

Output filter for motor drives

SCHAFFNER

energy efficiency and reliability



- 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

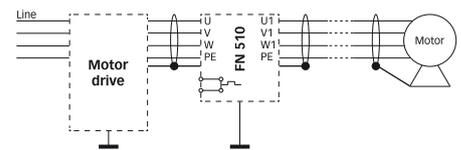
Design protected by international patent

ROHS
2002/95/EC

Technical specifications

Nominal operating voltage:	3x 500/288VAC
Motor frequency:	0 to 400Hz (4 to 24A)
	0 to 200Hz (33 to 66A)
Switching frequency:	2 to 16kHz
Rated currents:	4 to 66A @ 50°C
Motor cable length:	80m max. @ 16kHz
Voltage drop:	≤10V @ 50Hz
Typical dv/dt reduction:	Factor 8 to 12
Typical reduction of overvoltages:	≤1000V
High potential test voltage:	P → E 2500VDC for 2 sec
	P → P 1100VDC for 2 sec
Protection category:	IP20
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 94V-2 or better
Design corresponding to:	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 50°C/400V (Mil-HB-217F):	>100,000 hours

Typical block schematic



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.
- IP20 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

Filter selection table

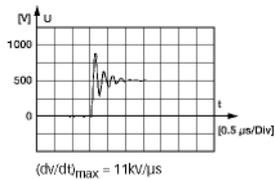
Filter	Rated current @ 50°C	Typical motor power rating*	Typical power loss**	Input/Output connections 	Weight [kg]
	[A]	[kW]	[W]		
FN 510-4-29	4	1.5	90	-29	2.1
FN 510-8-29	8	3.7	90	-29	2.1
FN 510-12-29	12	5.5	90	-29	4
FN 510-16-29	16	7.5	90	-29	4.8
FN 510-24-33	24	11	100	-33	7.7
FN 510-33-33	33	15	110	-33	10
FN 510-50-34	50	22	130	-34	21
FN 510-66-34	66	30	150	-34	22

* General purpose four-pole (1500r/min) AC induction motor rated 400V/50Hz.

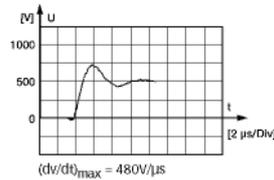
** Power loss at 16kHz switching frequency/80m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

Typical measurement results

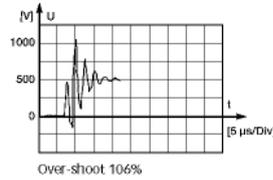
dv/dt without FN 510



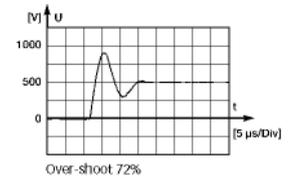
dv/dt with FN 510



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 14kHz switching frequency, 5m of shielded cable, motor with 100% load.

Overvoltage limitation: maximum overvoltages at the motor terminals, measured with the motor drive operating at 14kHz switching frequency, 80m 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	10kHz	80m

Possible application, e.g.:

50°C	16kHz	50m
40°C	16kHz	80m

Temperature monitoring function

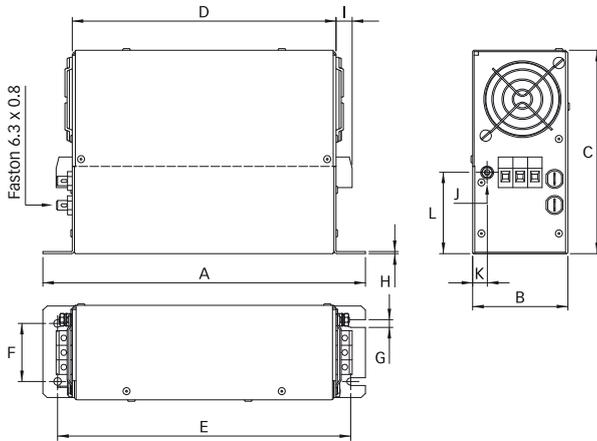
The temperature monitoring device opens a potential-free contact in the case of filter overtemperature (>120°C). The maximum

switching capability is 5A/240V. The switch can be used, for example, in the input of a CNC controller or as the trip of a circuit

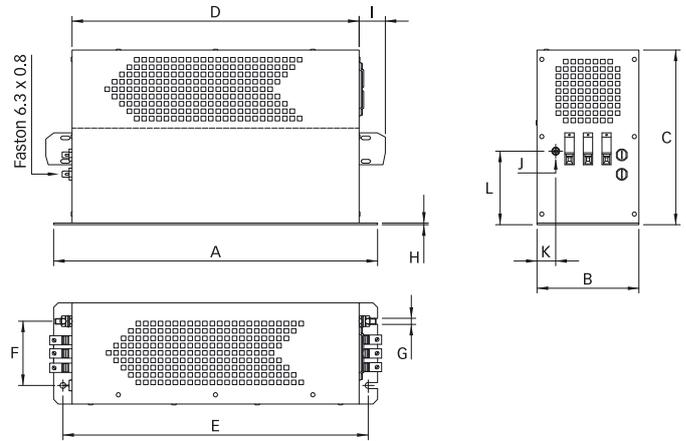
breaker in order to interrupt the mains power supply.

Mechanical data

4 to 16A types



24 to 66A types



Dimensions

	4A	8A	12A	16A	24A	33A	50A	66A
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 = 25.4mm
Tolerances according: ISO 2768-m / EN 22768-m

Filter input/output connector cross sections

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

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“.