EMC/EMI Components and Quality Filters for Factory Automation

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Typical Factory Automation Applications Include:

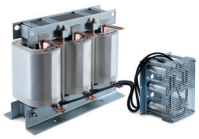
- Robotics
- Conveyors
- Assembly Lines
- Control Units
- Mining Industry
- Chemical Industry
- Oil Production
- Metal Processing

Single-phase Filters and DC Filters

Single-phase Filters and AC Filters

Three-phase Filters

Three-phase and Neutral Line Filters



Output Filters & Load Reactors

Feedthrough Components

EMC/EMI Chokes

Product Selection Chart

EMC filter & components

Number of phases

1-phase

Feedthrough components

≤ 250 A

Capacitors
FN 751X

Filter
FN 761X

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Chassis mount filter

≤ 100 A

1-stage filters

FN 332
FN 350
FN 2010
FN 2020
FN 2030
FN 2410
FN 2450

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≤ 36 A

2-stage filters

FN 343
FN 685
FN 2060
FN 2070
FN 2080
FN 2090

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DC

≤ 30 A

3-stage filters

FN 352Z
FN 700Z
FN 2060
FN 2070
FN 2090

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DC filter

≤ 2500 A

FN 2200
FN 2210
FN 2210 HV
FN 2211
FN 2211 HV

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3-phase

3-phase filter

≤ 300 A

FN 351
FN 3025/3026
FN 3100
FN 3120
FN 3258
FN 3268
FN 3287
FN 3288

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≤ 2500 A

FN 3270
FN 3359
FN 3310
FN 3310 HV
FN 3311
FN 3311 HV

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3-phase + neutral filter

≤ 600 A

FN 354
FN 355
FN 356
FN 3256
FN 3280

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Chokes

Commonmode

No

Differential mode chokes

≤ 4 A

RS series

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Yes

1-phase

≤ 80 A

RD series
RN series
RT series

page 10

3-phase

≤ 80 A

RD series
RT series

page 10

3-phase + neutral

≤ 64 A

RD series

page 10

3-phase reactor

Line and load side

Load

0.8%

≤ 1100 A

RWK 305

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Line

4%

≤ 1000 A

RWK 3044
RWK 3062

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Output filter

Voltage shape

dv/dt

dv/dt filter

≤ 1200 A

FN 510
FN 5060
FN 5060 HV

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Sinewave

Sinusoidal filter

≤ 1320 A

FN 530
FN 5020
FN 5030
FN 5040
FN 5040 HV
FN 5045

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Single-phase and DC filters.

Single-phase filters for chassis or DIN-rail mounting are key for EMC compliance of higher power office equipment and low to medium power industrial applications. A broad selection of electrical and mechanical features allows a specific choice and deployment for countless applications. DC filters are specifically optimized for applications with DC supply like e.g. PV inverters.

Filter family	Max. voltage	Attenuation performance / Rated current [A] (standard / high / very high; 0 20 40 60 80 100)	1-stage filter circuit	2-stage filter circuit	3-stage filter circuit	For DC applications	With overvoltage protection	Low frequency attenuation	High frequency attenuation	Choice of connection style	DIN-rail mounting
FN 332	250 VAC	1–10	■				■				
FN 350	250 VAC	8 – 55	■								
FN 2010	250 VAC	1 – 60	■							■	
FN 2020	250 VAC	1 – 60	■							■	
FN 2030	250 VAC	1 – 30	■				■	■	■	■	
FN 2200	1200 VDC	25 – 2300	■			■		■	■		
FN 2210 FN 2211	1000 VDC	250–2300	■			■		■	■		
FN 2210 HV FN 2211 HV	1500 VDC	250–2300	■			■		■	■		
FN 2410	250 VAC 520 VAC (H)	8 – 100	■					■			
FN 2412	250 VAC 520 VAC (H)	8 – 45	■					■			■
FN 2450	250 VAC	1 – 20	■					■	■		

* Products evaluated by one or more of the above certification agencies. For details please consult the detailed data sheet.

Single-phase and DC filters. (continued)

Filter family	Max. voltage	Attenuation performance / Rated current [A] (standard / high / very high; 0 20 40 60 80 100)	1-stage filter circuit	2-stage filter circuit	3-stage filter circuit	With earth line choke	With overvoltage protection	Low frequency attenuation	High frequency attenuation	Choice of connection style	TEMPEST protection
FN 343	250 VAC	1 10		■		■					
FN 2060	250 VAC	1 30		■						■	
FN 2070	250 VAC	1 26		■					■	■	
FN 2080	250 VAC	1 16		■				■		■	
FN 2090	250 VAC	1 30		■			■	■	■	■	
FN 700Z	250 VAC	6 20			■		■	■	■		■

* Products evaluated by one or more of the above certification agencies. For details please consult the detailed data sheet.

Single-phase AC filters. Single-phase filters for chassis or DIN-rail mounting are key for EMC compliance of higher power office equipment and low to medium power industrial applications. A broad selection of electrical and mechanical features allows a specific choice and deployment for countless applications.

Filter family	Max. voltage	Attenuation performance / Rated current [A] (standard / high / very high; 0 20 40 60 80 100)	1-stage filter circuit	2-stage filter circuit	3-stage filter circuit	For DC applications	With overvoltage protection	Low frequency attenuation	High frequency attenuation	Choice of connection style	DIN-rail mounting
FN 2030	250 VAC	1 30	■				■	■	■	■	
FN 2410	250 VAC 520 VAC (H)	8 100	■					■			
FN 2412	250 VAC 520 VAC (H)	8 45	■					■			■

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Three-phase filters and line reactors.

EMC/EMI filter solutions for industrial applications like motor drives and machine tools. Furthermore, these types of filters are also suitable for mainframe computer systems, large uninterruptible power supplies, medical equipment, wind turbine power stations and a vast array of other three-phase power electronics. Line reactors, also operated on the line side of power drive systems, efficiently protect inverter electronics and DC link capacitors from inrush, peak and short-circuit currents. Additionally, low-frequency interference and harmonics are reduced significantly.

	Filter family	Approvals *	Max. voltage	Attenuation performance / Rated current [A] (standard / high / very high; 0 – 200 – 400 – 600 – 800 – >1000)	Features: Multi-stage filter circuit	Safety connector blocks	Busbar connection	Optional protective covers	Standard protective covers	Offering EMC compliance	Low leakage current	Less commutation notches	Inrush current limitation	Harmonics reduction	4% impedance
	FN 351 		440 VAC 520 VAC (H)	8 – 280		■				■					
	FN 3025 		520 VAC	10–50		■			■	■	■				
	FN 3026 		520 VAC	10–50		■			■	■	■				
	FN 3100 		520 VAC	35 – 300		■				■					
	FN 3120 		520 VAC (H)	25 – 230		■				■					
	FN 3258 		480 VAC 520 VAC (H)	7 – 180		■				■					
	FN 3268 		520 VAC	7 – 180		■				■	■				
	FN 3270 		520 VAC	10 – 1000		■	■	■		■					
NEW	**FN 3287** 		**480 VAC**	10 – 160	■	■				■	■				
NEW	**FN 3288** 		**690 VAC**	10 – 160	■	■				■	■				
	FN 3310 FN 3311 		520 VAC	250 – 2300			■			■					
	FN 3310 HV FN 3311 HV 		690 VAC	250 – 2300			■			■					
	FN 3359 		520 VAC 690 VAC (HV)	150 – 2500	■		■	■		■					
NEW	**RWK 3044** 		**530 VAC**	2 – 1000		■	■					■	■	■	■
NEW	**RWK 3062** 		**760 VAC**	1.5 – 870		■	■					■	■	■	■

* Products evaluated by one or more of the above certification agencies. For details please consult the detailed data sheet.

Three-phase filters and neutral line filters.

Three-phase and neutral line filters are a compact solution for the interference suppression on the mains input of cabinets and control units of equipment, ranging from industrial applications like machine tools to sensitive medical installations. These typically involve separate and often insufficiently filtered frequency inverters and SMPS, causing current imbalance and significant interference problems.

As individual elements, they may be interference-suppressed already. The conjunction of several switching components in the same cabinet and non-EMC conscious cabling will raise the demand for an additional EMC/EMI filter on the mains input of the whole installation. Many times, this is the only way to get the CE mark for the cabinet in accordance with the EMC directive.

Approvals *

IEC/EN 60939

Attenuation performance

Rated current [A]

standard | high | very high

0 120 240 360 480 600

Features

Filter family	Max. voltage	1-stage filter circuit	2-stage filter circuit	Safety connector blocks	Faston connectors	Offering EMC compliance	For asymmetrical loads	Broadband attenuation	Very low leakage current
FN 354 	440 VAC		■		■	■		■	
FN 355 	440 VAC	■			■	■			■
FN 356 	440 VAC	■		■		■	■		
FN 3256 	520 VAC (H)	■		■		■	■		
FN 3280 	520 VAC (H)		■	■		■	■	■	

4–25 (FN 354) · 3–20 (FN 355) · 16–150 (FN 356) · 8–160 (FN 3256) · 8–600 (FN 3280)

* Products evaluated by one or more of the above certification agencies. For details please consult the detailed data sheet.

Output filters & 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.

Approvals *		Typical motor power [kW] / Rated current [A]	**Features**										
Filter family	**Max. voltage**	0 / 0 — 60 / 200 — 120 / 400 — 180 / 600 — 240 / 800 — 300 / >1000	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
FN 510 	520 VAC	1.5–30 / 4–66	■	■	■							■	■
FN 530 	520 VAC	1.5–7.5 / 4–16	■	■	■	■	■	■	■	■	■	■	■
FN 5020 	500 VAC	11 55 / 25–120	■	■	■	■	■					■	■
FN 5030** 	500 VAC	11 55 / 25–120			■	■		■	■	■	■	■	■
FN 5040 	500 VAC	1.1 630 / 4.5 1200	■	■	■	■	■					■	■
FN 5040 HV 	690 VAC	7.5 1200 / 13 1320	■	■	■	■	■					■	■
FN 5045 	500 VAC	1.1 630 / 4.5 1200	■	■	■	■	■					■	■
FN 5060 	500 VAC	5 630 / 12 1100	■	■	■							■	■
FN 5060 HV 	690 VAC	7.5 1000 / 16 1200	■	■	■							■	■
RWK 305 	500 VAC	1.5 630 / 4 1100	■		■							■	■

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** Additional output filter module to be operated in conjunction with FN 5040/45 or FN 5020.

Feedthrough components.

Interference suppression up into the GHz range for high-tech applications such as medical devices.

Approvals *

Capacitance [nF]
Rated current [A]
Attenuation performance

Feedthrough capacitors	Max. voltage	0 1000 2000 3000 4000 5000 0 50 100 150 200 250	Features: AC capacitors	DC capacitors	AC filters	DC filters	Very high performance	Y2 capacitor class	Y4 capacitor class
FN 7510 	300 VAC	2.2–47 / 10 – 100	■					■	
FN 7511 	300 VAC	4.7–220 / 10 – 200	■					■	
FN 7512 	300 VAC	47–100 / 16 – 63	■					■	
FN 7513 	300 VAC	100 / 16	■					■	

Feedthrough filters		standard / high / very high							
FN 7611 	300 VAC	10 – 250			■			■	
FN 7612 	300 VAC	10 – 100			■		■	■	

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EMC/EMI chokes.

An extensive selection of discrete EMC/EMI chokes with various inductance and current ratings allows optimized circuitry for EMC compliance to be designed easily and economically.

Choke family	Approvals *	Max. voltage	Inductance value [mH] / Rated current [A] (0 20 40 60 80 100 / 0 30 60 90 120 150)	Features: For common-mode noise	Saturating chokes	Single-choke	Dual-choke	Triple-choke	Quad-choke	PCB mounting	With flying leads
RN series 		300 VAC 300 VDC	0.4 – 100 0.3–10	■			■			■	
RD 5000 series 		600 VAC 850 VDC	1–10 6–16	■			■	■		■	
RD 6000 series 		600 VAC 850 VDC	1.5 – 15 6–16	■			■	■			■
RD 7000 series 		600 VAC 850 VDC	0.2 – 25 6 – 36	■			■	■	■		■
RD 8000 series 		600 VAC 850 VDC	0.2–12 16 – 64	■			■	■	■		■
RT series 		600 VAC 425 VDC		■			■	■		■	
NEW **RS series** 		**250 VAC**	**0.003–3.6** **0.5–4**			■	■			■	

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** forced cooling

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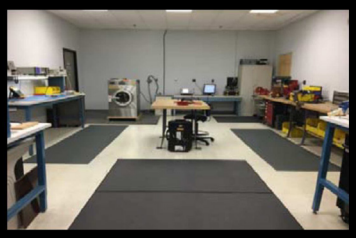
EMC SAMPLE & DESIGN CENTER

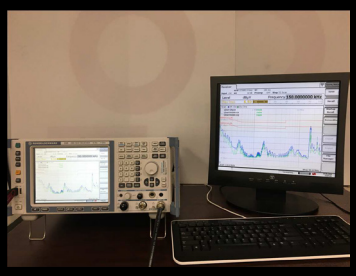
Our expert engineering team can help avoid future EMI/EMC related issues by analyzing designs, building quick-turn prototypes, and working with the customer right through the testing phase.

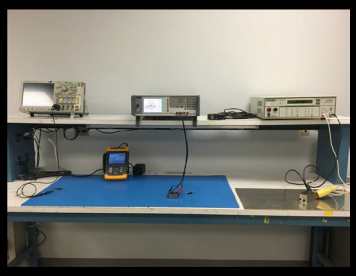
- **Rapid prototype delivery of custom RFI/EMC filters**
  - ✓ Material on hand to wind cores, assemble filters and produce samples for all types of filters
  - ✓ Cost effective approach with safety in mind in order to comply with various industry standards including UL/CSA/IEC/EN
  - ✓ Simulation of expected insertion loss: Leakage currents, residual voltage, thermal characteristics and core saturation
  - ✓ Hi-pot and insulation resistance testing of final samples
  - ✓ 3-D mechanical housing design meeting custom layouts, size, installation and connection requirements

- **Pre-Compliance testing service and consultation**
  - ✓ Test / Consult can be in-house, on customer site or at their local test house in order to achieve the optimal EMC solution for the customer's end product
  - ✓ Analyze the conducted emissions profile of a customer's existing design and provide the best cost effective filter solution for meeting EMC requirements
  - ✓ This could result in utilizing one of our standard filters or a custom solution
  - ✓ Conducted emissions are performed using the latest technology in test equipment for close correlation with test lab compliance results
  - ✓ Testing to FCC part 15 and European standards, (i.e. EN61000 series, EN55011, EN55014, EN55015, EN55022, CISPR16)

Over 40 years of engineering experience solving EMC related issues







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