the motor terminals, measured with the motor drive operating at 14 kHz switching frequency, 5 m of shielded cable, motor with 100% load.
Overvoltage limitation: maximum overvoltages at the motor terminals, measured with the motor drive operating at 14 kHz switching frequency, 80 m of shielded cable, motor idling.

Typical application range at different operating conditions

The power loss in the filter depends mainly on the switching frequency (fs) of the motor drive and the length of the motor cable. FN 510 have been designed for an ambient temperature of 50°C.

Other conditions can, however, occur in practice. In such cases, care must be taken to limit the maximum cable length and/or the switching frequency of the motor drive, depending on the real ambient temperature conditions.

FN 510 are designed for:

Tamb.	Max. fs	Max. cable
50°C	10 kHz	80 m

Possible application, e.g.:

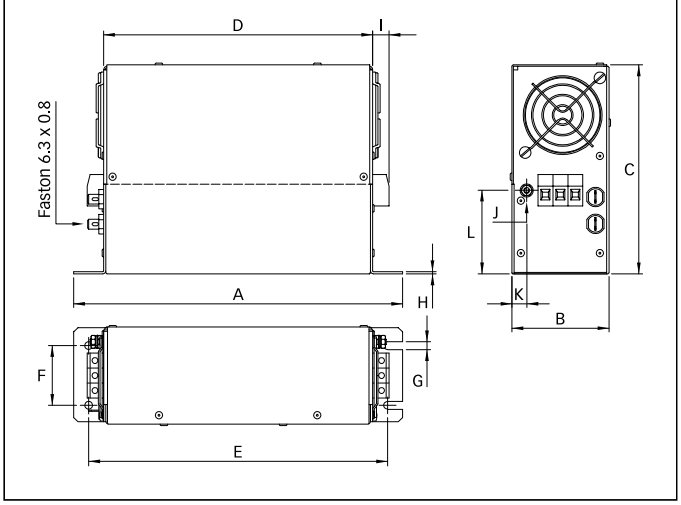
50°C	16 kHz	50 m
40°C	16 kHz	80 m

Temperature monitoring function

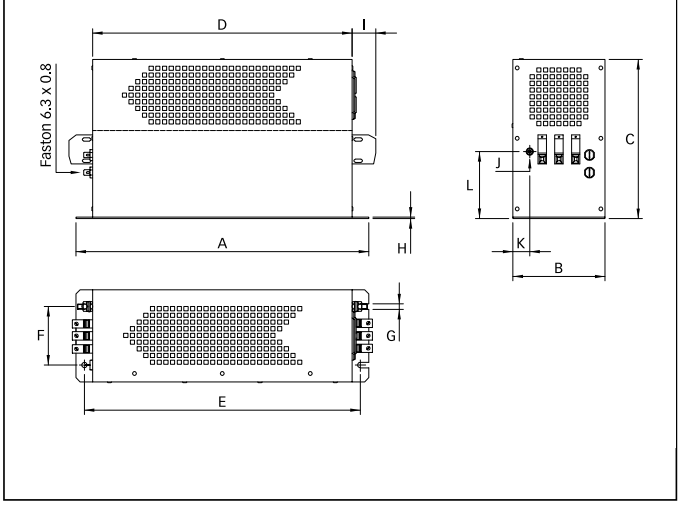
The temperature monitoring device opens a potential-free contact in the case of filter overtemperature (>120°C). The maximum switching capability is 5 A/240 V. The switch can be used, for example, in the input of a CNC controller or as the trip of a circuit breaker in order to interrupt the mains power supply.

Mechanical data

4 to 16 A types



24 to 66 A types



Dimensions

	4 A	8 A	12 A	16 A	24 A	33 A	50 A	66 A
A	220	220	260	260	350	350	470	470
B	65	65	85	85	110	110	140	140
C	140	140	160	160	190	190	235	235
D	180	180	220	220	310	310	420	420
E	200	200	240	240	330	330	440	440
F	40	40	60	60	70	70	100	100
G	5.3	5.3	6.5	6.5	6.5	6.5	8.3	8.3
H	1.5	1.5	1.5	1.5	2	2	5	5
I	10.9	10.9	10.9	10.9	25	25	39	39
J	M4	M4	M4	M4	M6	M6	M8	M8
K	10	10	12.5	12.5	20	20	20	20
L	56	56	65	65	80	80	125	125

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

Filter input/output connector cross sections

	-29	-33	-34
Solid wire	6 mm^2	16 mm^2	35 mm^2
Flex wire	4 mm_2	10 mm^2	25 mm^2
AWG type wire	AWG 10	AWG 6	AWG 2
Recommended torque	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm

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

For additional information please ask for FN 510 installation instructions and the Schaffner application note „Output Filters for Use with Frequency Inverters in Motor Drive Applications".

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