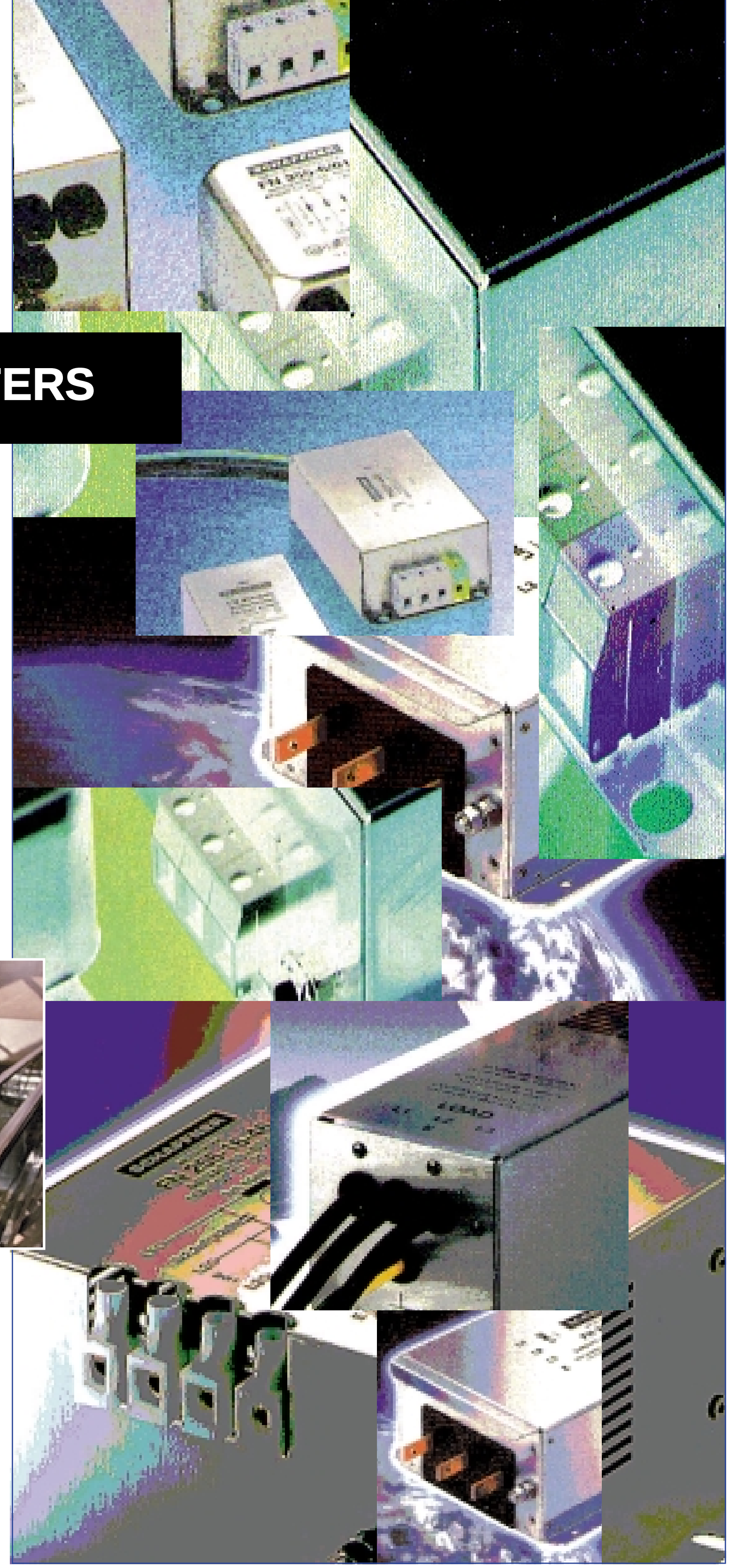
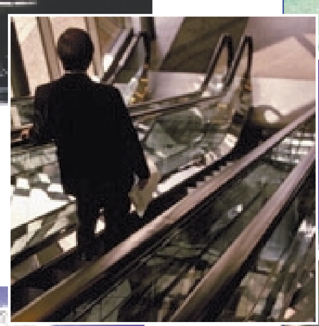
THREE-PHASE FILTERS

for chassis-mounting





SCHAFFNER

Your number one name for EMC

Three-phase chassis-mounting powerline filters

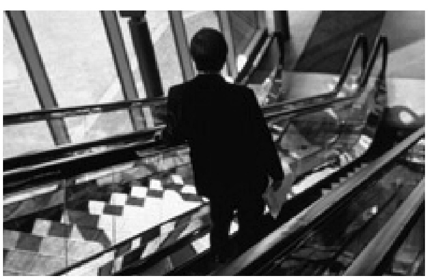
CONTENTS

SCHAFFNER

Powerline filters – a vital element of today’s equipment designs

In today’s world, more electrical energy is being generated at increasing levels of power, and more and more low power energy is being used for the transmission and processing of data. The result is vastly increased ‘electronic smog’ or noise. This noise can disrupt, and even destroy, electronic devices: an unacceptable situation, and one which is illegal in certain markets. **The electronics industry must strive to protect equipment against such ‘noise’.**

Noise, or interference, travels two ways. Switches - such as semiconductors - can emit interference, and be susceptible to it. The same is true for data processing equipment. The most common method of protection is the use of powerline filters, in conjunction with screening or gasket materials.

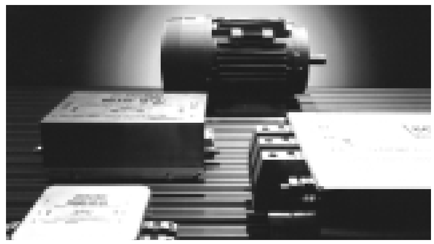


The mains, or powerline, filter is the key element in eliminating mains-borne interference. This filter not only has to meet the requirements of electro-magnetic compatibility (EMC), but safety aspects as well. For some applications, the filter also has to protect equipment from destructive voltages on the power line, such as those caused by lightning.

Schaffner is one of the world’s leading suppliers of electromagnetic compatibility (EMC) products. The breadth of our product range, the high attenuation characteristics of our filters under various load conditions, our dedication to quality - and above all our organization’s unique experience in filter design and manufacturing which spans more than 25 years - is your guarantee of excellence.

Power electronic devices such as industrial frequency converters, as well as machine tools, are typical application areas for three-phase powerline filters.

In addition to this industrial market sector, these types of filter are also suitable for mainframe computer systems, large uninterruptible power supplies, and medical equipment such as X-ray machines.



Total commitment to quality

Schaffner’s aim is to provide all its customers with fault-free products. To achieve this, 100% of our products undergo rigorous final testing. To ensure high quality we have instituted a system which meets all the stringent requirements of ISO 9001/EN 29001. The phrase ‘Quality Assurance’ is not just a slogan for us; it is applied in practice, and the Schaffner brand truly stands for reliability and quality.

Wide product range

This catalog describes three-phase powerline filters for currents from 3A to 1200A, which are suitable for the majority of high power office and mainframe computer equipment, as well as medium to high power industrial applications.
All the filters are supplied in chassis-mounting metal cases, facilitating good connection to earth and optimum high frequency performance. Versions are also available with a neutral line, or different operating voltages up to 690VAC, enabling designers to quickly locate the most economic and technically suitable EMC solutions for their projects.

Safety standard IEC 950

The IEC 950 standard is a key safety specification for computers, business and industrial applications. A primary requirement is protection for personnel who come into contact with terminal equipment. Compliance with this standard by equipment manufacturers is essential - especially for deliveries within Europe - by virtue of the newly-introduced legislation. The standard applies in Europe under the designation EN 60950 and the USA as UL 1950.

Most of Schaffner’s three-phase filters are so constructed that the test requirements called for in IEC 950 (basic and supplementary isolation) can be met.

Further information on this topic can be found in the application note ‘IEC 950’, which your local Schaffner representative will be pleased to send you.

SQS

Swiss Association for Quality and Management Systems

Schaffner Electronics Ltd.
CH-4542 Luterbach
Whole company / Electromagnetic compatibility

the SQS Certificate ISO, 9001

Time to market

The key reasons for choosing ready-made three-phase filters are convenience and cost. Although you can design your own filter using discrete components, or have a custom solution designed and assembled for you, the timescales involved - especially if safety approvals are required - invariably rule this approach out. The availability of off-the-shelf filters is particularly important to industrial users and system commissioning personnel, who often require next-day delivery of fit-and-forget EMC solutions simply to meet contractual obligations or to avoid incurring penalty clauses.

Ready-made filters provide a convenient single-source solution. The following guide to Schaffner's three-phase products - with brief details on key parameters - will help you to identify one or more filters for closer review of specifications. From this initial selection, a review of the circuit diagram and detailed specifications in the following pages will tell you if the module is suitable for your application, allowing you to choose a unit (or units) for trial. Schaffner's application engineers, based in numerous sales outlets around the world, are available to provide in-depth advice if you require it.

General technical information

Insertion loss

The insertion loss characteristics of the filters are measured in accordance with the CISPR 17 standard. Two test conditions are specified in Section 4.2 of the CISPR 17 standard, namely input and output impedances of 50/50Ω and 0.1/100Ω.

In general, three-phase filters perform the same in the face of differential interference as in the 50Ω insertion loss test. In order to show the performance under realistic conditions, Schaffner also shows the attenuation curves obtained from the 0.1/100Ω test, which are more meaningful for common mode interference. The inductance of the chokes used in the filters can change under load because of a saturation effect, which can also affect insertion loss.

Flammability classification

All the filters in this catalog comply with the requirements of UL 94V2 or UL 94V0.

Climatic classification

Schaffner three-phase filters comply with the climatic classification 25/085/21 according to DIN IEC 68 Part 1 (ambient temperature -25 to +85˚C).

Component tolerances

Parameter	- Tol.	+ Tol.	Test
Inductance	30%	50%	1kHz
Capacitance	20%	20%	1kHz
Resistance	10%	10%	DC

Current ratings

The nominal currents stated refer to an ambient temperature of $\theta_N = 40˚C$ or $\theta_N = 50˚C$. The maximum operating current at any other ambient temperature θ can be calculated by means of the following formula:

$$I = I_N \sqrt{(85 - \theta)/(85 - \theta_N)}$$

Leakage current

Operational conditions

The values given in the technical filter specifications are based on IEC 1000-2-4, section 5.5, and the following conditions: nominal voltage 440VAC for standard types, 520VAC for H types, 690VAC for HV types; nominal frequency 50Hz; tolerance of capacitance ± 20%; unsymmetrical input voltage ± 3%.

Worst case conditions

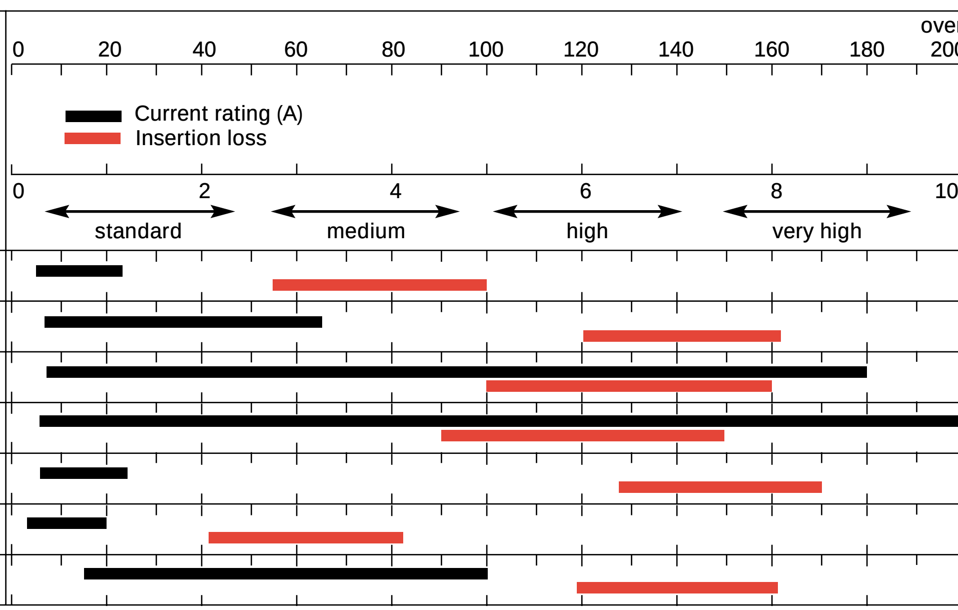
Worst case conditions are based on the assumption that two of the three lines were disconnected. For the calculation of the leakage current the voltage of one phase towards the ground UP→E 50Hz is used; capacitance tolerance ± 20%.

The values calculated under worst case conditions are equal to the values corresponding to the operational conditions on standard Japanese networks. In the case of a network with a neutral line, the values corresponding to the European operational conditions are equal to the Japanese operational conditions with a neutral line.

Schaffner's 3-phase chassis-mounting filter range

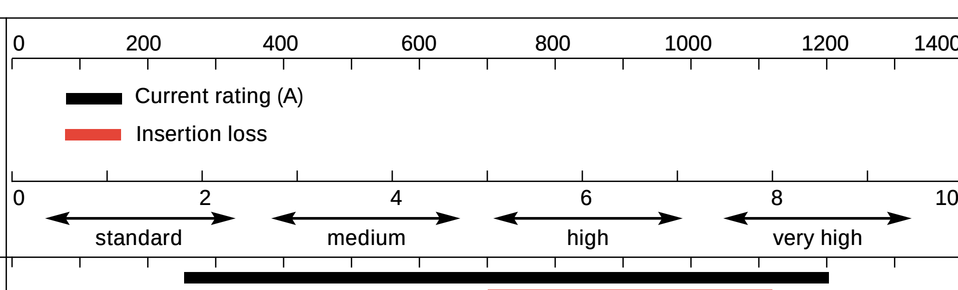
Rapid selection Using the current rating and attenuation performance indicators, together with the major features shown on the right, this table allows you to quickly identify a 'short list' of filter families which are potentially suitable for your application, for subsequent detailed investigation using the technical specifications on the following pages.

For currents up to 280A



Family	2-stage	Safety terminal	Three phases	Three phases + N	For frequency inverters	Catalog page
FN 251	✓	✓	✓		✓	8
FN 256		✓		✓		16
FN 258	✓	✓	✓		✓	10
FN 351		✓	✓		✓	12
FN 354	✓			✓		18
FN 355				✓		20
FN 356		✓		✓		22

For high currents



Family	2-stage	Safety terminal	Three phases	Three phases + N	For frequency inverters	Catalog page
FN 359	✓		✓		✓	14

Understanding EMC standards and filter specifications

This section introduces the standards and regulations associated with EMC protection, and provides detailed information to help you understand filter design and specifications. It will help you identify for your application the right specifications and type of filter.

Interference protection standards

Until recently most countries have had their own regulations and standards governing electro-magnetic interference (EMI) or radio frequency interference (RFI). However, on the 1 January 1996 the European Directive 89/336/EMC on electro-magnetic compatibility (EMC) came into force. This directive brings a common approach to EMC to every member state of the European Union. Common standards will be used throughout Europe to ensure that technical trade barriers are removed. As well as controlling EMI emissions from equipment, the directive also calls for equipment to be immune to external electro-magnetic disturbances.

Types of standards:

Basic standards describe the general and fundamental rules for meeting the requirements. Terminology, phenomena, compatibility levels, measurement, test techniques and classification of EM environments are so described within.

Generic standards refer to specific environments. They set minimal EMI levels which equipment in these environments must meet. Where no product specific standards exist then the generic standards are to be used. Generic standards describe household and industrial EMI environments.

Products standards are for specific products or product groups. These standards are coordinated with the generic standards.

In countries outside Europe other standards will be used, such as the FCC in the USA. Table 1 shows the main European standards.

Permissible noise limits

The various standards set down limits for conducted EMI emissions. These limits are measured in voltage and given in dBµV where 0dB is 1µV. The interference is measured using measurement equipment which has defined bandwidths and receivers. The two receivers used are a quasi-peak detector, and an average detector.

To ensure repeatability of the measurements, the impedance of the mains supply must be constant. The standards calls for a defined artificial mains network - sometimes called a line impedance stabilisation network (LISN) - which gives a defined impedance to the noise and also helps filter any noise on the mains which may affect the measurements.

Figure 1 shows the limits of EN 50081-1 the European generic standard for residential, commercial and light industrial environments, and Figure 2 of EN 50081-2, the European generic standard for the industrial environment.

Above 30MHz, radiated noise interference is measured instead of conducted noise. This takes place on an open field test site using defined antennas.

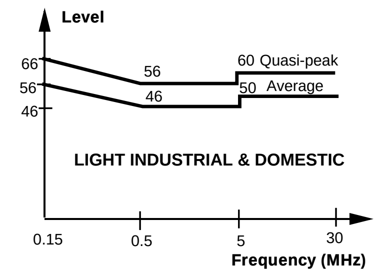


Figure 1. *Permissible interference limits for EN 50081-1*

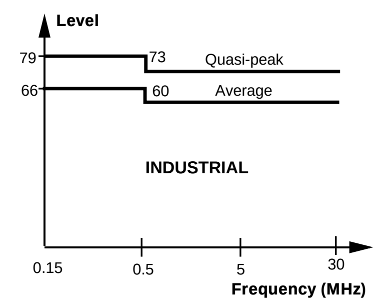


Figure 2. *EN 50081-2 limits*

Product type	Emissions			Immunity
	Harmonics	Voltage fluctuations	Radio interference	All aspects
Household appliances & portable tools: vacuum cleaners, washing machines, heating, cooking equipment, dimmers	EN 60555-2	EN 60555-3	EN 55014	EN 50082-1
Luminaires with discharge lamps	EN 60555-2		EN 55015	EN 50082-1
TV receivers	EN 60555-2		EN 55013	EN 55020
Information Technology Equipment (ITE)	EN 60555-2		EN 55022	EN 55024 all parts
Mains signalling equipment			EN 50065-1	EN 50082-2
Industrial, scientific and medical eqpt. designed to generate RF energy			EN 55011	EN 50082-2
Industrial electronic power and control equipment			EN 50081-2	EN 50082-2
Industrial non-electronic equipment			EN 50081-2 (if producing RF interference)	

Table 1. European EMC standards

Interference sources and spectrums

The most common source of conducted EMI is power electronic products such as switched mode power supplies (SMPS), pulse width modulated (PWM) frequency converters or motor drives, and phase angle controllers.

The emissions spectrum typically starts off very large at low frequency and rolls off as frequency increases. The point at which the noise falls below the permitted limits depends on several factors, the most important being the frequency of operation and the rise time of the semiconductor devices.

Interference spectrums generated can be either continuous, as in the case of phase angle controllers, (Figure 3) or discrete which is typical of the SMPS (Figure 4).

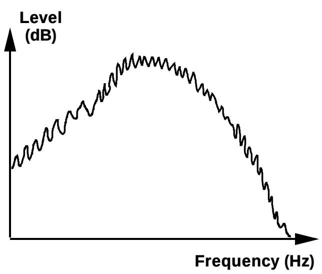


Figure 3. *Continuous spectrum*

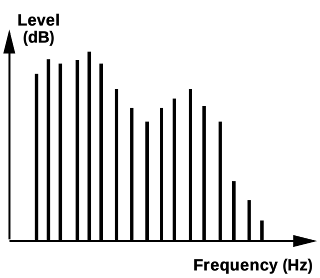


Figure 4. *Discrete spectrum*

Interference propagation

EMI can propagate by two means:

• by radiation - where the energy can be coupled either through magnetic or electric field, or as an electro-magnetic wave between the source and the victim

• by conduction - where the EMI energy will propagate along power supply lines and data cables

Radiated and conducted EMI cannot be thought of as totally separate problems, because noise conducted along a cable may be radiated as the cable acts as an antenna. The radiation will increase as the cable length becomes comparable to the wavelength of the noise. Also, the cable will act as a receiving antenna and pick up radiated interference.

Below around 150MHz, the most efficient radiating devices in a system are usually the power supply and data cables. Proper filtering of these cables will reduce radiation due to the cables as well as conducted interference.

Above around 150MHz, PCB tracks and short internal cables will start to become efficient antennas. To reduce this radiation a PCB should be laid out to reduce track length and loop areas; ground planes should be used if possible. Decoupling of digital ICs is very important and shielding may be necessary.

Interference types

To understand the problems associated with conducted EMI it is first necessary to understand the two modes of conducted noise: differential mode (or symmetrical mode) and common mode (or asymmetrical mode). Differential mode interference creates a voltage between the phases of the system and is independent of earth; the differential mode currents flow along one phase and returns along another phase (Figure 5).

Common mode noise creates a voltage between each phase and the earth. The common mode currents flow from the noise source to the earth (usually via a parasitic capacitance) along the earth path and returns along the phases (Figure 6). A power line filter must be designed to attenuate both common mode and differential mode interference.

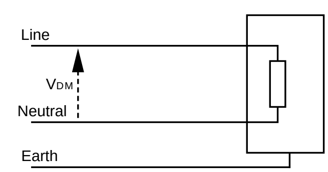


Figure 5. *Differential mode interference* (V_{DM})

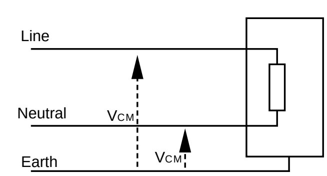
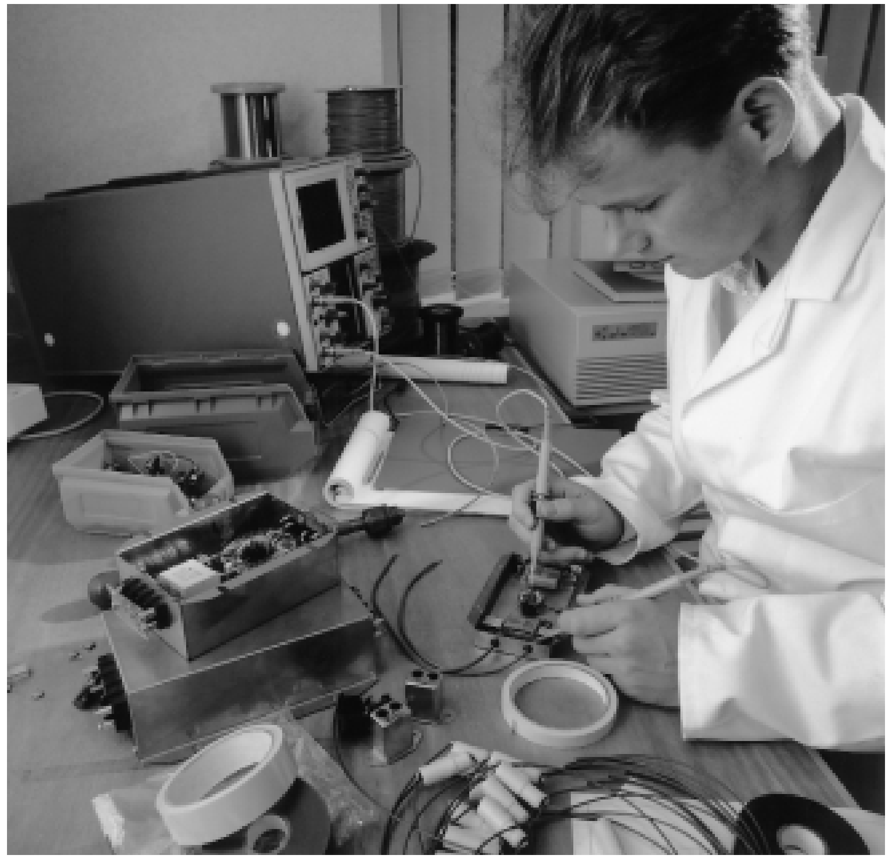


Figure 6. *Common mode interference* (V_{CM})

EMC measurement and engineering services

In addition to offering one of the world's most comprehensive ranges of standard filter products, Schaffner offers the full complement of measurement and engineering services to support equipment manufacturers and users.



EMC testing

Schaffner operates the most sophisticated EMC test facilities available anywhere today - with extensive investment in screened rooms, specialist test equipment, and application engineering teams - distributed at seven locations throughout the world. Services available at these locations include:

- Faraday cage and open field testing
- harmonics instrumentation for current and voltage to the 49th harmonic
- radio emission measurements to CISPR, EN, VDE, FCC, Mil or SEV
- simulation of electro-magnetic fields
- simulation of short-term DC or AC mains failures
- simulation of transient parasitic voltages
- electro-static discharges to IEC 801-2, VDE 0843 part 2 specifications
- AC and DC insulation testing

Engineering services

Schaffner has extensive engineering experience in solving EMC problems. In addition to testing and measuring services Schaffner can provide the expert engineering support to help you bring your equipment to market quickly and efficiently; services available include:

- custom filter design
  - to optimize filter performance, and solve space, layout, mounting or connection problems
- circuit and equipment design
  - advising on circuit and equipment or enclosure design to overcome EMC problems
- turnkey component design and build

Ordering information

For all three-phase filters

FN 251 & - x / y

- output connections (y):
  - 01 = solder-lug
  - 03 = clamp terminal with M4 screw
  - 05 = AMP fast-on
  - 06 = solder-lug/fast-on combination
  - 07 = wire
  - 24 = screw lead - through M6
  - 28 = screw lead - through M10
  - 29 = terminal block
  - 33 = terminal block
  - 34 = terminal block
  - 35 = terminal block
  - 36 = terminal block
  - 37 = terminal block
  - 40 = terminal block
  - 46 = strip terminal block
  - 47 = strip terminal block
  - 52 = strip terminal block
  - 99 = busbar connections

  for details see mechanical data
- current rating (A) (x)
- &:
  - H = high voltage
  - HV = very high voltage
  - P = medium leakage current
  - L = low leakage current
- filter type (FN 251)

Examples:

FN 251-8/07 Type FN 251; current rating 8A; with wire output connections
FN 351H-50/33 Type FN 351H (high voltage); current rating 50A; with safety terminal block connections
FN 258L-55/07 Type FN 258L (low leakage current); current rating 55A; with wire output connections

Filter for motor drives

FN 251

This filter family provides a very economic solution for overcoming EMI problems with motor drives and inverters. All FN 251 filters employ advanced two-stage LCR filter circuitry with non-saturating toroidal inductors, and have a very low leakage current which helps maximize performance and ensure operational reliability.

- **4 to 24A current ratings**
- **compact size**
- **insulated safety input terminals**
- **wire outputs**

Technical specifications

Maximum operating voltage: 440VAC at 40ºC; Operating frequency: DC to 60Hz at 40°C
Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1700VDC
MTBF at 40°C, 400V per Mil-HB-217F: 160,000 hours
Protection category: IP20
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

Filter	Current ratings A at 40ºC (25º)	Leakage current† (400V/50Hz) mA	Power loss W	Component values/phase L mH	L1 mH	Cx µF	Cy nF	R kΩ	Connections input	Connections output	Weight kg
FN 251 - 4 / 07	4 (4.6)	0.5	5.5	7	1.5	1	15	470	/29	/07	0.75
FN 251 - 8 / 07	8 (9.2)	0.5	7	4.2	1.5	1	15	470	/29	/07	0.75
FN 251 - 16 / 07	16 (18.4)	0.5	14	2.6	0.7	1	15	470	/29	/07	1.8
FN 251 - 24 / 07	24 (27.6)	0.5	18	1	0.5	1	15	470	/29	/07	1.95

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst case leakage current could reach 7.7 times higher levels.

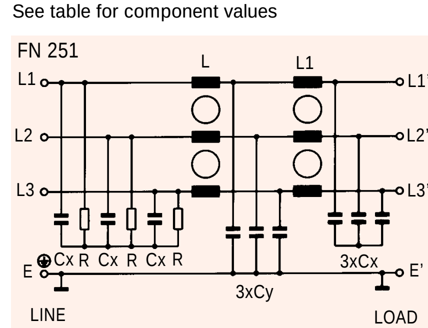
Mechanical data

Current	-4, -8	-16, -24	Tol.* ± mm
A	145	180	± 0.5
B	75	115	± 0.5
C	40	60	± 0.5
D	123	85	± 0.5
E	135	115	± 0.2
F	55 ± 0.1	100	± 0.2
G	0.7	0.7	± 0.05
H		20	± 1
M	7 x 5.3	6.4	± 0.1
P		M6	-
W	1.31mm²	2.08mm²	-
Y	6	6	+ 1
Z	300	300	+ 10

All dimensions in mm; 1 inch = 25.4mm
* Measurements share this common tolerance unless otherwise stated

Electrical schematic

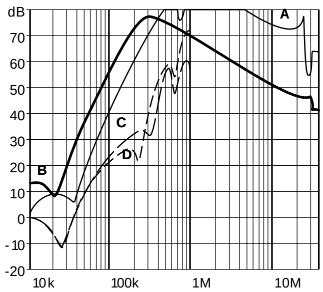
See table for component values



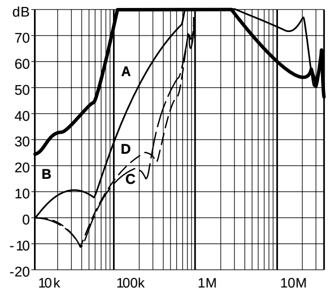
FN 251 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

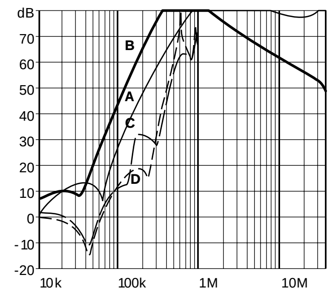
4 amp types



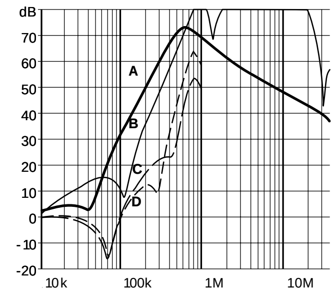
8 amp types



16 amp types



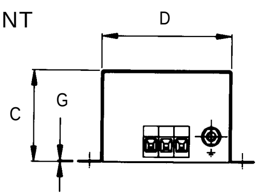
24 amp types



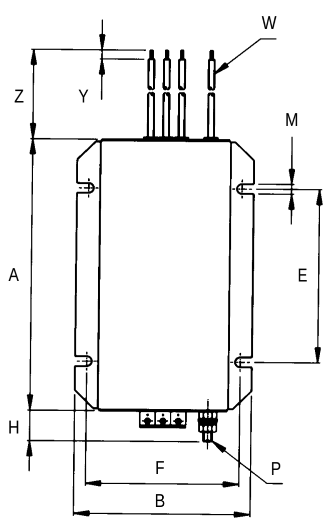
Mechanical drawings

See mechanical data table for dimensions

FRONT

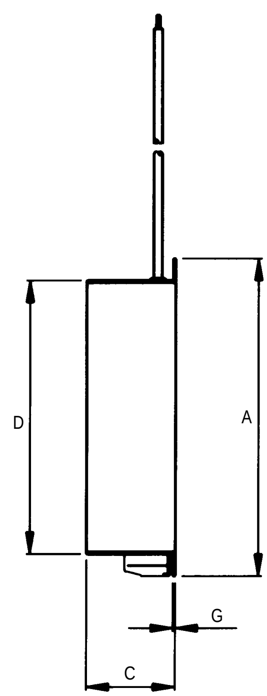


TOP



FN 251-16, -24
Input connection: /29

SIDE



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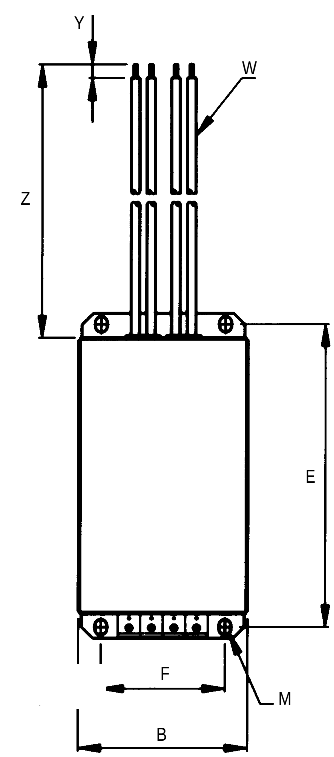


FN 251-4, -8
Input connection: /29

SCHAFFNER

3-phase inverter/PDS filtering

FN 258

FN 258 provides state-of-the-art filtering for industrial frequency inverters or power drive systems (PDS). This product sets major new performance standards, through its universal 480V rating; via its slim-line shape which sits neatly alongside the latest inverters; and innovative 2-stage circuitry which provides superlative performance that meets the latest EMC standards (EN 55011/55014, IEC 22G/21/CDV, UL1283 and the new EN 133200).

- **7 to 180A current ratings**
- **480V/50˚C ratings for world compatibility and simple specification**
- **slim book-style housing**
- **designed for long cable lengths (50m/54yds+)**
- **meets UL and new EN 133200 standards**

SL11
EN 133200

up to 130A (pending)

Technical specifications

Maximum operating voltage: 480VAC at 50ºC. Operating frequency: DC to 60Hz at 50ºC
Hipot test voltage: P ⇒ E 2800VDC; P ⇒ P 1700VDC
MTBF at 50°C, 400V per Mil-HB-217F: 220,000 hours
Protection category: IP20
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

Filter	Current ratings A at 50ºC (40º)	Leakage current† (480V/50Hz) mA	Power loss W	Component values/phase ΣL mH	ΣCx µF	ΣCy µF	R1 MΩ	R2 MΩ	Connections input	Connections output		Weight kg
FN 258 - 7 / ??	7 (8)	18.0	4.5	4.5	4	1.5	1.5	0.68	/29	/07	/29	1.1
FN 258 - 16 / ??	16 (18)	20.0	9	3.0	5.9	1.5	1.5	0.68	/29	/07	/29	1.7
FN 258 - 30 / ??	30 (34)	26.5	14	2.0	6.6	2.2	1.5	0.68	/33	/07	/33	1.8
FN 258 - 42 / ??	42 (47)	28.2	19	1.5	6.6	2.3	1.5	0.68	/33	/07	/33	2.8
FN 258 - 55 / ??	55 (62)	28.2	20	1.1	6.6	2.3	1.5	0.68	/34	/07	/34	3.1
FN 258 - 75 / ??	75 (85)	28.2	20	0.9	6.6	2.3	1.5	0.68	/34	-	/34	4
FN 258 - 100 / ??	100 (113)	28.2	36	0.9	6.6	2.3	1.5	0.68	/35	-	/35	5.5
FN 258 - 130 / ??	130 (145)	32.8	40	0.6	11	2.3	1.5	0.68	/35	-	/35	7.5
FN 258 - 180 / ??	180 (204)	32.8	61	0.13	11	2.3	1.5	0.68	/40	/07	/40	11

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst case leakage current could reach 5.6 times higher levels. Filters with lower leakage current (P [3.5mA] and L [0.8mA] types) are available on request. The insertion loss values of the P and L types are not identical with the standard versions.

Mechanical data

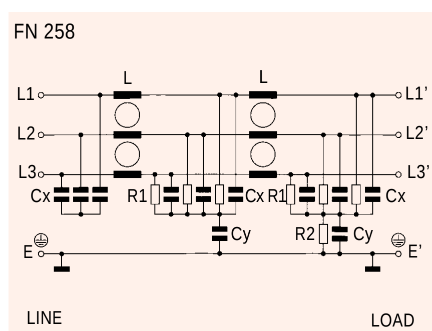
Current	-7	-16	-30	-42	-55	-75	-100	-130	-180	Tol.* ± mm
A	255	305	335	329		329	379 ± 1.5	439 ± 1.5	438 ± 1.5	± 1
B	126 ± 0.8	142 ± 0.8	150 ± 1	185 ± 1		220	220	240	240	± 1.5
C	50	55	60	70	80	80	90 ± 0.8	110 ± 0.8	110 ± 0.8	± 0.6
D	225 ± 0.8	275 ± 0.8	305	300		300	350 ± 1.2	400 ± 1.2	400 ± 1.2	± 1
E	240	290	320	314		314	364	414	413	± 0.5
F	25	30	35	45	55	55	65	80	80	± 0.3
G	6.5					6.5			6.5	± 0.2
H	300		400	500					500	± 15
J	1 ± 0.1			1.5		1.5		3	4	± 0.2
L	9			12					15	± 1
O	M5			M6		M6	M10		M10	-
P	AWG 16	AWG 14	AWG 10	AWG 8	AWG 6				50mm²	-

All dimensions in mm; 1 inch = 25.4mm

* Measurements share this common tolerance unless otherwise stated

Electrical schematic

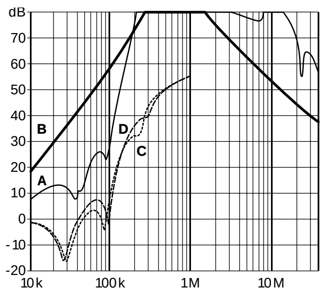
See table for component values



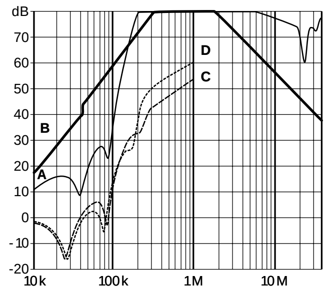
FN 258 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

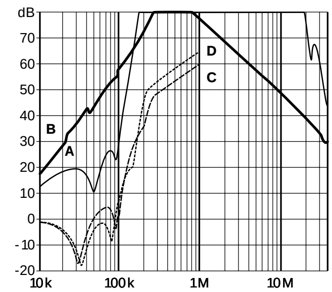
7 amp types



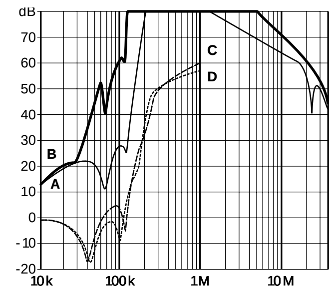
16 amp types



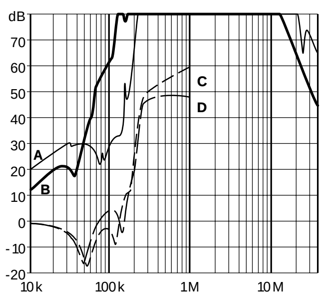
30 amp types



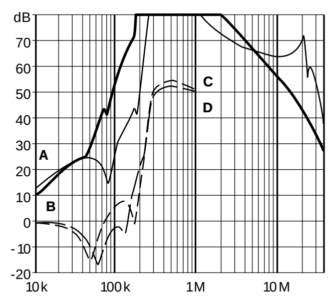
42 amp types



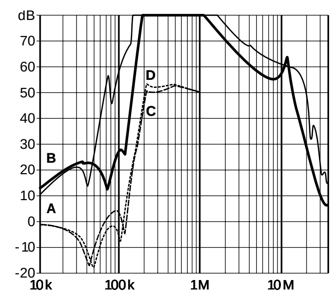
55 amp types



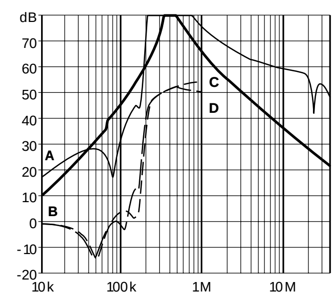
75 amp types



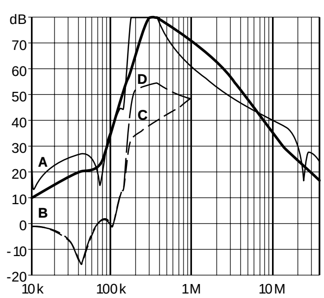
100 amp types



130 amp types



180 amp types



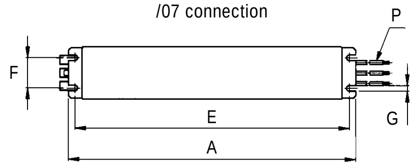
Note: the insertion loss values of the P and L types are not identical with those of the standard versions

Mechanical drawings

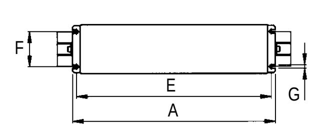
See mechanical data table for dimensions

BOTTOM VIEW

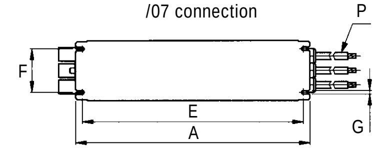
7 to 55A current ratings
/07 connection



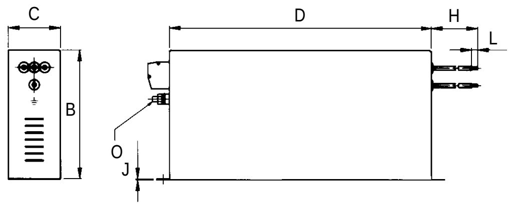
7 to 180A current ratings

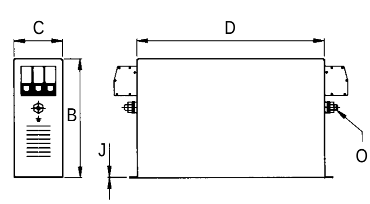


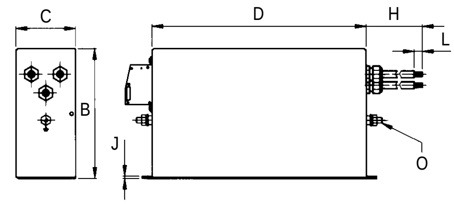
180A current rating
/07 connection



END/SIDE VIEW







SCHAFFNER

High-power filter

FN 351

FN 351 provides highly effective filtering solutions for industrial frequency inverters and drives, delivering standard-setting performance which has been widely imitated. Available in an extremely wide range of power ratings and two voltage levels the filter employs special core winding and inductor techniques which remain effective under extreme EMI.

- **5 to 280A current ratings, 440V and 520V versions**
- **high differential/common mode attenuation**
- **IEC 950 compliant**

Technical specifications

Maximum operating voltage: 440VAC at 40ºC for standard types; 520VAC at 40ºC for H types
Hipot test voltage: standard: P ⇒ E 2600VDC; P ⇒ P 1900VDC; H: P ⇒ E 2800VDC, P ⇒ P 2300VDC
MTBF at 40°C, 400V per Mil-HB-217F: 135,000 hours standard types, 100,000 hours H types
Protection category: IP20
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

up to 110V* up to 110V* up to 110V*

Approvals are for standard voltage types only
* pending for connections /46, /47 and /52

Filter	Current ratings A at 40ºC (25º)	Leakage current† IEC 1000-2-4 mA at 50Hz	Power loss W	Component values/phase L mH	ΣCx µF	ΣCy µF	R1 MΩ	R2 MΩ	Phase connections	Weight kg
FN 351 - 5 / ??	5 (5.8)	1.9	6	12	1.6	0.17	2	-	/29	1.1
FN 351 - 8 / ??	8 (9.2)	1.9	7	7.6	1.6	0.17	2	-	/29	1.8
FN 351H - 8 / ??	8 (9.2)	2.7	7	7.6	1.5	0.18	2	-	/29	1.8
FN 351 - 16 / ??	16 (18.4)	1.9	8	5.2	3.4	0.17	1.5	-	/29 /46	1.8
FN 351H - 16 / ??	16 (18.4)	2.7	8	5.2	3	0.18	1.5	-	/29	1.8
FN 351 - 25 / ??	25 (28.8)	28.0	8	2.2	4.4	1.8	1.5	1.1	/33 /46	3
FN 351H - 25 / ??	25 (28.8)	35.2	8	2.2	3	1.7	1.5	1.1	/33	3
FN 351 - 36 / ??	36 (41.5)	28.0	9	1.3	4.4	1.8	1.5	1.1	/33 /47	3
FN 351H - 36 / ??	36 (41.5)	35.2	9	1.3	3	1.7	1.5	1.1	/33	3
FN 351 - 50 / ??	50 (57.7)	29.6	11	0.8	4.4	2	1.5	1.1	/33 /34 /47 /52	3.1
FN 351H - 50 / ??	50 (57.7)	35.2	11	0.8	3	1.7	1.5	1.1	/33 /34	3.1
FN 351 - 64 / ??	64 (73.8)	29.6	15	0.65	4.4	2	1.5	1.1	/33 /34 /47 /52	3.3
FN 351H - 64 / ??	64 (73.8)	35.2	15	0.65	3	1.7	1.5	1.1	/33	3.3
FN 351 - 80 / ??	80 (92.3)	31.8	23	0.85	6.7	2.2	1.5	1.1	/34	9.5
FN 351H - 80 / ??	80 (92.3)	41.3	23	0.85	6.1	2.2	1.5	1.1	/34	9.5
FN 351 - 110 / ??	110 (127)	31.8	25	0.5	6.7	2.2	1.5	1.1	/35	9.5
FN 351H - 110 / ??	110 (127)	41.3	25	0.5	6.1	2.2	1.5	1.1	/35	9.5
FN 351 - 180 / ??	180 (207)	31.3	49	0.5	5	2.2	1.5	1.1	/36	13
FN 351H - 180 / ??	180 (207)	40.7	49	0.5	5	2.2	1.5	1.1	/36	13
FN 351 - 280 / ??	280 (323)	35.8	70	0.3	10	2.6	1.5	1.1	/37	28
FN 351H - 280 / ??	280 (323)	46.5	70	0.3	10	2.6	1.5	1.1	/37	28

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst case leakage current could reach 7.6 times (5A to 16A types) or 6.0 times (25A to 280A types) higher levels. Measured at: standard types 400VAC; H types 520VAC.

Mechanical data

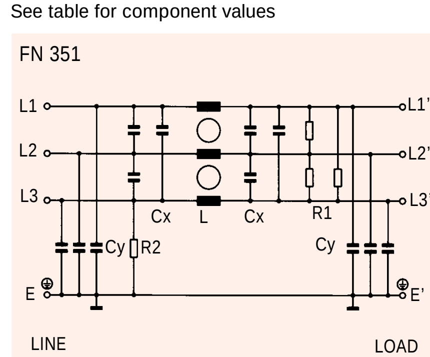
Current	-5	-8 (std voltage)	-8, -16 (H type)	-25, -36, -50, -64	-80, -110	-180	-280	Tol.* ± mm
A	150	180	200		400	510	700	± 1
B	105	115	150		170 ± 1	180 ± 1	260 ± 1	± 0.5
C	50	60	65	75†	90 ± 1	115 ± 1	130 ± 1	± 0.5
D	75	85	120		350	360	530	± 1
E	85	115			373	470 ± 0.5	660 ± 0.5	± 0.3
F	90	100 ± 0.5	136		130 ± 0.2	156 ± 0.5	220 ± 0.5	± 0.3
G	0.7		0.7/1.0	1.0		4 ± 0.2		± 0.1
H	19	20 ± 2			25	25		± 1
K	17	17 ± 0.5			20	30		± 1
M	6.5	6.4			15	16		± 0.2
N					6.5	9 ± 0.2		± 0.2
P	M6				M10	M10		-

All dimensions in mm; 1 inch = 25.4mm

† for connections /34 and /52 only
* Measurements share this common tolerance unless otherwise stated

Electrical schematic

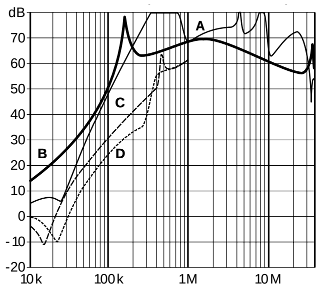
See table for component values



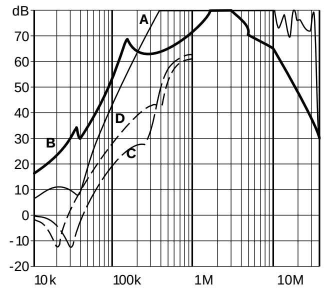
FN 351 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

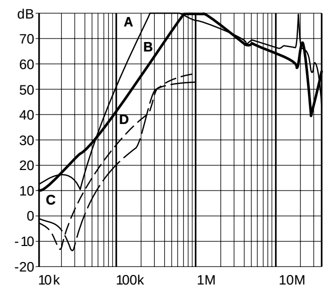
5 amp types



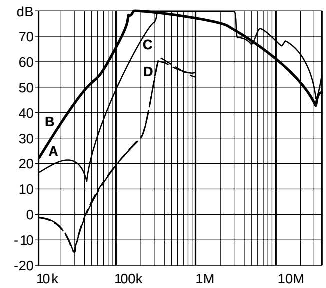
8 amp types



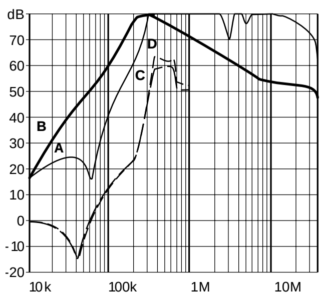
16 amp types



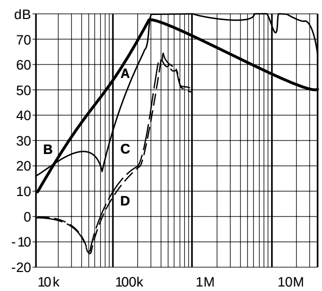
25 amp types



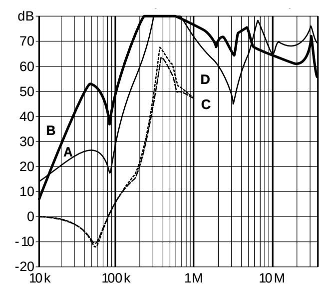
36 amp types



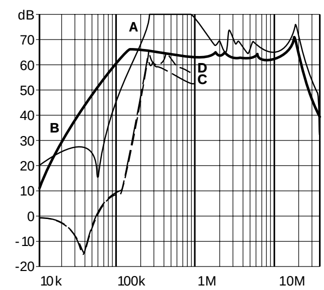
50 amp types



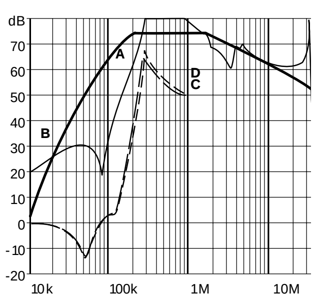
64 amp types



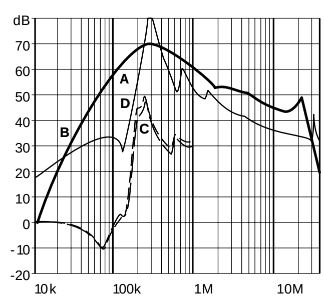
80 amp types



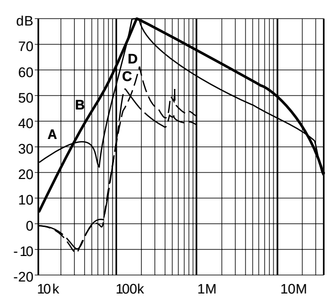
110 amp types



180 amp types



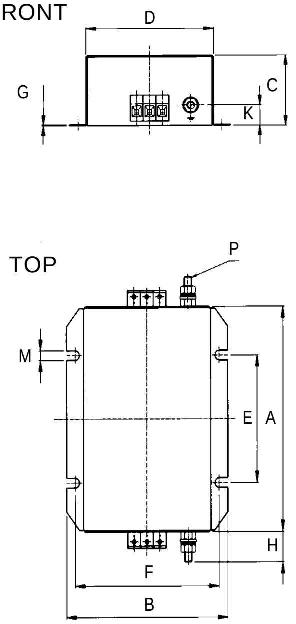
280 amp types



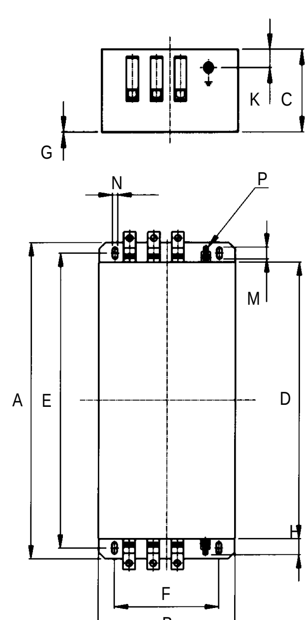
Mechanical drawings

See mechanical data table for dimensions

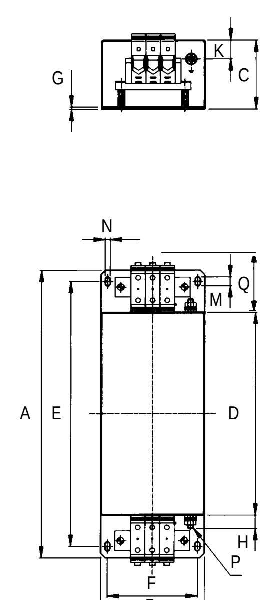
FRONT



FN 351-5, -8, -16, -25, -36, -50, -64
/29 connections shown



FN 351-80, -110



FN 351-180, -280

2-stage high current 3-phase filter FN 359

FN 359 sets a new standard in EMC filtering solutions for industrial frequency inverters or power drive systems, UPSs and other high power equipment. This family is additionally offered in a very high voltage version to match every type of power supply in use worldwide. Despite availability in a wide range of current ratings, all FN 359s come in the same compact, lightweight package, simplifying OEM system building.

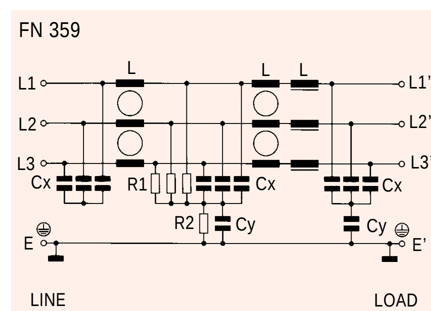
- **250 to 1200A current ratings**
- **440, 520 or 690VAC versions for worldwide compatibility**
- **small leakage current**
- **compact, light 'one-size' packaging**
- **built to meet UL, CSA and EN 133200 standards**

Technical specifications

Maximum operating voltage: standard types 440VAC; H types 520VAC; HV types 690VAC
Operating frequency: DC to 60Hz at 50°C
Hipot test voltage: standard: P ⇒ E 2600VDC, P ⇒ P 1900VDC; H: P ⇒ E 2750VDC, P ⇒ P 2250VDC; HV: P ⇒ E 3050VDC, P ⇒ P 3000VDC; all for 2s (factory test)
MTBF at 40°C, per Mil-HB-217F: standard types 155,000 hours; H types 109,000 hours; HV types 128,000 hours
MTBF at 25°C, per Mil-HB-217F: standard types 307,000 hours; H types 222,000 hours; HV types 257,000 hours
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour
Design corresponding to: UL 1283, CSA 22.2 No 8 1986, EN 133200

Electrical schematic

See table for component values



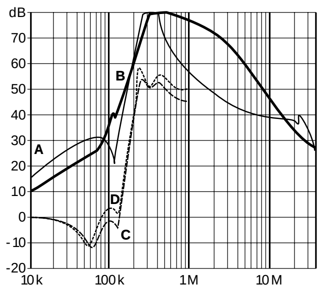
Filter	Current ratings A at 50ºC	Leakage current† IEC 1000-2-4 mA at 50Hz	Power loss W	Component values/phase ΣL µH	ΣCx µF	ΣCy µF	R1 MΩ	R2 MΩ	Phase connections	Weight kg
FN 359 - 250/99	250	39	37	157	11	2.3	1	0.68	busbar	16
FN 359H - 250/99	250	51	37	157	11	2.3	1	0.68	busbar	17
FN 359HV - 250/99	250	60	37	157	5.5	2.1	1.5	0.68	busbar	17
FN 359 - 300/99	300	39	48	157	11	2.3	1	0.68	busbar	16
FN 359H - 300/99	300	51	48	157	11	2.3	1	0.68	busbar	17
FN 359HV - 300/99	300	60	48	157	5.5	2.1	1.5	0.68	busbar	17
FN 359 - 400/99	400	39	65	157	11	2.3	1	0.68	busbar	18.5
FN 359H - 400/99	400	51	65	157	11	2.3	1	0.68	busbar	19.5
FN 359HV - 400/99	400	60	65	157	5.5	2.1	1.5	0.68	busbar	19.5
FN 359 - 500/99	500	39	75	165	11	2.3	1	0.68	busbar	19.5
FN 359H - 500/99	500	51	75	165	11	2.3	1	0.68	busbar	20.5
FN 359HV - 500/99	500	60	75	165	5.5	2.1	1.5	0.68	busbar	20.5
FN 359 - 600/99	600	39	87	165	11	2.3	1	0.68	busbar	20.5
FN 359H - 600/99	600	51	87	165	11	2.3	1	0.68	busbar	21.5
FN 359HV - 600/99	600	60	87	165	5.5	2.1	1.5	0.68	busbar	21.5
FN 359 - 900/99	900	39	104	63	11	2.3	1	0.68	busbar	33
FN 359H - 900/99	900	51	104	63	11	2.3	1	0.68	busbar	33.5
FN 359HV - 900/99	900	60	104	63	5.5	2.1	1.5	0.68	busbar	34.5
FN 359 - 1200/99	1200	39	146	63	11	2.3	1	0.68	busbar	35
FN 359H - 1200/99	1200	51	146	63	11	2.3	1	0.68	busbar	35.5
FN 359HV - 1200/99	1200	60	146	63	5.5	2.1	1.5	0.68	busbar	36.5

†Max. leakage under normal circumstances. Note: if two phases are interrupted, worst case leakage current could reach 5.7 times higher levels.
Measured at: standard types 400VAC; H types 520VAC; HV types 690VAC.

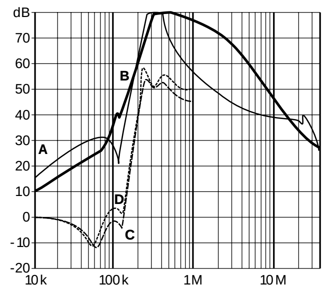
FN 359 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

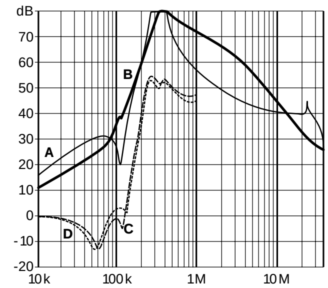
250A types



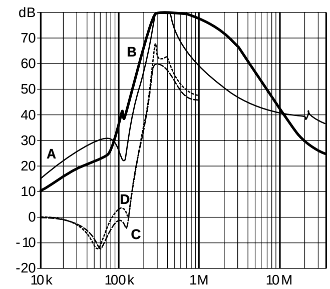
300A types



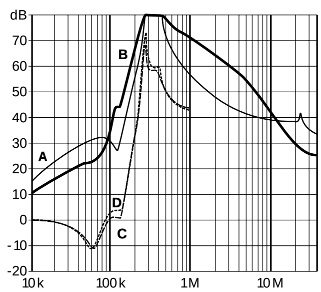
400A types



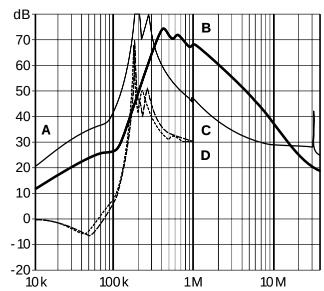
500A types



600A types



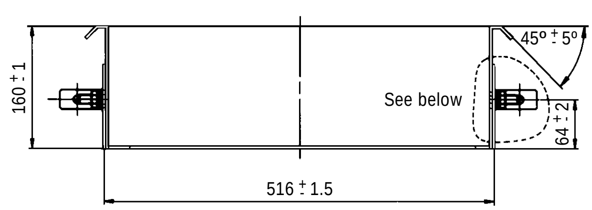
900A/1200A types



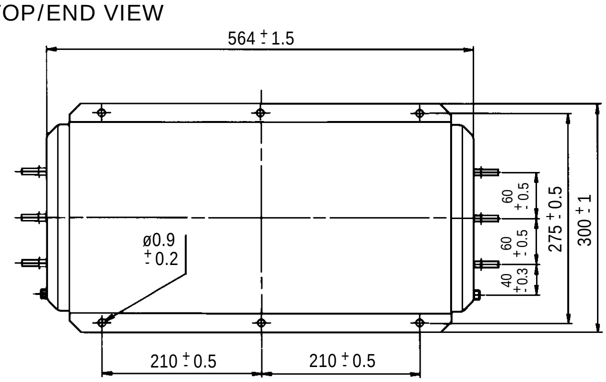
Mechanical drawings

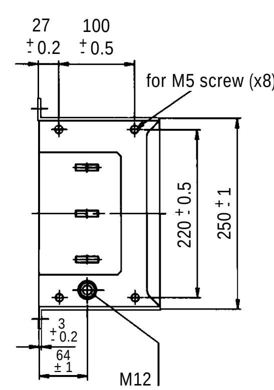
See mechanical data table for dimensions

SIDE VIEW



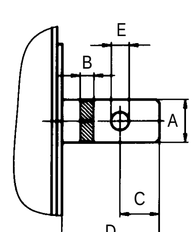
TOP/END VIEW

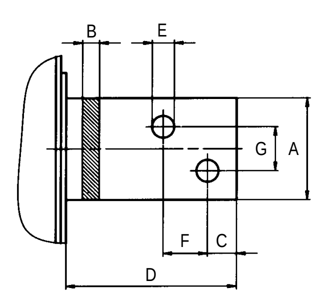




I/O connections

FN 359 filters are fitted with an M12 screw for earth connection, and busbar-type connectors for phase terminals (dimensions vary according to current rating - see table).





Dimension	Current rating of filter						Tol.
	250/300A	400A	500A	600A	900A	1200A	mm
A	20	25	25	30	50	60	±0.1
B	5	6	8	8	10	10	±0.1
C	15	18	18	23	17	17	±0.5
D	47	47	47	57	100	100	±1.5
E	8.5	10.5	10.5	10.5	13	13	±0.2
F	-	-	-	-	26	26	±0.2
G	-	-	-	-	20	26	±0.2

All dimensions in mm; 1 inch = 25.4mm

SCHAFFNER

3-phase + neutral filter

FN 256

The FN 256 family of filters is designed specifically for applications involving asymmetric loads, ranging from industrial control to medical electronics systems. These typically involve separate - and often unfiltered - frequency inverters and switch-mode power supplies on different phases, causing current imbalance and significant interference problems. Employing single-stage LCR circuits for each phase and the neutral line, FN 256 series filters provide particularly high attenuation of both symmetrical and asymmetrical interference. A special lightweight housing with a very small footprint ensures that the filters can be easily accommodated on control panels and in crowded equipment cabinets.

- **8 to 64A current ratings**
- **high attenuation**
- **small leakage current**
- **very compact dimensions**

EN 133200 (pending) (pending)

Technical specifications

Maximum operating voltage: 480VAC (520VAC on request) at 50°C
Operating frequency: DC to 60Hz at 50°C
Hipot test voltage: P/N ⇒ E 3000VDC for 2s; P/N ⇒ P 2100VDC for 2s
MTBF at 50°C, 400V per Mil-HB-217F: 8/16A 1,300,000 hours; 25/36/64A 600,000 hours
Protection category: IP20
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour
Temperature range: -25°C to +100°C
Flammability class: UL 94V2

Filter	Current ratings A at 50ºC (40º)	Leakage current† (480V/50Hz) mA	Power loss W	Component values/phase L mH	ΣCx µF	ΣCy µF	R1 MΩ	R2 MΩ	Phase connections	Weight kg
FN 256 - 8 / ??	8 (9.1)	3.4	2.9	1.78	2.20	0.19	0.68	1.50	/46	1.0
FN 256 - 16 / ??	16 (18.1)	3.4	5.6	1.14	2.20	0.19	0.68	1.50	/46	1.1
FN 256 - 25 / ??	25 (28.3)	3.4	9.8	1.57	4.40	0.19	0.68	0.82	/47	1.4
FN 256 - 36 / ??	36 (40.8)	3.4	10.9	1.10	4.40	0.19	0.68	0.82	/47	1.5
FN 256 - 64 / ??	64 (72.6)	3.4	17.2	1.00	4.40	0.19	0.68	0.82	/52	2.2

† Max leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6 times higher levels.

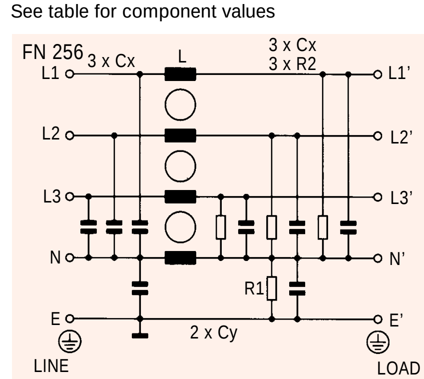
Mechanical data

Current	-8, -16	-25, -36	-64	Tol. ± mm
A	143	153	153	± 1
B	115	125	125	± 0.5
C	80	115	125	± 0.5
D	120	130	140	± 0.5
E	130	142	158	± 1
F	156	166	176	± 1
G	1	1	1.5	± 0.1
H	80	90	100	± 0.3
I	127.5	137.5	137.5	± 0.5
J	6.5	6.5	6.5	± 0.1
K	M6	M6	M6	-
L	59	94	99	± 1
M	13.5	14.5	20	± 1

All dimensions in mm; 1 inch = 25.4mm

Electrical schematic

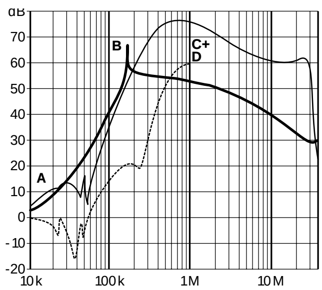
See table for component values



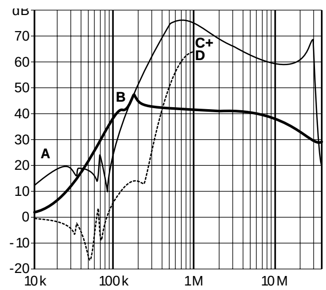
FN 256 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

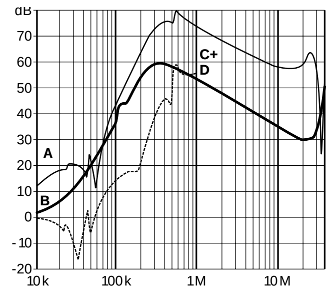
8 amp types



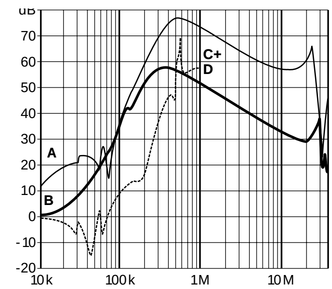
16 amp types



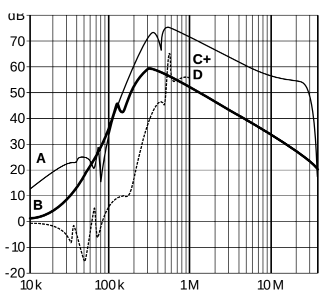
25 amp types



36 amp types



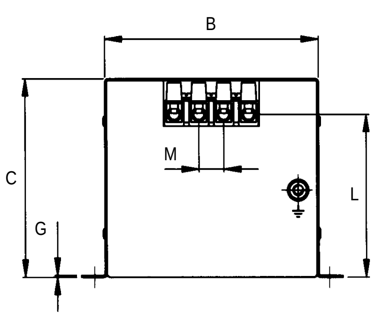
64 amp types

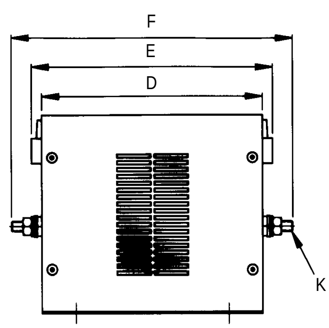


Mechanical drawings

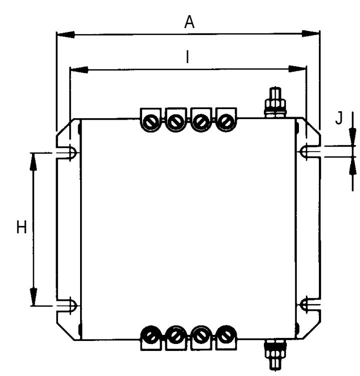
See mechanical data table for dimensions

SIDE VIEW





TOP VIEW



High-attenuation filter

FN 354

The FN 354 family of filters is intended primarily for applications that demand extremely effective interference protection across a broad frequency spectrum. Advanced two-stage LCR filter circuits with non-saturating toroidal inductors, in conjunction with feed-through capacitors on each of the three phases and the neutral line, ensure that these filters provide very high attenuation in the upper frequency band.

- **4 to 25A current ratings**
- **high attenuation up to 300MHz**
- **three phases + neutral + earth connections**
- **choice of solder, fast-on or shrouded terminals**
- **suitable for Y and ∆ networks**

4 to 12A | 12A only | 12A only | 4 to 6A

Technical specifications

Maximum operating voltage: 440VAC at 40ºC; Operating frequency: DC to 60Hz at 40°C

Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1100VDC (1700VAC for 4 and 6A types)

MTBF at 40°C, 400V per Mil-HB-217F: 400,000 hours for 4 and 6A types

Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

Filter	Current ratings A at 40ºC (25º)	Leakage current† (400V/50Hz) mA	Power loss W	Component values/phase L mH	L1 µH	Cx µF	Cy nF	Cy1 nF	R MΩ	Phase connections			Weight kg
FN 354 - 4 / ??	4 (4.6)	0.71	2.5	0.3	4	0.33	15	-	1	/01		/05	0.225
FN 354 - 6 / ??	6 (6.9)	0.71	4.0	0.5	4	0.47	15	-	1	/01	/03	/05	0.38
FN 354 - 12 / ??	12 (13.8)	0.72	10.0	0.08	1700	2.2	15	-	0.33			/05	0.68
FN 354 - 15 / ??	15 (17.3)	0.40	18.0	3	100	0.47	0.01	2.5	0.5		/03		5.45
FN 354 - 25 / ??	25 (28.8)	1.94	30.0	1.4	60	0.47	0.01	0.035	0.5		/03		5.6

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6.7 times higher levels.

Mechanical data

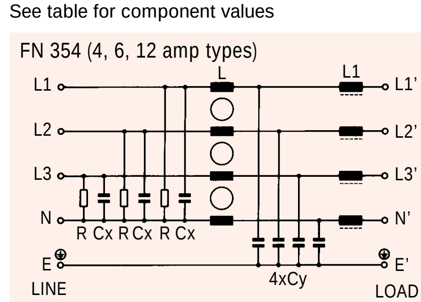
Current	-4	-6	-12	-15, -25	Tol.* ± mm
A	103 ± 5	120 ± 0.5	150	270	± 1
B	43 ± 0.8	55	65	155	± 1
C	40.5 ± 0.5	50.5 ± 0.5	60	110	± 1
D	80	95	125		± 1
E	95	110	140	230	± 0.3
F	35	45	55	115 ± 0.3	± 0.2
G	0.5		0.75		± 0.1
H	15	22		30	± 1
I	7	11		9.5 ± 0.5	± 1
K	29	36		35.5	± 1
M	3.8 ± 0.1		4.4 x 7.5	7	± 0.2
P				PG13.5	-
Q				SAK4	± 2
U	26.5	28	32.5		± 0.3

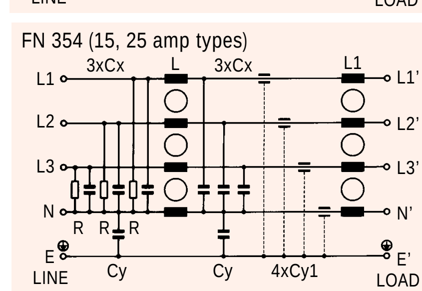
All dimensions in mm; 1 inch = 25.4mm

* Measurements share this common tolerance unless otherwise stated

Electrical schematic

See table for component values

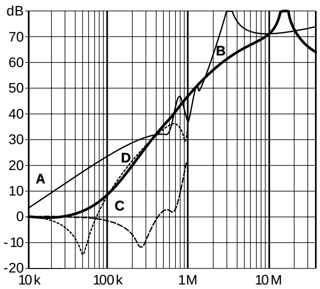




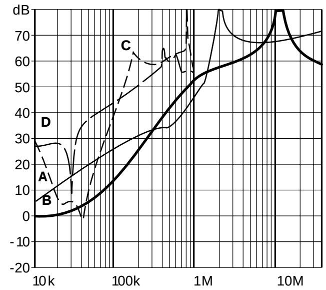
FN 354 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

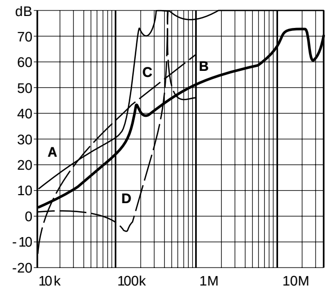
4 amp types



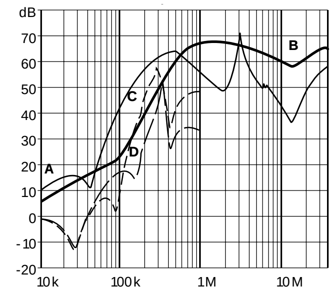
6 amp types



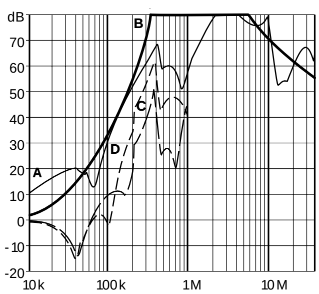
12 amp types



15 amp types



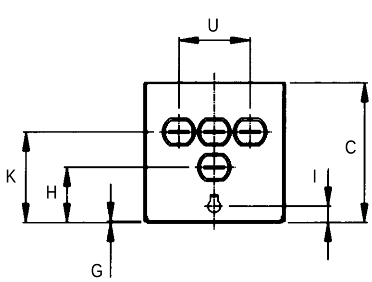
25 amp types



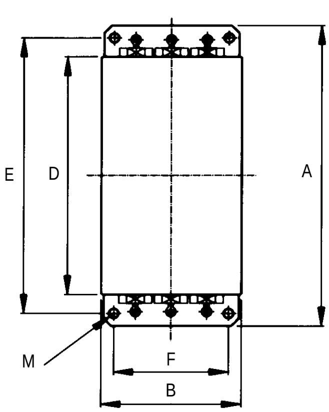
Mechanical drawings

See mechanical data table for dimensions

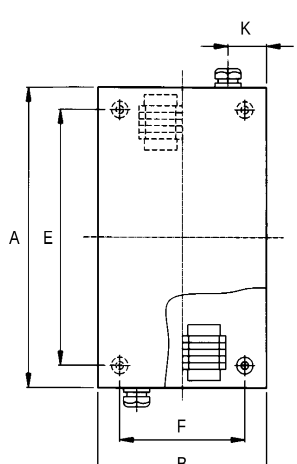
FRONT



TOP

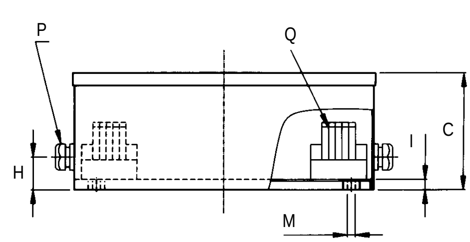


FN 354-4, -6, -12
/01 connections shown



FN 354-15, -25

SIDE



SCHAFFNER

General-purpose filter

FN 355

The FN 355 family of general-purpose filters provides a cost-effective interference suppression solution for a wide variety of applications. Available in seven versions, with current ratings from 3 to 20A, the filters employ a single-stage 4-line LC circuit with non-saturating toroidal inductors, and have a very low leakage current. FN 355 filters are contained within an extremely compact housing, making them ideal for use in situations where space is at a premium.

- **3 to 20A current ratings**
- **low leakage current**
- **three phases + neutral + earth connections**
- **compact size**
- **suitable for Y and Δ networks**

Technical specifications

Maximum operating voltage: 440VAC at 40ºC; Operating frequency: DC to 60Hz at 40°C
Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1700VDC
MTBF at 40°C, 400V per Mil-HB-217F: 850,000 hours
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

Filter	Current ratings A at 40ºC (25º)	Leakage current† (400V/50Hz) mA	Power loss W	Component values/phase L mH	Cx µF	Cy nF	Phase connections			Weight kg
FN 355 - 3 / ??	3 (3.4)	0.07	1.5	1	0.1	4.7	/01		/05	0.25
FN 355 - 6 / ??	6 (6.9)	0.07	1.5	0.45	0.1	4.7	/01		/05	0.25
FN 355 - 10 / ??	10 (11.5)	0.07	1.7	0.2	0.1	4.7	/01		/05	0.25
FN 355 - 20 / ??	20 (23)	0.29	3.6	0.12	0.1	22		/03		0.29

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 5.8 times higher levels.

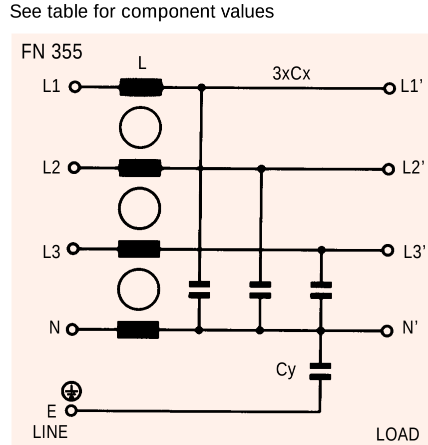
Mechanical data

Current	-3, -6, -10, -20	Tol. ± mm
A	85	± 0.5
B	54	± 0.5
C	40.3	± 1
D	65	± 1
E	75	± 0.2
G	0.7	± 0.05
H	11.3	± 0.5
I	28.8	± 0.5
K	36.8	± 0.5
L	27	± 0.5
M	6.3	± 0.1
N	5.3	± 0.1
P	50	± 1

All dimensions in mm; 1 inch = 25.4mm

Electrical schematic

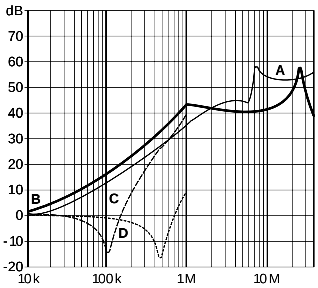
See table for component values



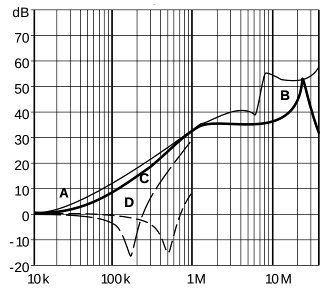
FN 355 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

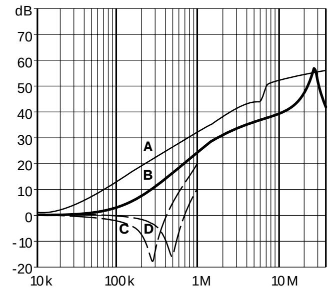
3 amp types



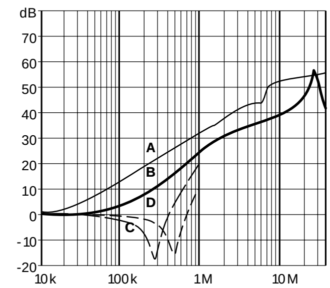
6 amp types



10 amp types



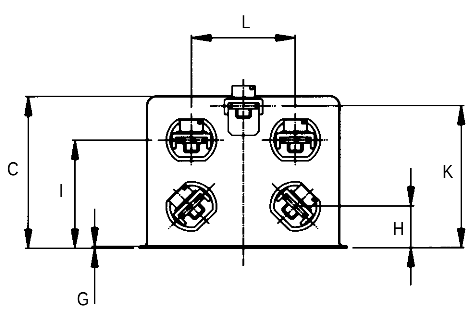
20 amp types



Mechanical drawings

See mechanical data table for dimensions

FRONT



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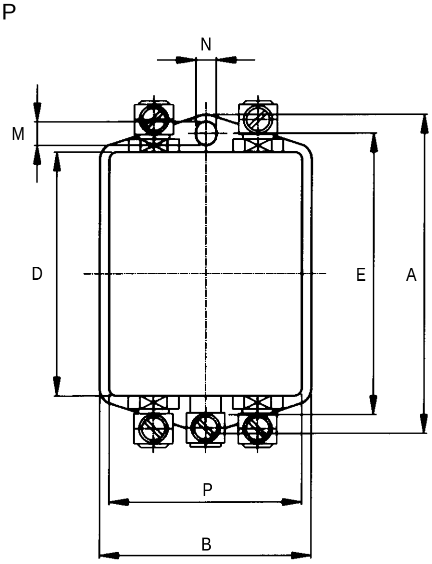


High-current filter

FN 356

This filter family is designed specifically for high-current applications, such as large frequency inverters for motor drives, and high-power uninterruptible and switch-mode supplies. FN 356 filters are fully compliant with the IEC 950 safety standard, making them particularly suitable for use in large mainframe computer systems. Employing a single-stage LCR circuit for each phase and the neutral line, the filters provide high attenuation of both symmetrical and asymmetrical interference.

- **16 to 100A current ratings**
- **three phases + neutral + earth connections**
- **IEC 950 compliant**
- **meets EN 55011/55014 & VDE 0871/0875**

Technical specifications

Maximum operating voltage: 440VAC at 40ºC; Operating frequency: DC to 60Hz at 40°C
Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1700VDC
MTBF at 40°C, 400V per Mil-HB-217F: 220,000 hours
Protection category: IP20 for connections /29, /33 and /34
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

(There is no VDE qualification above 36A)

Filter	Current ratings A at 40ºC (25º)	Leakage current† (400V/50Hz) mA	Power loss W	Component values/phase L mH	Cx µF	Cx1 µF	Cy nF	R kΩ	Phase connections			Weight kg
FN 356 - 16 / ??	16 (18.4)	0.43	8	1.2	0.68	1	15	220	/06		/29	1.5
FN 356 - 25 / ??	25 (28.8)	0.43	28	1.3	2	2	15	100		/24	/33	2.6
FN 356 - 36 / ??	36 (41.5)	0.43	30	0.95	2	2	15	100		/24	/33	2.7
FN 356 - 50 / ??	50 (57.7)	0.43	13	0.55	2	2	15	100		/24	/33	3.9
FN 356 - 100 / ??	100 (115.4)	1.33	14	0.32	2	2	47	100		/28	/34	10

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6.0 times higher levels.

Mechanical data

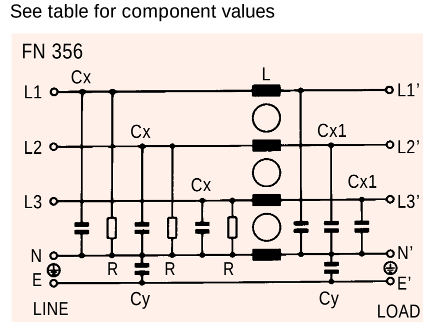
<table>
<tr><th>Current</th><th>-16 (/29)</th><th>-16 (/06)</th><th>-25, -36 (/24)</th><th>-50 (/24)</th><th>-25, -36 (/33)</th><th>-50 (/33)</th><th>-100 (/28)</th><th>-100 (/34)</th><th>Tol.* ± mm</th></tr>
<tr><td>A</td><td>189.5</td><td>149</td><td>140</td><td>143.25 ± 0.5</td><td>189.5</td><td>192 ± 0.5</td><td>250</td><td>249.6</td><td>± 1</td></tr>
<tr><td>B</td><td>105</td><td>104</td><td>105</td><td>122 ± 0.5</td><td>105</td><td>122 ± 0.5</td><td colspan="2">160 ± 0.8</td><td>± 1</td></tr>
<tr><td>C</td><td>80</td><td>50 ± 0.5</td><td>80</td><td>102</td><td>80</td><td>102</td><td colspan="2">130</td><td>± 1</td></tr>
<tr><td>D</td><td>140</td><td colspan="3"></td><td>140</td><td>142.5</td><td colspan="2">210</td><td>± 1</td></tr>
<tr><td>E</td><td>165.5</td><td colspan="2">44 ± 0.2</td><td>44</td><td>165.5</td><td>168</td><td>232</td><td>230</td><td>± 0.3</td></tr>
<tr><td>F</td><td>80</td><td colspan="2">75</td><td>75 ± 0.3</td><td>50</td><td>98 ± 0.3</td><td>120 ± 0.3</td><td>130 ± 0.3</td><td>± 0.2</td></tr>
<tr><td>G</td><td>0.7</td><td colspan="3"></td><td colspan="2">0.7</td><td colspan="2">1</td><td>± 0.1</td></tr>
<tr><td>H</td><td>20</td><td>12.3</td><td colspan="2">20</td><td colspan="2">20</td><td colspan="2">24</td><td>± 1</td></tr>
<tr><td>I</td><td></td><td>10.8</td><td colspan="2">25.4</td><td colspan="4"></td><td>± 1</td></tr>
<tr><td>K</td><td>25</td><td colspan="2">14 ± 0.5</td><td>14</td><td>20</td><td>35</td><td>65</td><td>40</td><td>± 1</td></tr>
<tr><td>L</td><td></td><td>27.5 ± 0.5</td><td>33.5</td><td>33.5</td><td colspan="2"></td><td>105</td><td></td><td>± 1</td></tr>
<tr><td>M</td><td>13</td><td colspan="3">M5</td><td colspan="4">13</td><td>± 0.2</td></tr>
<tr><td>N</td><td>6.5</td><td colspan="3"></td><td colspan="4">6.5</td><td>± 0.2</td></tr>
<tr><td>P</td><td colspan="6">M6</td><td colspan="2">M10</td><td>-</td></tr>
</table>

All dimensions in mm; 1 inch = 25.4mm

* Measurements share this common tolerance unless otherwise stated

Electrical schematic

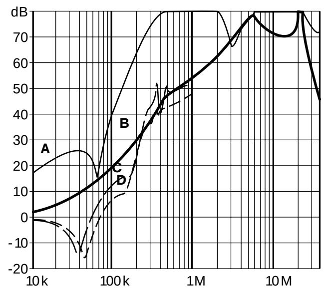
See table for component values



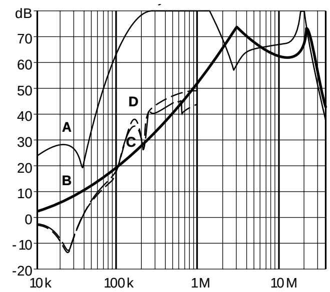
FN 356 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

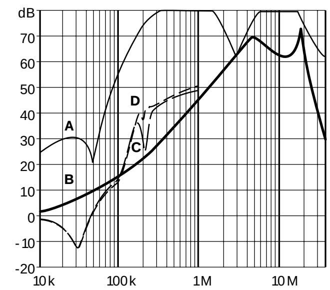
16 amp types



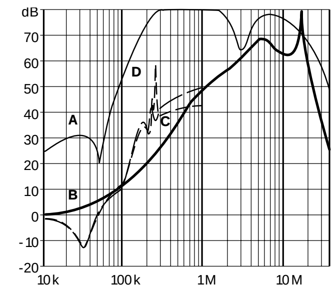
25 amp types



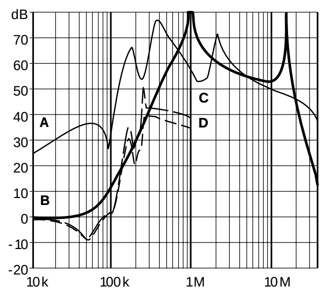
36 amp types



50 amp types



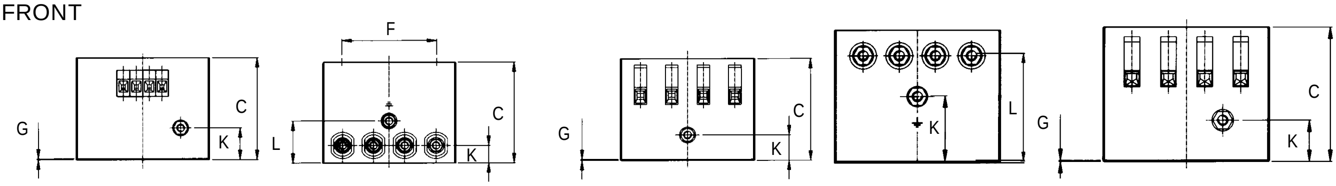
100 amp types



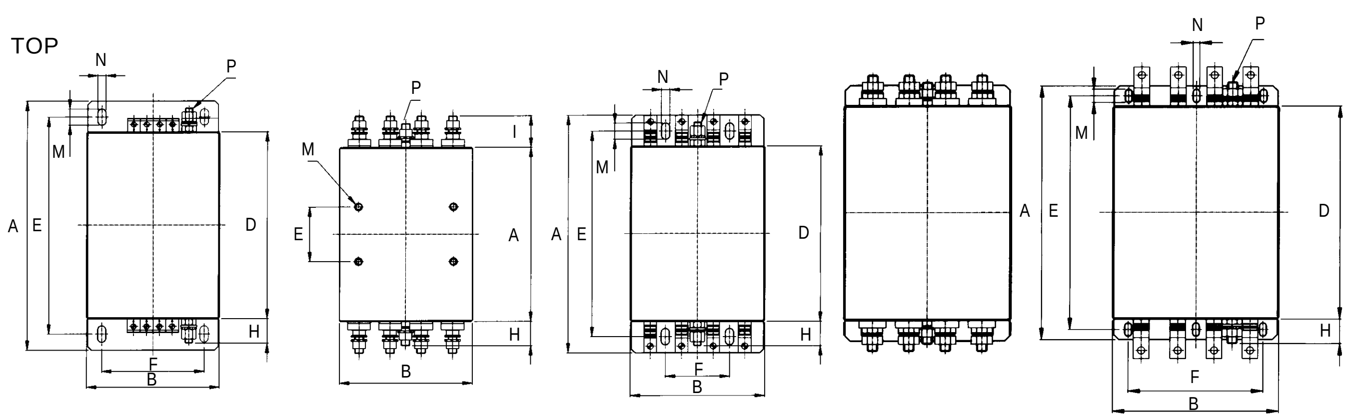
Mechanical drawings

See mechanical data table for dimensions

FRONT



TOP



FN 356-16 with /29 connections

FN 356-16 /06 and FN 356-36, -50 with /24 connections (/24 shown)

FN 356-25, -36, -50 with /33 connections

FN 356-100 with /28 connections (note centred earth terminal)

FN 356-100 with /34 connections

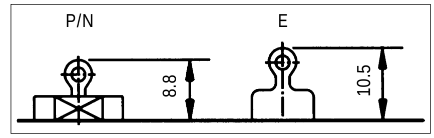
Filter input/output connections

SCHAFFNER

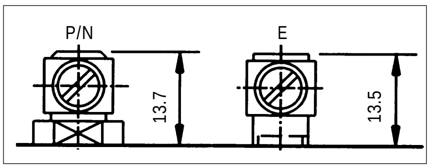
These are the standard types of input and output connections available for Schaffner's range of filter families.

Schaffner can also produce filters with other popular output connectors, or user-specific interfaces, to custom order. Please call your local sales office to discuss requirements.

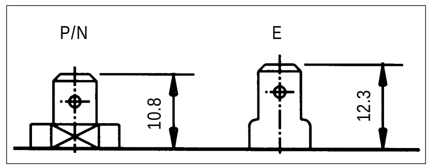
All dimensions in mm.



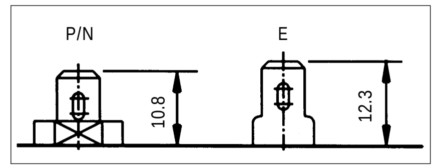
Type /01
Solder lug with a hole capable of accommodating several small wires.



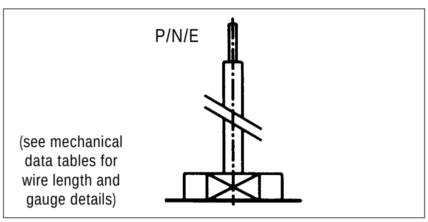
Type /03
Clamp terminal with M4 screw.



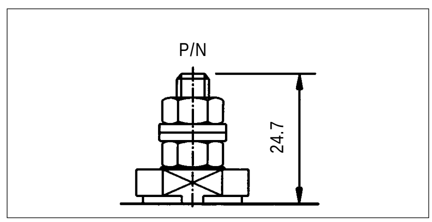
Type /05
Industry-standard size fast-on terminal, 6.3 x 0.8mm.



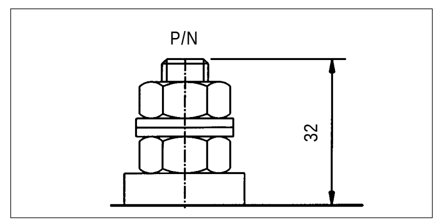
Type /06
Industry-standard size fast-on which may also be used as a solder lug, 6.3 x 0.8mm.



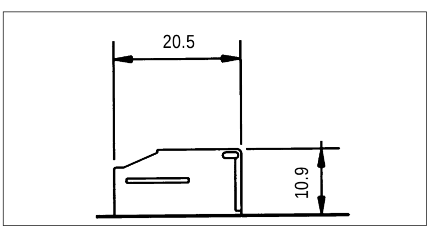
Type /07
Insulated wire, stripped ready for soldering. Wire gauge varies according to filter.



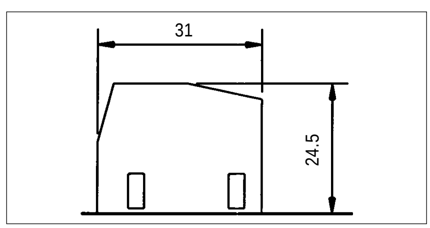
Type /24
M6 screw lead-through.



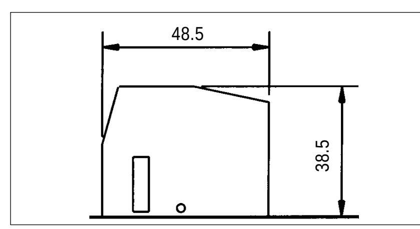
Type /28
M10 screw lead-through.



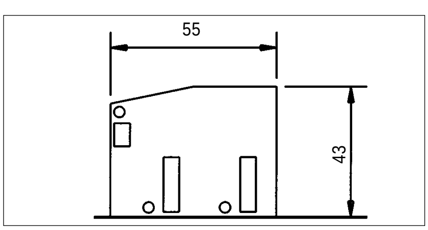
Type /29
Safety terminal block for $6mm^2$ or AWG 10 cables.



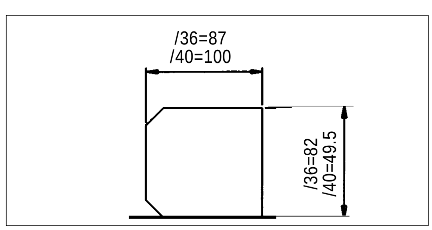
Type /33
Safety terminal block for $10mm^2$ or AWG 6 cables.



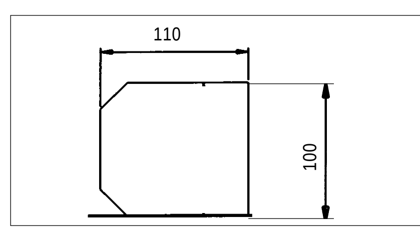
Type /34
Safety terminal block for $25mm^2$ or AWG 3 cables.



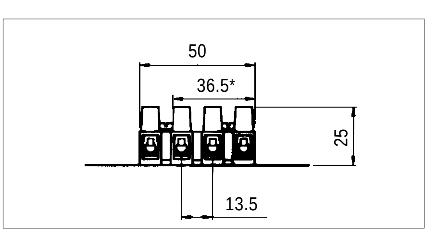
Type /35
Safety terminal block for $50mm^2$ or AWG 1/0 cables.



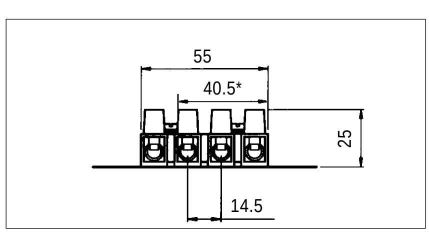
Type /36 and /40
Safety terminal block for $95mm^2$ or AWG 4/0 cables.



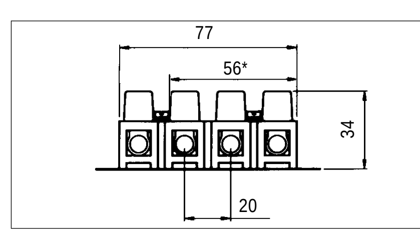
Type /37
Safety terminal block for $150mm^2$ or AWG 6/0 cables.



Type /46
Strip terminal block for solid wire $10mm^2$, flex wire $6mm^2$, AWG 8.
*without neutral line



Type /47
Strip terminal, block for solid wire $16mm^2$, flex wire $10mm^2$, AWG 6.
*without neutral line



Type /52
Strip terminal, block for solid wire $25mm^2$, flex wire $16mm^2$, AWG 4.
*without neutral line

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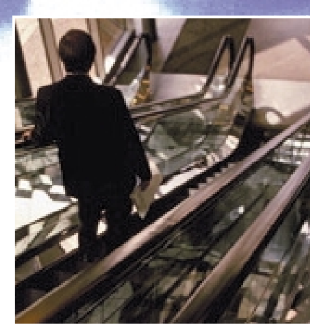

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