



Output filters and load reactors

FN 510	63
FN 520	66
FN 530	69
FN 5010	72
FN 5020	75
FN 5030	78
RWK 305	81

Output filters and load reactors. Output components for motor protection and the improvement of system reliability, availability and functionality. Deployed at the output side of frequency inverters, these filters ensure reliable operation by avoiding expensive downtimes of installations, manufacturing plants, machinery and a vast array of other industrial and domestic motor drive applications due to premature motor damage. An appropriate output solution will even allow the deployment of unshielded motor cables, the use of multiple motors in parallel on the same drive or the retrofit of modern drives in existing installations with old motors and unshielded cabling.

Filter family	Max. voltage	Typical motor power [kW]						Features										Typ. applications							
		0	60	120	180	240	>300	dv/dt restriction	Overvoltage restriction	Motor temperature reduction	Red. acoustic motor noise	Sym. sinusoidal output signal	Asym. sinusoidal output signal	Eliminat. of bearing damage	Replaces cable shields	Connection to dc link required	Improves overall EMC	Reduces equipment downtime	Motor drives	Servo drives, torque motors	High-speed motor applications	Appl. with long unshield. cabl.	Retrofit of motor drives		
FN 510 p. 63	520VAC	0	60	120	180	240	>300																		
FN 520 p. 66	520VAC	0	60	120	180	240	>300																		
FN 530 p. 69	520VAC	0	60	120	180	240	>300																		
FN 5010 p. 72	440VAC	0	60	120	180	240	>300																		
FN 5020 p. 75	500VAC	0	60	120	180	240	>300																		
FN 5030* p. 78	500VAC	0	60	120	180	240	>300																		
RWK 305 p. 81	500VAC	0	60	120	180	240	>300																		

* Additional output filter module to be operated in conjunction with FN 5010 or FN 5020

Output filter for motor drives



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

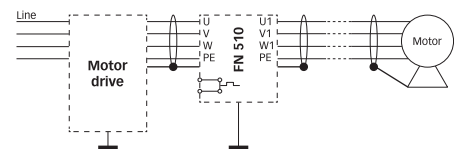
Design protected by international patent



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

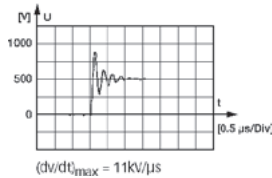
Filter	Rated current @ 50°C	Typical motor power rating*	Typical power loss**	Input/Output connections 	Weight [kg]
	[A]	[kW]	[W]		
FN 510-4-29	4	1.5	90	-29	2.1
FN 510-8-29	8	3.7	90	-29	2.1
FN 510-12-29	12	5.5	90	-29	4
FN 510-16-29	16	7.5	90	-29	4.8
FN 510-24-33	24	11	100	-33	7.7
FN 510-33-33	33	15	110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

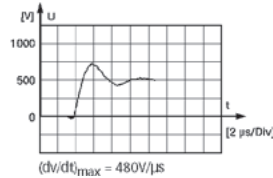
** Power loss at 16kHz switching frequency/80m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

Typical measurement results

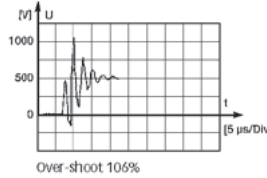
dv/dt without FN 510



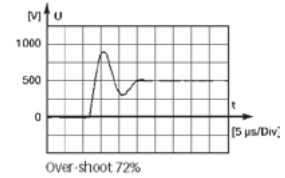
dv/dt with FN 510



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.

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 have been designed for an ambient

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

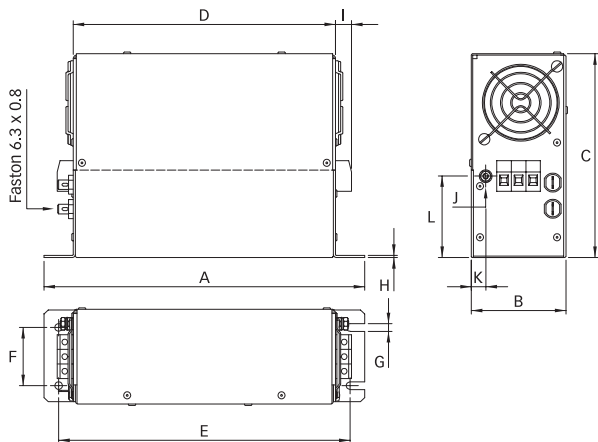
The temperature monitoring device opens a potential-free contact in the case of filter overtemperature (>120°C). The maximum

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

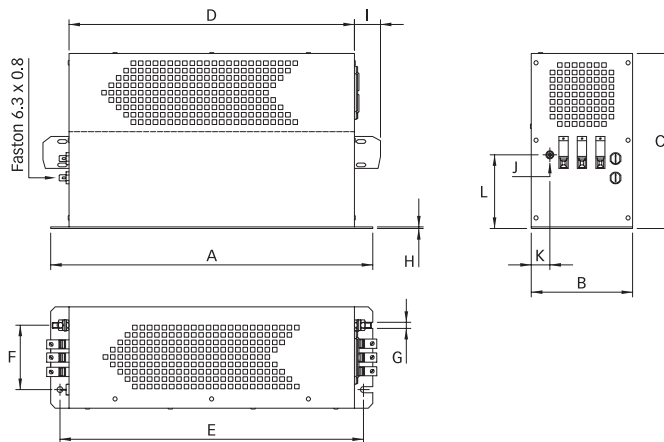
breaker in order to interrupt the mains power supply.

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 / EN 22768

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“.

Sine wave output filter for motor drives

SCHAFFNER

energy efficiency and reliability



- Smoothing of PWM drive output voltage
- Efficient motor protection
- Increase of motor service life
- Reduction of audible motor noise
- Reduction of parasitic losses
- Improvement of system reliability

Approvals



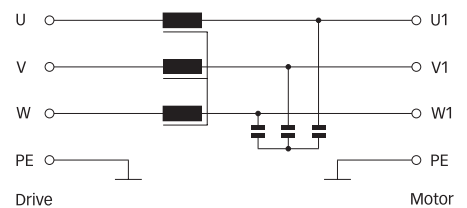
Technical specifications

Nominal operating voltage:	3x 500/288VAC
Motor frequency:	0 to 200Hz
Switching frequency:	6 to 20kHz
Rated currents:	4 to 16A @ 40°C
Motor cable length:	200m max.
Voltage drop:	≤10V @ 50Hz
Residual ripple voltage:	<5%
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 +100°C (25/100/21)
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 40°C/400V (Mil-HB-217F):	>100,000 hours

Features and benefits

- Conversion of the PWM output signal (symmetrical voltage components) of motor drives into a smooth sine wave with low residual ripple.
- Elimination of premature motor damage caused by high dv/dt, overvoltages, motor overheating and eddy current losses.
- Significantly increased service life of electric motors.
- Reduction of the pulse load of motor drive IGBTs and the parasitic losses on long shielded motor cables.
- Reduction of audible motor noise.
- Less interference propagation towards neighboring equipment or lines.
- IP20 housing and touch-safe terminals contribute to overall equipment safety.


Typical electrical schematic



Typical applications

- Motor drive applications with medium to long motor cables
- Pumps
- Conveyors
- HVAC applications
- Elevators
- General automation tasks
- Applications with multiple motors in parallel

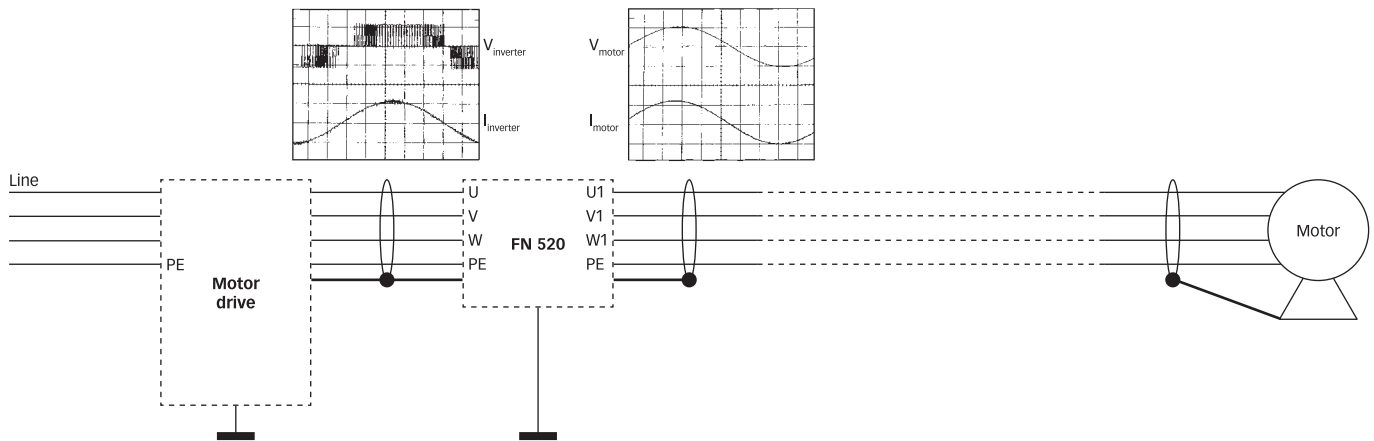
Filter selection table

Filter	Rated current @ 40°C	Typical motor power rating*	Typical power loss**	Input/Output connections	Weight
	[A]	[kW]	[W]		[kg]
FN 520-4-29	4	1.5	13	-29	8
FN 520-8-29	8	3.0	25	-29	11
FN 520-12-29	12	5.5	42	-29	15
FN 520-16-33	16	7.5	33	-33	18

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

** Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

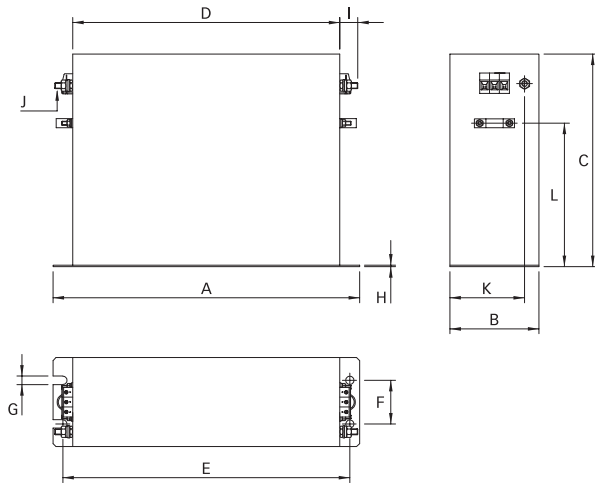
Typical block schematic



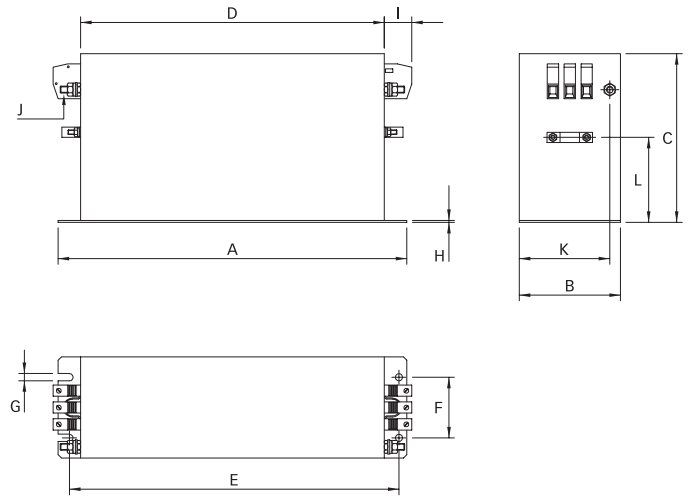
For additional information please ask for FN 520 installation instructions and the Schaffner application note „Output Filters for Use with Frequency Inverters in Motor Drive Applications“.

Mechanical data

4 to 12A types



16A types



Dimensions

	4A	8A	12A	16A
A	310	310	310	300
B	90	90	90	145
C	150	180	215	190
D	270	270	270	260
E	293	293	290	280
F	44	44	44	105
G	6.5	6.5	8.7	8.7
H	1.5	1.5	1.5	2.3
I	19	19	19	25
J	M6	M6	M6	M6
K	75	75	75	112.5
L	80	110	145	100

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

Filter input/output connector cross sections

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

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

Sine wave and EMC output filter for motor drives with a voltage dc link

SCHAFFNER

energy efficiency and reliability



- Smoothing of PWM drive output voltage
- Efficient motor protection
- Reduction of common-mode interferences on motor cables
- Improvement of EMC environment
- Elimination of motor bearing damages
- Possibility to use very long unshielded motor cables
- Improvement of system reliability

Design protected by international patent

ROHS
2002/95/EC

Technical specifications

Nominal operating voltage:	3x 500/288VAC
dc link voltage:	850VDC max.
Motor frequency:	0 to 200Hz
Switching frequency:	6 to 20kHz
Rated currents:	4 to 16A @ 40°C
Motor cable length:	1000m max.
Voltage drop:	≤10V @ 50Hz
Current in +/- control loop:	1 to 2A approx.
Residual ripple voltage:	<5%
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 +100°C (25/100/21)
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 40°C/400V (Mil-HB-217F):	>100,000 hours



Features and benefits

- Conversion of the PWM output signal (differential and common-mode voltage components) of motor drives into a smooth sine wave with low residual ripple.
- Elimination of premature motor damage caused by high dv/dt, overvoltages, motor overheating, eddy current losses or bearing damage.
- Elimination of interference propagation towards components or conductors in the vicinity.
- Provision of all benefits of traditional LC sine wave filters, plus:
- Allows the use of extremely long unshielded motor cables without causing radiation problems (EN 55014, MDS clamp).
- Restricts pulse currents to ground and hence limits leakage currents in the PE.
- Reduces the required EMI suppression efforts on the line side.
- Allows the use of lower rated drives with long motor cables due to lower losses in the IGBTs and in the motor cable.

Typical applications

- Motor drive applications with extremely long motor cables
- Motor drive applications with unshielded motor cables
- Chemical and petro-chemical applications
- Semi-conductor manufacturing
- Mission critical applications
- Applications with multiple motors in parallel
- Retrofit of motor drives into existing installations with old wiring and motors

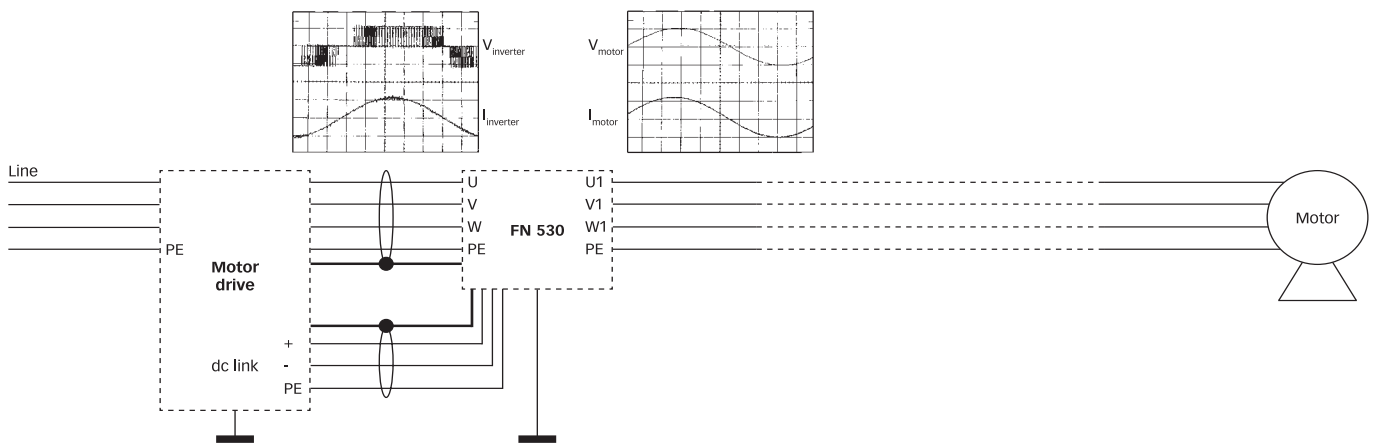
Filter selection table

Filter	Rated current @ 40°C	Typical motor power rating*	Typical power loss**	Input connections	Output connections	Weight
	[A]	[kW]	[W]			[kg]
FN 530-4-99	4	1.5	15	-29	-99	11.5
FN 530-8-99	8	3.0	33	-29	-99	15
FN 530-12-99	12	5.5	50	-29	-99	18.5
FN 530-16-99	16	7.5	37	-33	-99	21

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

** Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

Typical block schematic



Connection to the dc link

For best results, the connection to the dc link of the motor drive is required with this series of filters.

If only one connection to the dc link is brought out of the drive («+» or «-») then the dc link cable connections from the filter (identified by «DC+» and «DC-») must be con-

nected together to the «+» or «-» motor drive connection.

The operation of the sine wave interference filter is not seriously affected as a result.

The «+» and «-» connections on the motor drive must never be connected together.

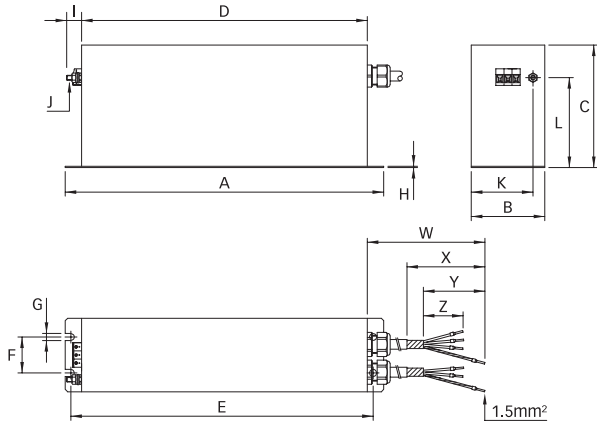
Otherwise a short-circuit will result.

The PWM switching frequency must lie within the range from 6 to 20kHz in order to ensure satisfactory operation of the filter. A lower switching frequency or a pure square wave is unsuitable and will result in the motor drive switching off with the error message «overcurrent or short to earth.»

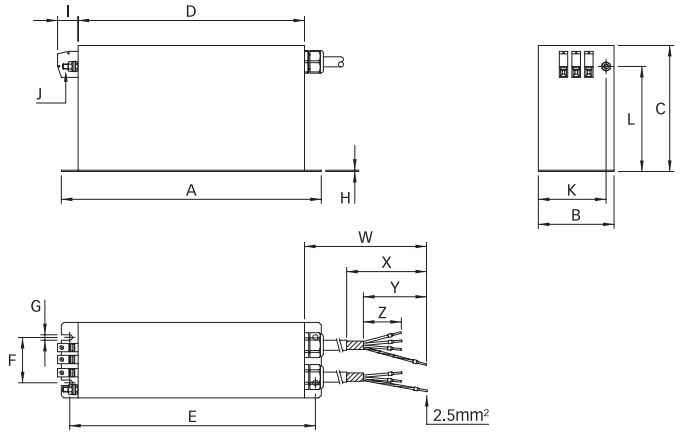
For additional information please ask for FN 530 installation instructions and the Schaffner application note „Output Filters for Use with Frequency Inverters in Motor Drive Applications“.

Mechanical data

4 to 12A types



16A types



Dimensions

	4A	8A	12A	16A
A	390	390	390	350
B	90	90	90	140
C	150	180	215	230
D	350	350	350	310
E	373	370	370	330
F	44	44	44	95
G	6.5	8.7	8.7	8.7
H	1.5	1.5	1.5	2.3
I	19	19	19	25
J	M6	M6	M6	M6
K	75	75	75	107.5
L	107	137	172	181
W	720 +15/-0	720 +15/-0	720 +15/-0	720 +15/-0
X	120	120	120	120
Y	100	100	100	100
Z	70	70	70	70

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

Filter input connector cross sections

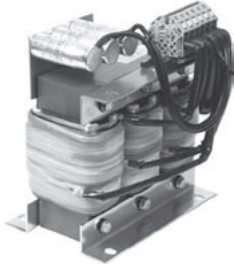
	-29	-33
Solid wire	6mm ²	16mm ²
Flex wire	4mm ²	10mm ²
AWG type wire	AWG 10	AWG 6
Recommended torque	0.6 - 0.8Nm	1.5 - 1.8Nm

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

Universal sine wave output filter for motor drives

SCHAFFNER

energy efficiency and reliability



- Smoothing of PWM drive output voltage
- Efficient motor protection
- Increase of motor service life
- Reduction of audible motor noise
- Reduction of parasitic losses
- Improvement of system reliability

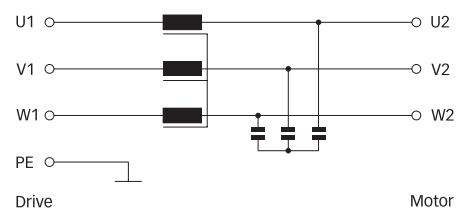
Approvals



Technical specifications

Nominal operating voltage:	3x 400/230VAC ±10%
Motor frequency:	0 to 70Hz
Switching frequency:	4 to 16kHz
Rated currents:	2.5 to 610A @ 40°C
Motor cable length:	400m max. shielded 300m max. unshielded
Impedance (uk):	10% @ nominal voltage, 50Hz & rated current
Residual ripple voltage:	<5%
High potential test voltage:	P → E 3000VAC for 3 sec P → P 2000VAC for 3 sec
Protection category:	IP00 (filters up to 150A according to VBG 4)
Overload capability:	2x rated current at switch on for 30 seconds, 1.5x rated current for 1 minute, once per hour
Temperature range (operation and storage):	-25°C to +85°C (25/085/21)
Insulation class:	T40/F (155°C)
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	EN 61558-2-20 (VDE 0570-2-20)

Typical electrical schematic



Features and benefits

- Conversion of the PWM output signal (symmetrical voltage components) of motor drives into a smooth sine wave with low residual ripple.
- Elimination of premature motor damage caused by high dv/dt, overvoltages, motor overheating and eddy current losses.
- Significantly increased service life of electric motors.
- Reduction of the pulse load of motor drive IGBTs and the parasitic losses on long shielded motor cables.
- Cost-effective and space-saving open frame filter design.
- Vacuum impregnation ensures less humming noise and high durability.

Typical applications

- Motor drive applications with long motor cables
- Pumps
- Conveyors
- HVAC applications
- Elevators
- General automation tasks
- Applications with multiple motors in parallel

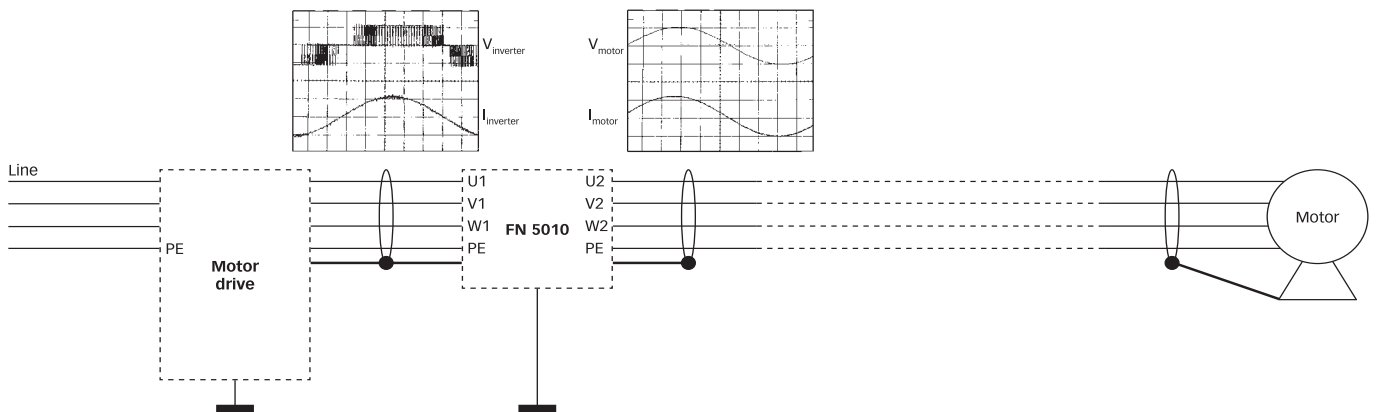
Filter selection table

Filter	Rated current @ 40°C	Typical motor power rating*	Nominal inductance	Nominal capacitance	Typical power loss**	Input/Output connections	Total	Cu.	Weight Al.
	[A]	[kW]	[mH]	[µF]	[W]	[kg]			
FN 5010-2.5-99	2.5	1.1	22.4	1.5	50	-99	2.6	0.68	
FN 5010-4.5-99	4.5	2.2	11	1.5	66	-99	3	1.1	
FN 5010-8-99	8	4	7.2	1.5	73	-99	6.6	2.2	
FN 5010-10-99	10	5.5	4.2	1.5	91	-99	6.6	2.6	
FN 5010-13-99	13	7.5	4.2	1.5	124	-99	7.3	3.2	
FN 5010-18-99	18	11	3.5	1.5	144	-99	11.5	3.6	
FN 5010-24-99	24	15	2.4	1.5	191	-99	14	5	
FN 5010-32-99	32	18.5	2	2	273	-99	16	6.8	
FN 5010-42-99	42	22	1.58	7	252	-99	22	7.4	
FN 5010-48-99	48	30	1.5	4	340	-99	28	8.8	
FN 5010-60-99	60	30	1.1	4	290	-99	35	10.9	
FN 5010-75-99	75	37	0.9	4	340	-99	42	11.5	
FN 5010-90-99	90	45	0.8	5	360	-99	46	12.8	
FN 5010-110-99	110	55	0.7	5	400	-99	58	13	
FN 5010-150-99	150	75	0.5	7	716	-99	75	14.8	
FN 5010-180-99	180	90	0.4	10	820	-99	88	1.4	10.9
FN 5010-210-99	210	110	0.4	10	1065	-99	115	2.1	11.2
FN 5010-270-99	270	132	0.3	12	1230	-99	150	2.1	14
FN 5010-325-99	325	160	0.3	12	1820	-99	194	5.2	21
FN 5010-410-99	410	200	0.2	18	1830	-99	206	5.2	23.8
FN 5010-510-99	510	315	0.17	20	2255	-99	290	6.5	32
FN 5010-610-99	610	355	0.14	25	2520	-99	330	7.7	37.5

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

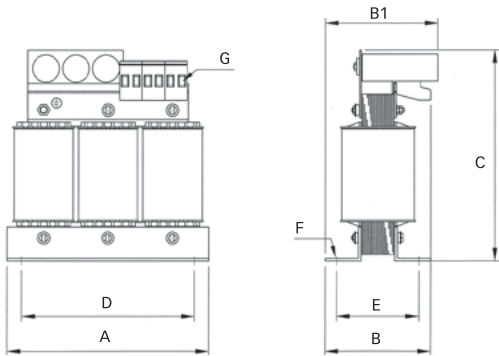
** Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

Typical block schematic

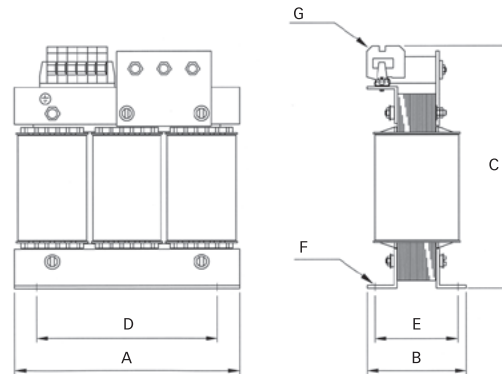


Mechanical data

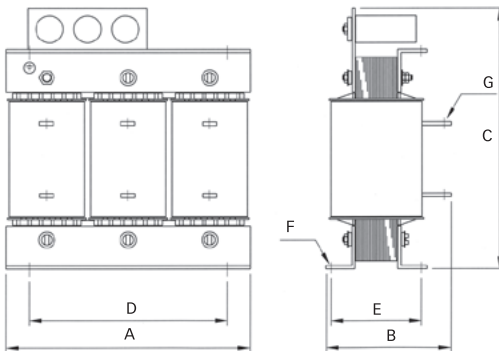
2.5 to 42A types



48 to 150A types



180 to 610A types



Dimensions

	A	B	B1	C	D	E	F	G
2.5A	125	65	110	180	100	45	5 x 8	2.5mm ²
4.5A	125	75	110	180	100	55	5 x 8	2.5mm ²
8 and 10A	155	95	118	205	130	70	8 x 12	4mm ²
13A	190	100	125	230	170	58	8 x 12	4mm ²
18A	190	120	125	230	170	78	8 x 12	10mm ²
24A	210	125	135	260	175	85	8 x 12	10mm ²
32A	210	135	135	260	175	95	8 x 12	10mm ²
42A	230	140	150	285	180	122	8 x 12	10mm ²
48A	240	210	<B	290	190	125	8 x 12	10mm ²
60A	240	220	<B	290	190	135	8 x 12	16mm ²
75A	300	210	<B	345	240	134	11 x 15	35mm ²
90A	300	215	<B	345	240	139	11 x 15	35mm ²
110A	300	237	<B	345	240	161	11 x 15	50mm ²
150A	420	217	<B	470	370	142	11 x 15	50mm ²
180A	420	235	<B	470	370	157	11 x 15	Ø11
210A	420	260	<B	470	370	182	11 x 15	Ø11
270A	420	295	<B	470	370	217	11 x 15	Ø11
325 and 410A	480	310	<B	580	430	234	13 x 18	Ø11
510A	500	370	<B	670	430	248	13 x 18	Ø11
610A	500	370	<B	670	430	268	13 x 18	Ø11

All dimensions in mm; 1 inch = 25.4mm

Tolerances according: ISO 2768 / EN 22768

Sine wave output filter for high-speed motor drives

SCHAFFNER

energy efficiency and reliability



- Smoothing of PMW drive output voltage
- Suitable for motor frequencies up to 600Hz
- Increased service life of expensive high-speed motors
- Reduction of audible motor noise
- Improvement of system reliability
- Production up time for mission critical applications

Approvals

ROHS
2002/95/EC

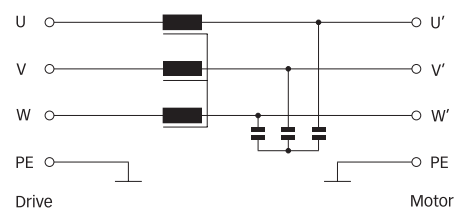
Technical specifications

Maximum continuous operating voltage:	3x 500/288VAC
dc link voltage:	1000VDC max.
Motor frequency:	0 to 600Hz
Switching frequency:	6 to 15kHz
Rated currents:	25 to 120A @ 50°C
Motor cable length:	200m max.
Residual ripple voltage:	<5%
High potential test voltage:	P → E 2000VAC for 2 sec P → P 1000VDC for 2 sec
Protection category:	IP20
Overload capability:	1.5x rated current for 1 minute, once per hour
Temperature range (operation and storage):	-25°C to +100°C (25/100/21)
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 50°C/400V (Mil-HB-217F):	>100,000 hours

Features and benefits

- Suitable for fast rotating fields up to 600Hz.
- Conversion of the PWM output signal (symmetrical voltage components) of motor drives into a smooth sine wave with low residual ripple.
- Elimination of premature motor damage caused by high dv/dt, overvoltages, motor overheating and eddy current losses.
- Significantly increased service life of expensive (high-speed) motors.
- Reduction of the pulse load of motor drive IGBTs and the parasitic losses on long shielded motor cables.
- Less interference propagation towards neighboring equipment or lines.
- Advanced choke design to minimize filter losses and voltage drop.
- IP20 protection, touch-safe terminals and temperature monitoring function to increase overall equipment safety.


Typical electrical schematic



Typical applications

- Motor drives and motors in high-speed applications, like:
 - High-speed spindles
 - Textile machinery
 - Lasers
 - Military appliances (400Hz)
- Motor drive applications with medium to long motor cables and/or with multiple motors in parallel, like:
 - Pumps
 - Conveyors

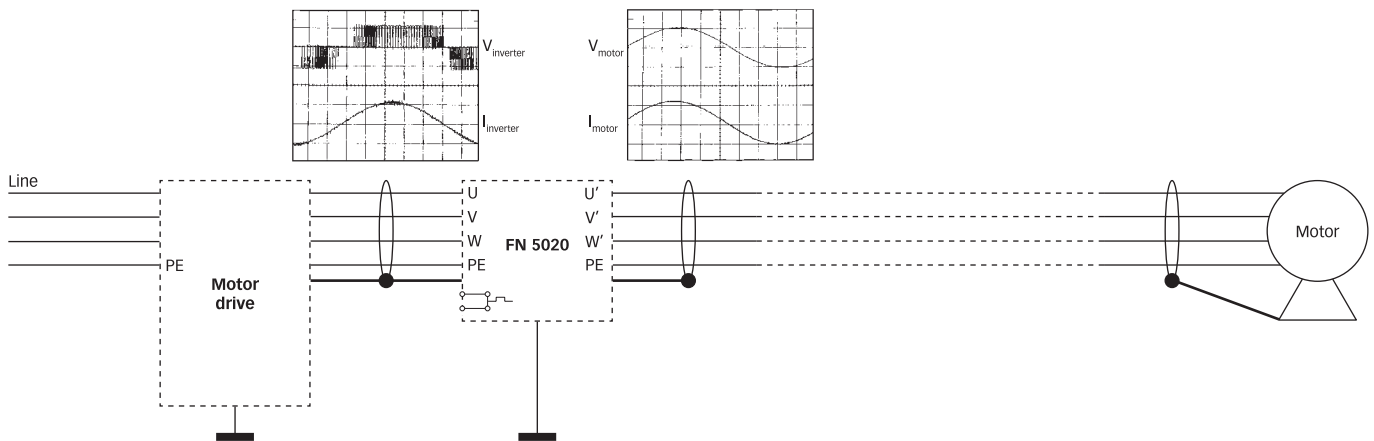
Filter selection table

Filter	Rated current @ 50°C	Typical motor power rating*	Typical power loss**	Output connections	Weight
	[A]	[kW]	[W]		[kg]
FN 5020-25-33	25	15	n.a.	-33	13
FN 5020-55-34	55	30	n.a.	-34	29
FN 5020-75-35	75	45	n.a.	-35	49
FN 5020-120-35	120	75	n.a.	-35	57

* General purpose four-pole (1500r/min) AC induction motor rated 480V/50Hz.

** Exact value highly depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system. Please contact your local Schaffner partner for individual application support.

Typical block schematic



Temperature monitoring function

All filters of this range are equipped with a temperature monitoring function. The built-in temperature sensor opens a potential-free contact in the case of filter overtemperature

(>120°C). The maximum switching capability is 6A/250V. This function 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. Connections are located next to the phase connectors (see mechanical data for details).

Forced cooling

The 75A and 120A filters provide internal cooling fans which require external power

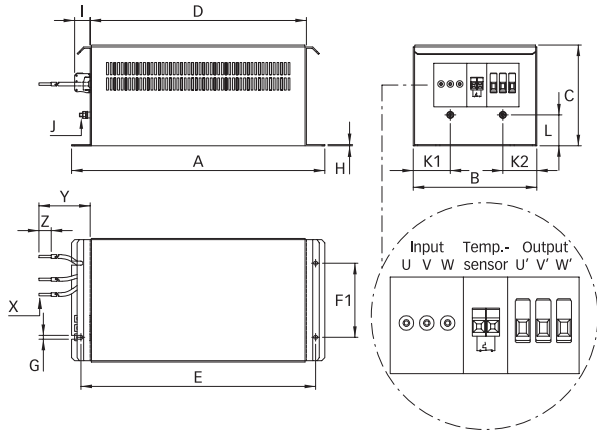
supply (24VDC/~4W). Connections are located next to the connectors of the

temperature sensor (see mechanical data for details).

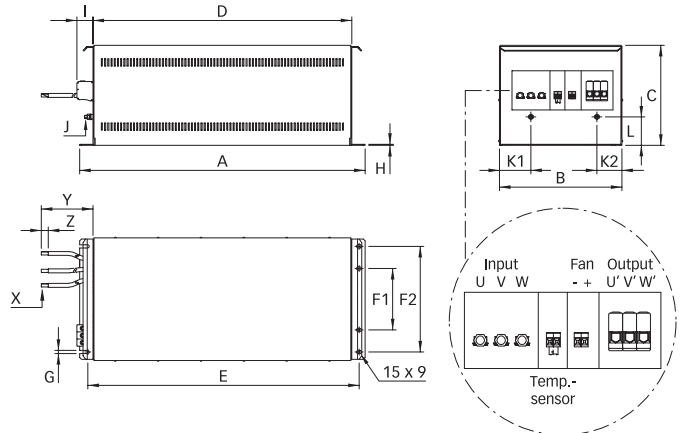
For additional information please consult the Schaffner application note „Sinus Plus – New Output Filter Concept for Power Drive Systems“.

Mechanical data

25 and 55A types



75 and 120A types



Dimensions

	25A	55A	75A	120A
A	410	554	799	799
B	200	250	343	343
C	163	203	280	280
D	350	500	725	725
E	380	524	760	760
F1	120	170	172	172
F2			296	296
G	6.5	9	9	9
H	2	3	3	3
I	25	39	45	45
J	M6	M6	M8	M8
K1	60	70	88	88
K2	55	55	70	70
L	50	69	80	80
X	AWG 10	AWG 6	25mm ²	35mm ²
Y	1000 +20/-0	1000 +20/-0	1000 +20/-0	1000 +20/-0
Z	20	20	20	20

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

Filter output connector cross sections

	-29	-33	-34	-35
Solid wire	6mm ²	16mm ²	35mm ²	50mm ²
Flex wire	4mm ²	10mm ²	25mm ²	50mm ²
AWG type wire	AWG 10	AWG 6	AWG 2	AWG 1/0
Recommended torque	0.6 - 0.8Nm	1.5 - 1.8Nm	4.0 - 4.5Nm	7 - 8Nm

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

Add-on sine wave output filter module for common-mode voltage improvement

SCHAFFNER
energy efficiency and reliability



- Additional module for use with FN 5010 or FN 5020 sine wave filters only
- For motor frequencies up to 600Hz
- Reduction of common-mode interferences on motor cables
- Improvement of EMC environment
- Elimination of motor bearing damages
- Possibility to use very long unshielded motor cables
- Improvement of system reliability

Design protected by international patent

ROHS
2002/95/EC

Technical specifications

Maximum continuous operating voltage:	3x 500/288VAC
dc link voltage:	1000VDC max.
Motor frequency:	0 to 600Hz
Switching frequency:	6 to 15kHz
Rated currents:	25 to 120A @ 50°C
Motor cable length:	1000m max. (in combination with FN 5020 only)
High potential test voltage:	P → E 2000VAC for 2 sec P → P 1100VDC for 2 sec
Protection category:	IP20
Overload capability:	1.5x rated current for 1 minute, once per hour
Temperature range (operation and storage):	-25°C to +100°C (25/100/21)
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
MTBF @ 50°C/400V (Mil-HB-217F):	>100,000 hours

Features and benefits

- Add-on output filter module for the use with FN 5010 or FN 5020 sine wave output filters from Schaffner.
- Elimination of premature motor failure caused by bearing damage.
- Eliminates interference propagation towards components or conductors in the vicinity.
- Restricts pulse currents to ground and hence limits leakage currents in the PE.
- Allows the use of extremely long unshielded motor cables without causing radiation problems (EN 55014, MDS clamp).
- Reduces the required EMI suppression efforts on the line side.
- Allows the use of lower rated drives with long motor cables due to lower losses in the IGBTs and in the motor cable.
- Suitable for rotating fields up to 600Hz.


Typical applications

- Motor drive applications with extremely long motor cables
- Motor drive applications with unshielded motor cables
- Motor drives and motors in high-speed applications
- Mission critical applications
- Applications with multiple parallel motors
- Retrofit of motor drives into existing installations with old wiring and motors

Important note

FN 5030 are additional common-mode modules. They can NOT work alone! FN 5030 have to be operated downstream of a regular (symmetrical) sine wave output filter. Possible combinations are FN 5020/FN 5030 for motor frequencies up to 600Hz, or FN 5010/FN 5030 for max. 70Hz. For additional information please consult the Schaffner application note „Sinus Plus – New Output Filter Concept for Power Drive Systems“.

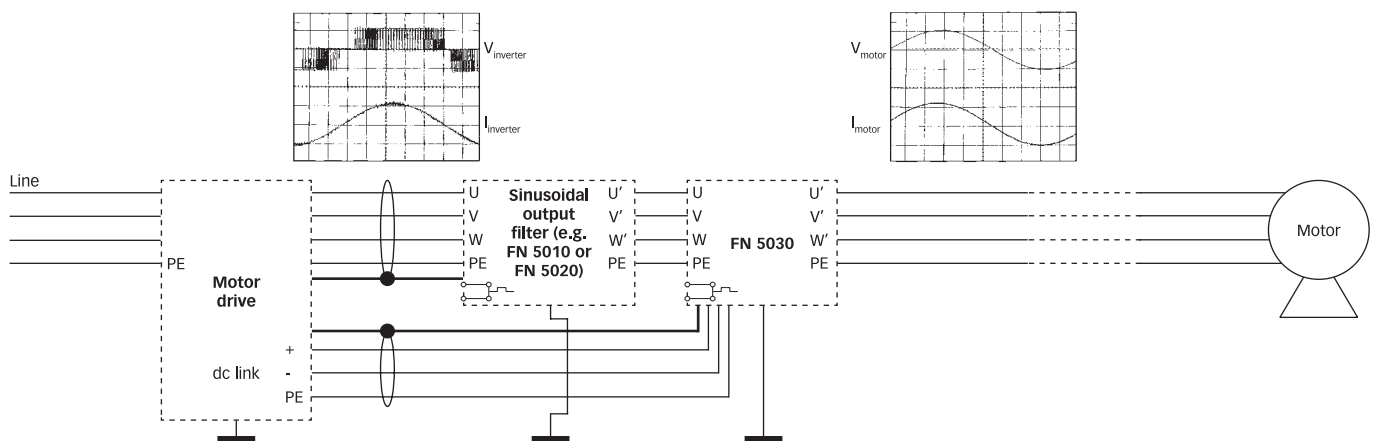
Filter selection table

Filter	Rated current @ 50°C	Typical motor power rating*	Typical power loss**	Output connections	Weight
	[A]	[kW]	[W]		[kg]
FN 5030-25-33	25	15	n.a.	-33	13
FN 5030-55-34	55	30	n.a.	-34	14
FN 5030-75-35	75	45	n.a.	-35	27
FN 5030-120-35	120	75	n.a.	-35	40

* General purpose four-pole (1500r/min) AC induction motor rated 480V/50Hz.

** Exact value highly depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system. Please contact your local Schaffner partner for individual application support.

Typical block schematic



Temperature monitoring function

All filters of this range are equipped with a temperature monitoring function. The built-in temperature sensor opens a potential-free contact in the case of filter overtemperature

(>120°C). The maximum switching capability is 6A/250V. This function 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. Connections are located next to the phase connectors (see mechanical data for details).

Forced cooling

The 75A and 120A filters provide internal cooling fans which require external power

supply (24VDC/~4W). Connections are located next to the connectors of the

temperature sensor (see mechanical data for details).

Connection to the dc link

For best results, the connection to the dc link of the motor drive is required with this series of filters.

If only one connection to the dc link is brought out of the drive («+» or «-») then the dc link cable connections from the filter (identified by «DC+» and «DC-») must be

connected together to the «+» or «-» motor drive connection.

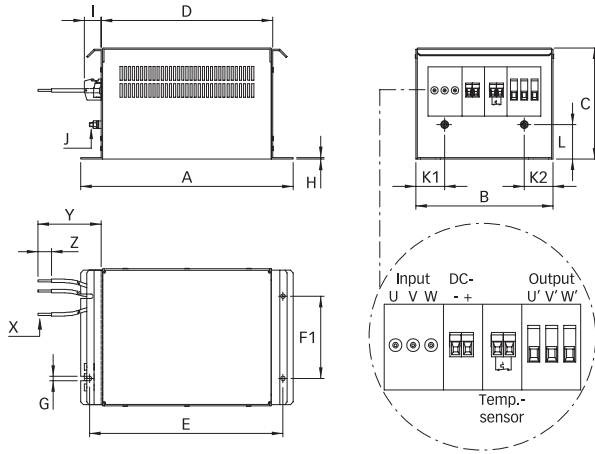
The operation of the add-on sine wave output filter is not seriously affected as a result.

The «+» and «-» connections on the motor drive must never be connected together. Otherwise a short-circuit will result.

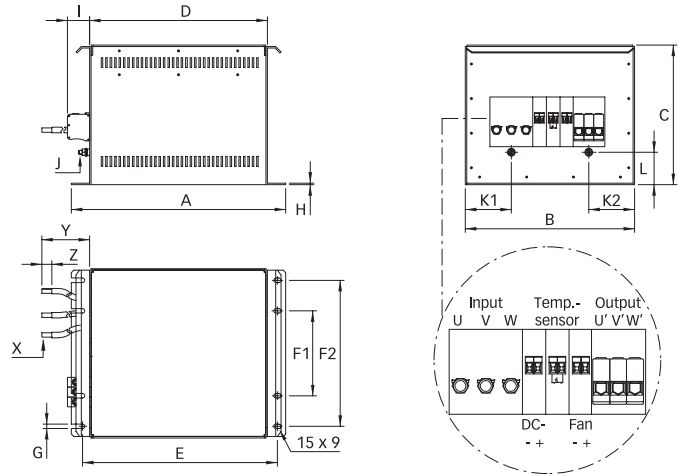
The PWM switching frequency must lie within the range from 6 to 15kHz in order to ensure satisfactory operation of the filter. A lower switching frequency or a pure square wave is unsuitable and will result in the motor drive switching off with the error message «overcurrent» or «short to earth».

Mechanical data

25 and 55A types



75 and 120A types



Dimensions

	25A	55A	75A	120A
A	310	354	434	434
B	200	250	343	343
C	162	200	283	283
D	246	300	360	360
E	280	324	395	395
F1	120	170	172	172
F2			296	296
G	6.5	9	9	9
H	2	3	3	3
I	25	39	45	45
J	M6	M6	M8	M8
K1	42	70	93	93
K2	42	55	93	93
L	50	66	66	66
X	AWG 10	AWG 6	25mm ²	35mm ²
Y	1000 +20/-0	1000 +20/-0	1000 +20/-0	1000 +20/-0
Z	20	20	20	20

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

Filter output connector cross sections

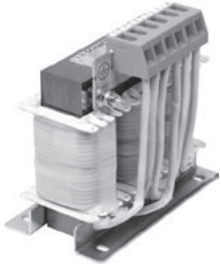
	-29	-33	-34	-35
Solid wire	6mm ²	16mm ²	35mm ²	50mm ²
Flex wire	4mm ²	10mm ²	25mm ²	50mm ²
AWG type wire	AWG 10	AWG 6	AWG 2	AWG 1/0
Recommended torque	0.6 - 0.8Nm	1.5 - 1.8Nm	4.0 - 4.5Nm	7 - 8Nm

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

Three-phase dv/dt reactor for efficient motor protection

SCHAFFNER

energy efficiency and reliability



- Reduction of drive output voltage dv/dt
- Reduction of motor temperature
- Increase of motor service life
- Compact and economic open frame design
- Standard catalog reactors up to 1100A
- UL rated materials used

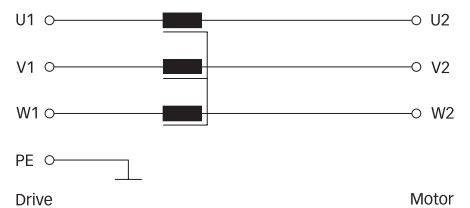
Approvals

ROHS
2002/95/EC

Technical specifications

Maximum continuous operating voltage:	3x 500/288VAC
Motor frequency:	60Hz max.
Switching frequency:	2 to 16kHz
Rated currents:	4 to 1100A @ 40°C
Motor cable length:	30m max. @ 16kHz (derating curve next page)
Impedance (uk):	0.8% @ 400VAC, 50Hz & rated current
Typical dv/dt reduction:	≥ factor 5
High potential test voltage:	P → E 3000VAC for 3 sec P → P 3000VAC for 3 sec
Protection category:	IP00 (KL types according to VBG 4)
Overload capability:	2x rated current at switch on for 30 seconds 1.5x rated current for 1 minute, once per hour
Temperature range (operation and storage):	-25°C to +100°C (25/100/21)
Insulation class:	T40/B (130°C) → RWK 305: ≤110A T40/F (155°C) → RWK 305: >110A
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	EN 61558-2-20 (VDE 0570-2-20)
MTBF @ 40°C/400V (Mil-HB-217F):	>200,000 hours

Typical electrical schematic






Features and benefits

- Efficient reduction of high output voltage dv/dt from IGBT motor drives.
- Protection of motor coil insulation from premature aging and destruction.
- Significantly increased service life of electric motors.
- High reliability and secured production up time for mission critical applications.
- Reduced converter pulse load.
- Less interference propagation towards neighboring equipment of lines.
- „Output filter“ with low impedance, ideal for processes requiring exceptional precision and reproducibility of movements.
- Vacuum impregnation for reduced humming noise and high durability.

Typical applications

- Servo drives
- Close loop vector drives
- Motor drive applications with short motor cables
- Machinery comprising servo or torque motors
- Robots
- Pick and place machines

Reactor selection table

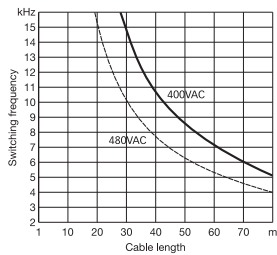
Reactor	Rated current @ 40°C [A]	Typical motor power rating* [kW]	Nominal inductance [mH]	Typical power loss** [W]	Input/Output connections			Total [kg]	Weight Al.	
									Cu. [kg]	Al. [kg]
RWK 305-4-KL	4	1.5	1.47	22	KL			1.2	0.14	
RWK 305-7.8-KL	7.8	3	0.754	25	KL			1.2	0.28	
RWK 305-10-KL	10	4	0.588	30	KL			1.8	0.22	
RWK 305-14-KL	14	5.5	0.42	34	KL			2.2	0.35	
RWK 305-17-KL	17	7.5	0.346	38	KL			2.5	0.5	
RWK 305-24-KL	24	11	0.245	45	KL			2.5	0.5	
RWK 305-32-KL	32	15	0.184	55	KL			3.9	0.56	
RWK 305-45-KL	45	22	0.131	60	KL			6.1	0.7	
RWK 305-60-KL	60	30	0.098	65	KL			6.1	1.3	
RWK 305-72-KL	72	37	0.082	70	KL			6.1	1.6	
RWK 305-90-KL	90	45	0.065	75	KL			7.4	2.4	
RWK 305-110-KL	110	55	0.053	90	KL			8.2	2.4	
RWK 305-124-KS	124	55	0.047	110		KS		8.2	2.4	
RWK 305-143-KS	143	75	0.041	115		KS		10.7	2.7	
RWK 305-156-KS	156	75	0.038	120		KS		10.7	2.85	
RWK 305-170-KS	170	90	0.035	130		KS		10.7	3.8	
RWK 305-182-KS	182	90	0.032	140		KS		16	2.8	
RWK 305-230-KS	230	132	0.026	180		KS		22	3.5	
RWK 305-280-KS	280	160	0.021	220		KS		29	2.8	
RWK 305-330-KS	330	160	0.018	240		KS		32	3.5	
RWK 305-400-S	400	200	0.015	330			S	34	3.8	2
RWK 305-500-S	500	250	0.012	340			S	35	5.4	3.3
RWK 305-600-S	600	355	0.01	380			S	37	5.4	3.3
RWK 305-680-S	680	400	0.009	410			S	38	7.2	3.5
RWK 305-790-S	790	450	0.007	590			S	43	10.5	3.5
RWK 305-910-S	910	500	0.006	740			S	49	12	3
RWK 305-1100-S	1100	630	0.005	760			S	66	12	3.5

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

** Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

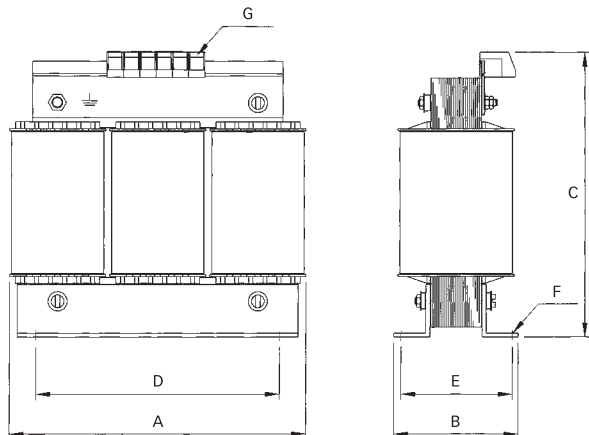
Reactor derating

The maximum admissible motor cable length depends mainly on the switching frequency and the drive output voltage. The applicable value for a given application can be found in the derating curve below.

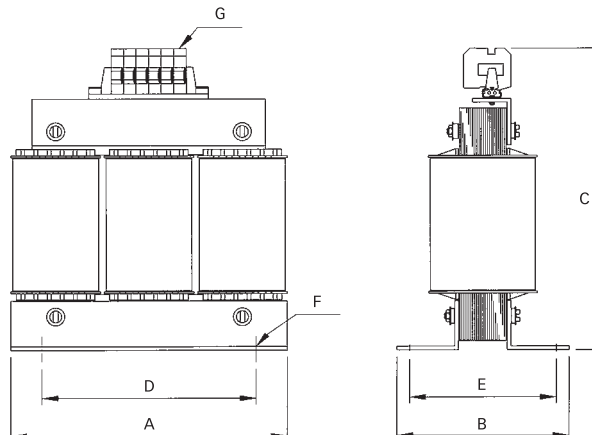


Mechanical data

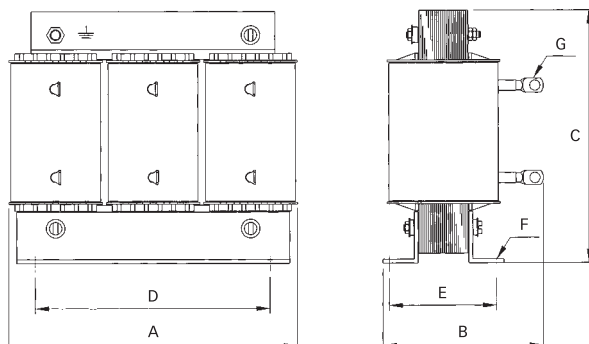
4 to 60A types



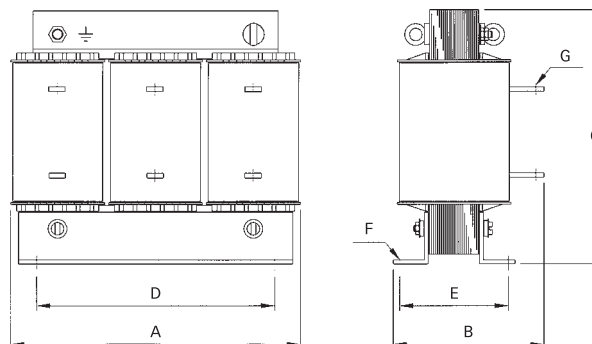
72 to 110A types



124 to 330A types



400 to 1100A types



Dimensions

	A	B	C	D	E	F	G
4 to 7.8A	100	57	120	56	34	4.8 x 8	1.5mm ²
10A	100	65	120	56	43	4.8 x 8	2.5mm ²
14A	125	70	140	100	45	5 x 8	2.5mm ²
17A	125	80	140	100	55	5 x 8	2.5mm ²
24A	125	80	140	100	55	5 x 8	4mm ²
32A	155	95	195	130	56	8 x 12	10mm ²
45 and 60A	155	110	195	130	70	8 x 12	10mm ²
72A	155	110	205	130	70	8 x 12	16mm ²
90A	190	100	240	130	57	8 x 12	35mm ²
110A	190	110	240	130	67	8 x 12	35mm ²
124A	190	150	170	130	67	8 x 12	Ø8
143A	190	160	170	130	77	8 x 12	Ø8
156 and 170A	190	160	170	130	77	8 x 12	Ø10
182A	210	160	185	175	95	8 x 12	Ø10
230A	240	220	220	190	119	11 x 15	Ø12
280A	240	235	220	190	133	11 x 15	Ø12
330A	240	240	220	190	135	11 x 15	Ø12
400 and 500A	240	220	325	190	119	11 x 15	Ø11
600 and 680A	240	230	325	190	128	11 x 15	Ø11
790A	300	218	355	240	136	11 x 15	Ø11
910A	300	228	355	240	148	11 x 15	Ø11
1100A	360	250	380	310	144	11 x 15	Ø11

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

