

# Book-style EMC/RFI Filter for regenerative drive application



- Designed for usage together with LCL filter
- Easy design in with system approach documentation
- Footprint space-saving book-style housing
- Thermal shutdown capability
- Solid safety connector blocks
- Versions with low leakage current

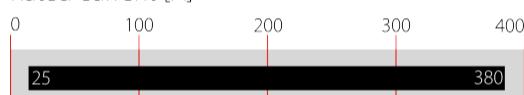


## Performance indicators

### Attenuation performance



### Rated current [A]



## Approvals & Compliances



## Features and Benefits

- FN 3840 series of filters provides state-of-the-art EMI attenuation based on an innovative filter topology. They help to ensure compliance with Class C2 or even C1 limits.
- The filters are built to fit perfectly to regenerative drive applications with LCL filters
- Internal thermocouples ensure reliability and thermal shutdown capabilities
- The slim book-style shape allows a convenient and space-saving installation next to inverters, converters or motor drives.
- The filters offer very high saturation performance, bundled with best EMI performance
- Fulfils the requirements in IEC/EN 61800-5-1 for electric strength, clearance and creepage
- Fulfils the requirements in IEC/EN 60204-1 for insulation resistance, electric strength, clearance and creepage
- Fulfils the requirements in IEC/EN 62477-1 for electric strength, clearance and creepage

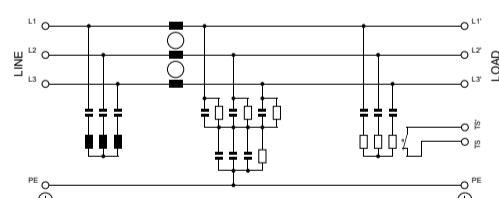
## Technical Specifications

<b>Maximum continuous operating voltage</b>	3x530/305 VAC
<b>Nominal operating voltage</b>	480 VAC
<b>Rated currents</b>	25 to 380 A 25 to 380 A @ 50°C
<b>Overload capability</b>	6x rated current for 1 sec, once per hour 1.6x rated current for 1 minute, once per hour
<b>Operating frequency</b>	DC to 50/60 Hz
<b>High potential test voltage</b>	TS/TS' -> 3P 2550 VDC for 2 s P -> E 2550 VDC for 2 s P -> P 2550 VDC for 2 s TS/TS' -> E 2550 VDC for 2 s TS/TS' -> E 2550 VDC for 2 s TS/TS' -> 3P 2550 VDC for 2 s TS/TS' -> E 2550 VDC for 2 s TS/TS' -> 3P 2550 VDC for 2 s TS/TS' -> E 2550 VDC for 2 s TS/TS' -> 3P 2550 VDC for 2 s
<b>Overvoltage category</b>	III acc. IEC 60664-1
<b>Pollution degree</b>	2 acc. IEC 60664-1
<b>Surge withstand</b>	2kV (P-P) / 4kV (3P - E) acc. to IEC 6100-4-5
<b>Temperature range (operation and storage)</b>	-40°C to +100°C (with current derating >50°C)
<b>Climatic category</b>	40/100/21 acc. to IEC 60068-1
<b>Altitude</b>	up to 2000m no derating applies. Above 2000m derating acc. to IEC 60664-1 applies
<b>Protection category</b>	IP 20 (terminal block versions) and IP00 (busbar versions) acc. to IEC 60529-1
<b>Flammability corresponding to</b>	Terminals: UL 94 V-0
<b>Vibration and shock</b>	3M4 (operation) acc. to IEC 60721-3-3
<b>Design corresponding to</b>	UL 60939-3, IEC 60939-3
<b>Compliance with insulation requirement</b>	> 1MOhm acc. to IEC 60204-1
<b>MTBF (Mil-HB-217F)</b>	>300,000 h @ 50°C/480 V

## Typical Applications

- Regenerative drives in combination with LCL filters
- Active infeed converter (AIC)
- Active front end (AFE) variable frequency drives (VFD)
- Three-phase variable speed drives (VSD) and power drive systems (PDS)
- Renewable Energy
- Machine tool and machinery equipment
- Process automation equipment

## Typical electrical schematic



## Filter Selection Table

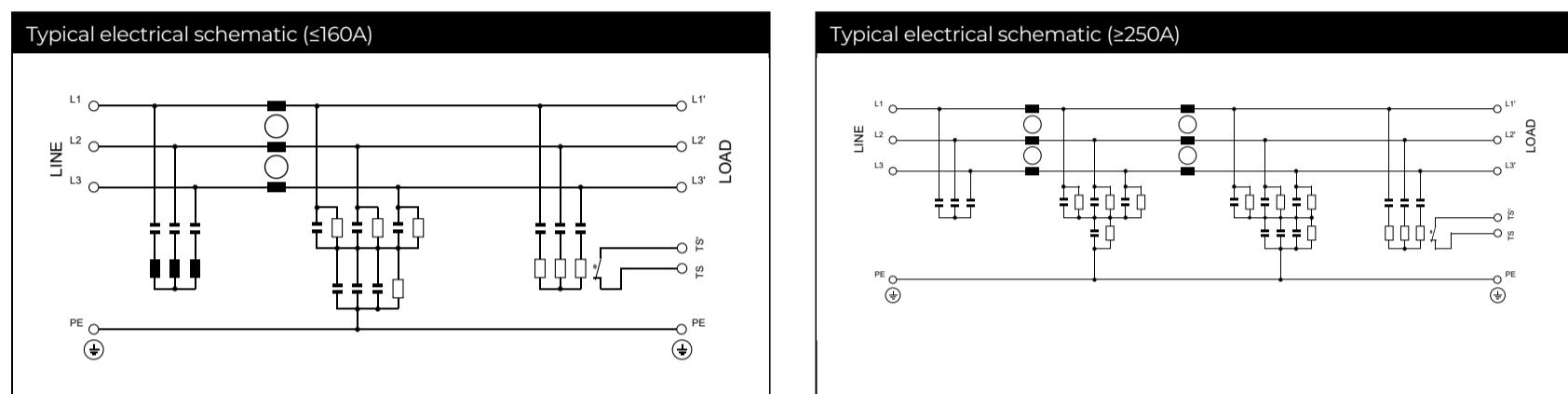
Filter	Rated current @ 50°C [A]	Typical drive power rating* [kW]	Leakage current** @ 530 VAC/50 Hz [mA]	DC Resistance @ 25°C [mOhm]	Typical Power Dissipation*** (Cu + Damping) [W]	Terminal Type	Weight [kg]	Thermal Switch**** Switching Temp. [°C]
<b>FN3840-25-33-C35-R65</b>	25	15	4.3	9.5	22 (18 + 4)	-33	2.5	180
<b>FN3840-50-53-C35-R65</b>	50	30	4.3	5	43 (38 + 5)	-53	3.5	180
<b>FN3840-80-34-C45-R65</b>	80	45	7.7	1.5	40 (29 + 11)	-34	5.7	180
<b>FN3840-160-40-C45-R65</b>	160	90	7.7	0.4	40 (31 + 9)	-40	7.9	180
<b>FN3840-250-99-C2835-R67</b>	250	150	10.7	0.1	26 (19 + 7)	-99	4.3	150
<b>FN3840-380-99-C2835-R67</b>	380	200	10.7	0.07	33 (28 + 5)	-99	4.5	150

\* Typical power rating at 400 VAC with cos phi=0.85. The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC 60939 under normal operating conditions.

\*\*\* Losses on copper (conductor) plus damping resistor losses. For further details on damping resistor losses please refer to page 4: Damping resistor losses vs switching frequency

\*\*\*\* Normally closed thermal protector switch, 250VAC / 24VDC, 6.3A (with cos phi 0.6); reverse switching temperature = switching temp - 50K.

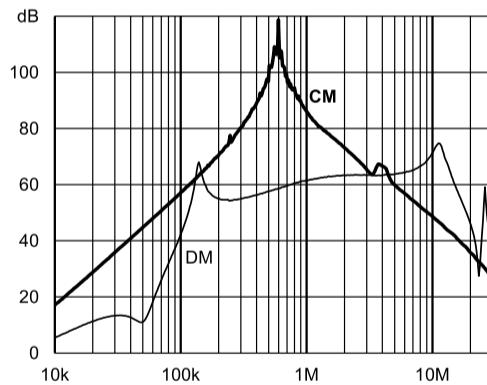


Tolerances apply: L +50%/-30%, C ±20%, R ±10%

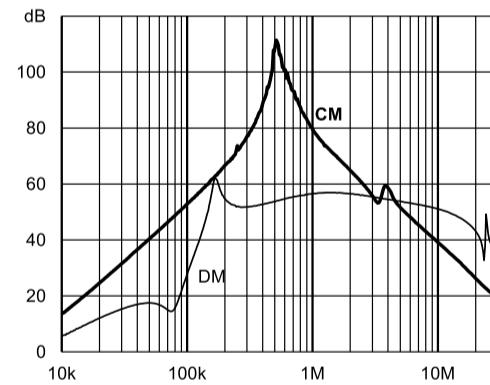
## Typical Filter Attenuation

Per CISPR 17: symmetrical 50 Ω/50 Ω -> Differential Mode (DM); asymmetrical 50 Ω/50 Ω -> Common Mode (CM)

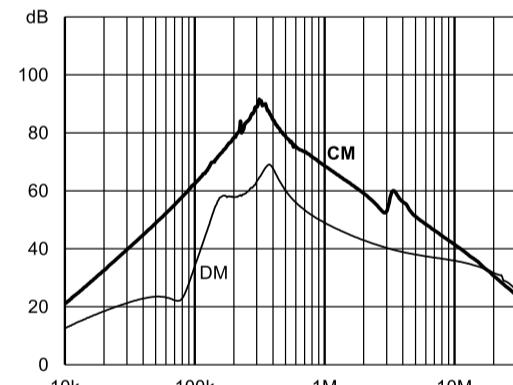
FN3840-25-33-C35-R65



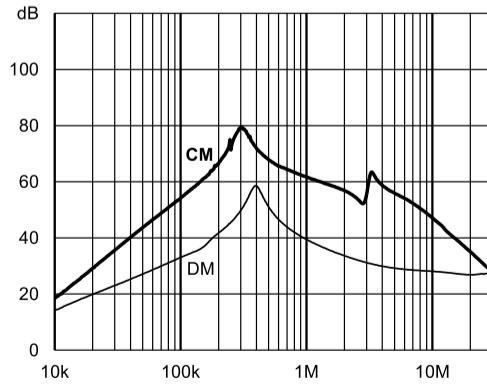
FN3840-50-53-C35-R65



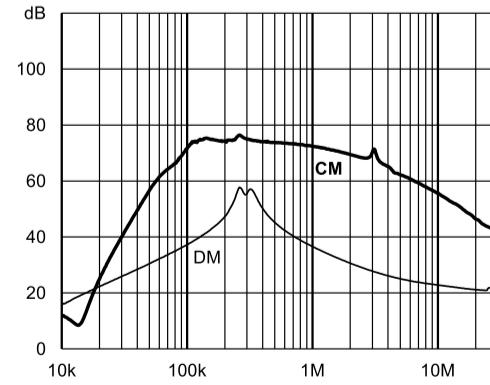
FN3840-80-34-C45-R65



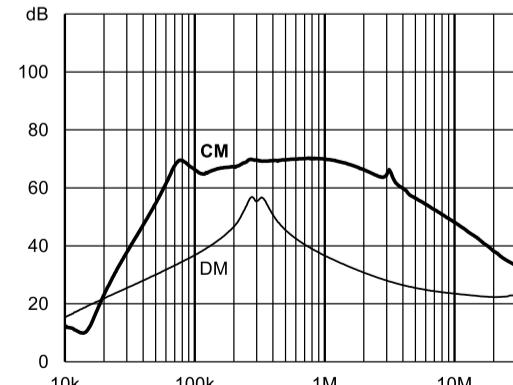
FN3840-160-40-C45-R65



FN3840-250-99-C2835-R67

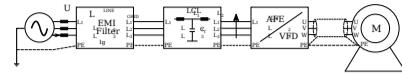


FN3840-380-99-C2835-R67



## Typical Application

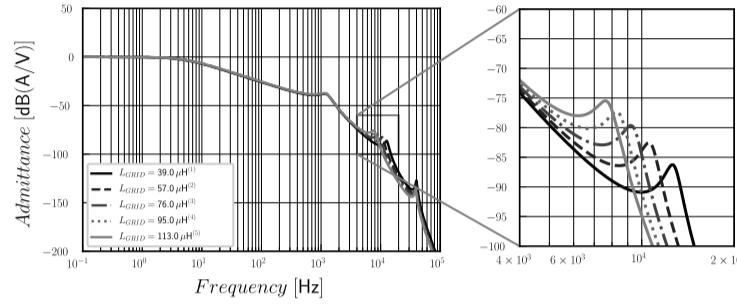
System diagram of an Active Front End (AFE) application



## Frequency Response

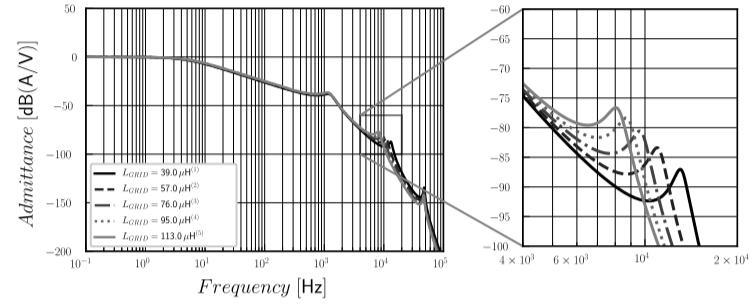
Frequency response at different values of the grid inductance. The grid inductance is calculated with details mentioned at each graph. Each figure represents the normalized admittance transfer function between the grid current,  $i_g$ , and the converter voltage  $u_s$ . At low frequencies, the equivalent admittance is inversely proportional to the total DC resistance of the grid, and EMI and LCL filters (RGRID+REMI+RLCL), which is dominated mainly by the LCL filter RLCL.

FN3840-25-33-C35-R65



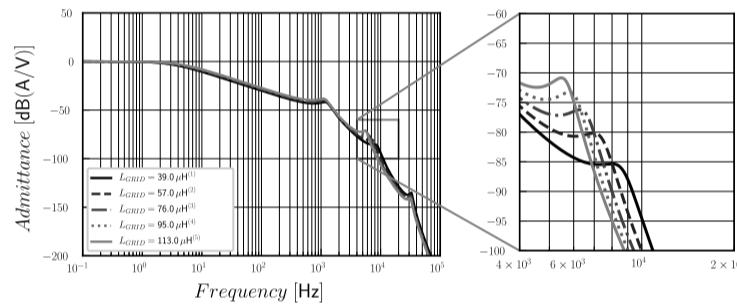
400 VAC/50 Hz, 250 kVA trafo with uk of (1) 1%, (2) 2%, (3) 3%, (4) 4%, (5) 5% and 50m cable.

FN3840-50-53-C35-R65



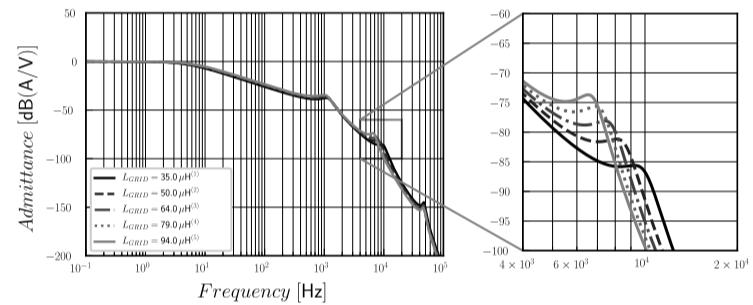
400 VAC/50 Hz, 250 kVA trafo with uk of (1) 1%, (2) 2%, (3) 3%, (4) 4%, (5) 5% and 50m cable.

FN3840-80-34-C45-R65



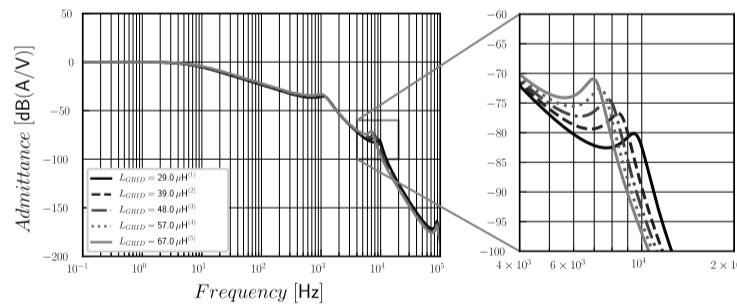
400 VAC/50 Hz, 250 kVA trafo with uk of (1) 1%, (2) 2%, (3) 3%, (4) 4%, (5) 5% and 50m cable.

FN3840-160-40-C45-R65



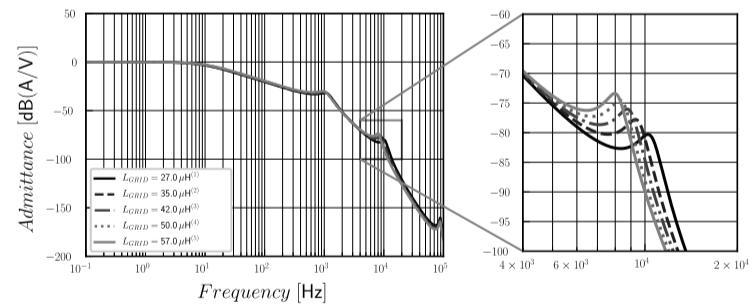
400 VAC/50 Hz, 315 kVA trafo with uk of (1) 1%, (2) 2%, (3) 3%, (4) 4%, (5) 5% and 50m cable.

FN3840-250-99-C2835-R67



400 VAC/50 Hz, 500 kVA trafo with uk of (1) 1%, (2) 2%, (3) 3%, (4) 4%, (5) 5% and 50m cable.

FN3840-380-99-C2835-R67



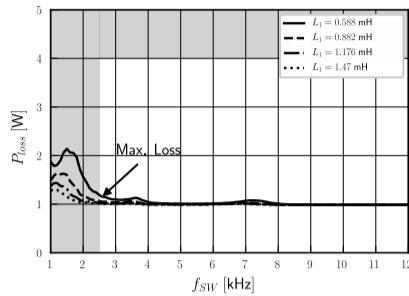
400 VAC/50 Hz, 630 kVA trafo with uk of (1) 1%, (2) 2%, (3) 3%, (4) 4%, (5) 5% and 50m cable.

## Damping Resistor Losses Vs Switching Frequency

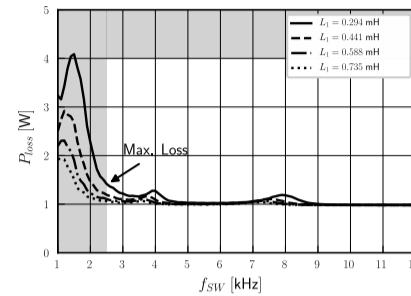
Typical losses at different values of the AFE-LCL L1 inductor with rated voltage (530 VAC/60 Hz) and differing grid inductance. (25A->95 $\mu$ H; 50A->95 $\mu$ H; 80A->95 $\mu$ H; 160A->79 $\mu$ H; 250A->57 $\mu$ H; 380A->50 $\mu$ H).

The highlighted gray area represents a non-operating area. Operating the filter in this area may cause overheating and damage to the filter, and may activate the temperature switch.

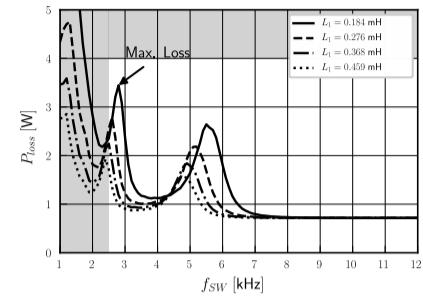
FN3840-25-33-C35-R65



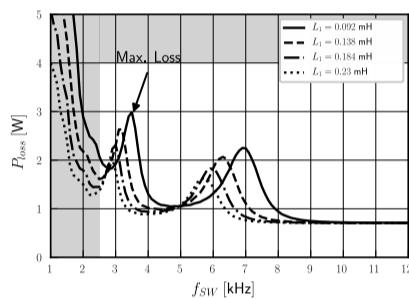
FN3840-50-53-C35-R65



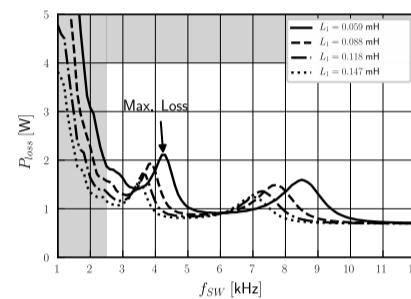
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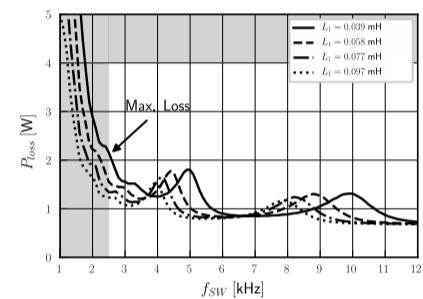
FN3840-160-40-C45-R65



FN3840-250-99-C2835-R67

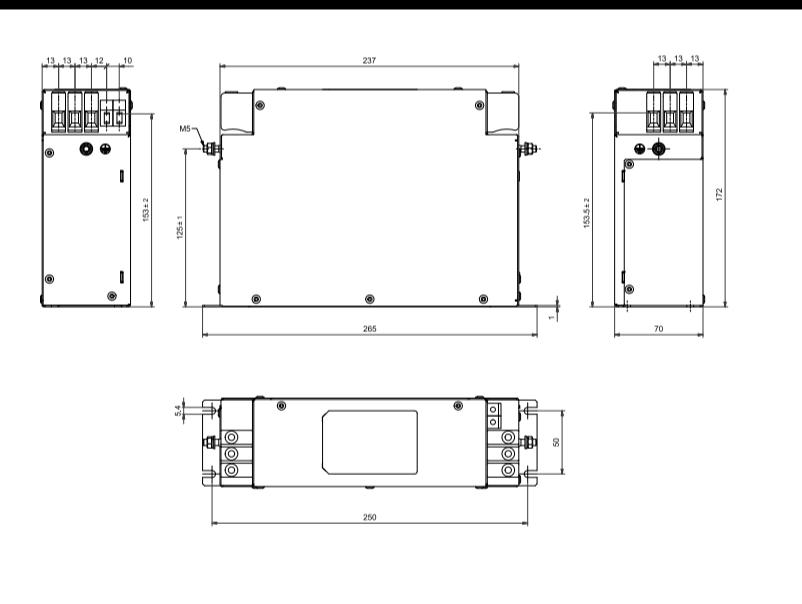


FN3840-380-99-C2835-R67

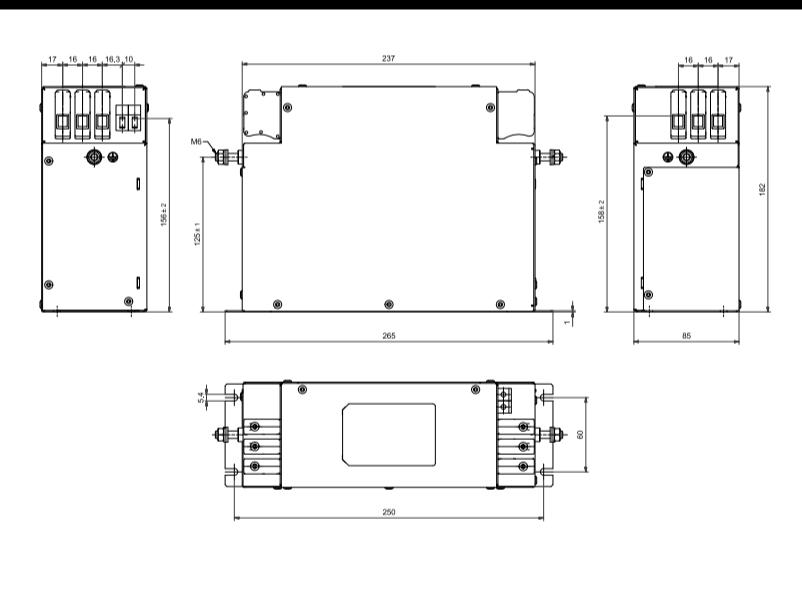


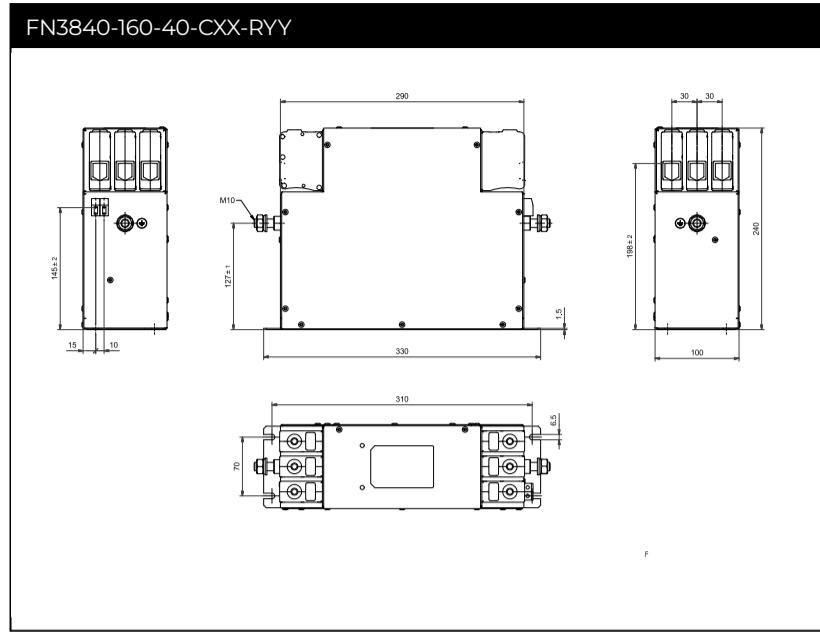
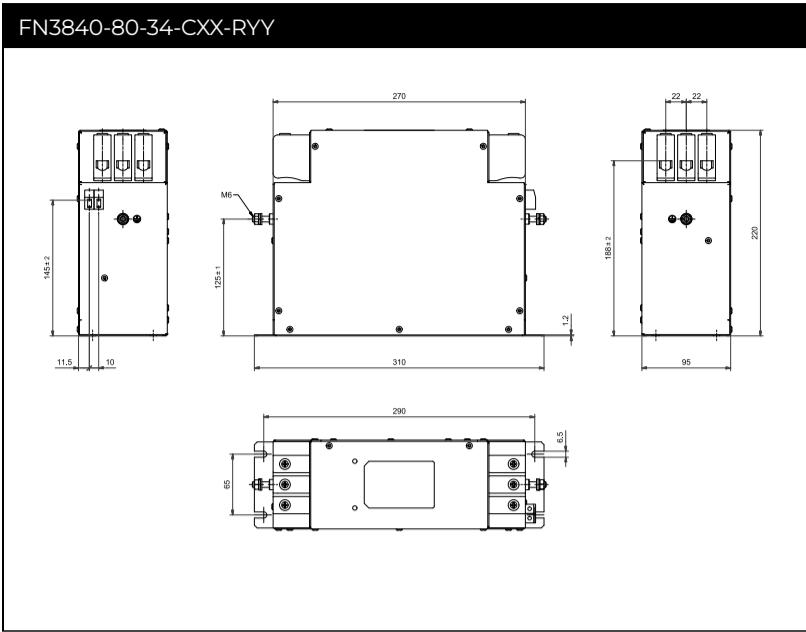
## Mechanical Data For Filters With Terminal Blocks

FN3840-25-33-CXX-RYY



FN3840-50-53-CXX-RYY



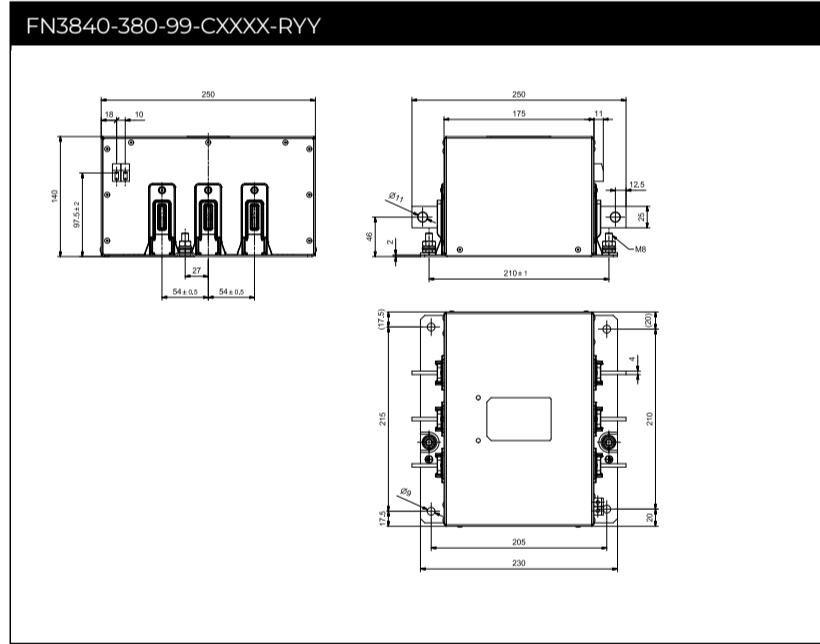
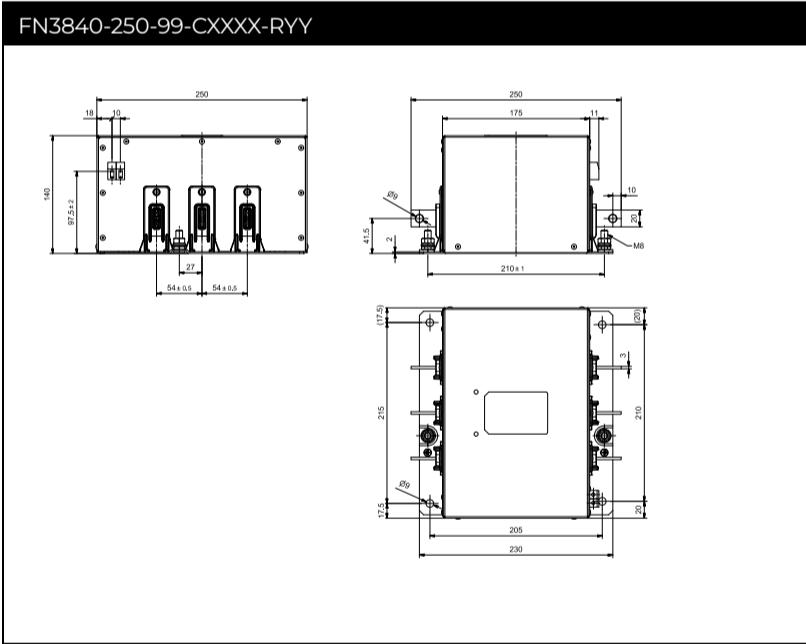


### Filter Input/Output Connector Cross Sections

	-33	-53	-34	-40	Thermal Switch	PE	PE	PE	PE
<b>Solid wire</b>	0.5-16 mm <sup>2</sup>	0.5-16 mm <sup>2</sup>	6-35 mm <sup>2</sup>	25-95 mm <sup>2</sup>	0.2-6 mm <sup>2</sup>				
<b>Flex wire</b>	0.5-10 mm <sup>2</sup>	0.5-16 mm <sup>2</sup>	6-25 mm <sup>2</sup>	25-95 mm <sup>2</sup>	0.2-4 mm <sup>2</sup>				
<b>Flex wire AWG</b>	AWG 22-6	AWG 20-4	AWG 6-2	AWG 4-4/0	AWG24-AWG10				
<b>Recommended torque</b>	1.5-1.8 Nm	2.0-2.3 Nm	4.0-4.5 Nm	17-20 Nm	0.7 -0.8mm	2.0-2.2 Nm	3.5-4.0 Nm	8.0-9.0 Nm	15-17 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

### Mechanical Data For Filters With Busbar Connection



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