

# Active Harmonic Filter ecosine active sync



- Most effective harmonic mitigation up to the 50<sup>th</sup> order, parameter setting for even and odd harmonics

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- Compact active harmonic filter for 3-phase loads with and without neutral wire

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- <5% THDi achievable even on most complex mixed loads and changing load profiles

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- New modular design with intelligent system approach offering tailored solutions for different applications and customers

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- 3-Level IGBT inverter topology for reduced power losses

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- Extended temperature range of modules up to 50°C

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- Ultra-fast and dynamic reactive power compensation (inductive and capacitive)

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- Load balancing and unloading of neutral wires

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- Flicker compensation (if caused by reactive power)

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- Compliance with IEEE 519, EN 61000-3-12 and other power quality standards

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- User-friendly, easy to install and maintain



## Approvals



## Features and benefits

Based on the broad knowledge and experience in terms of solutions and applications in power quality the Schaffner Group has developed a new generation of active harmonic filters. The new modular ecosine active sync series offers fitted and economical solutions for the most demanding harmonic mitigation challenges with any kind of non-linear load involved. Ecosine active sync filter series provides a solution concept which is modular, compact and can be used as stand-alone modules or as system solution. The optional sync module offers a smart load Management of the filter's usage and allows redundancy which guarantees a smart power quality solution in the era of Industry 4.0. Schaffner provides active harmonic filters with excellent performance in solving power quality problems focusing on customer needs and application demands for cleaner and smarter energy.

## Typical applications

- Building technology

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- Automation industry

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- Data centers

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- Elevators

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- Cement industry

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- HVAC installations

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- Battery charges

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- Oil and gas exploration

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- Paper mills

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- Ship propulsion

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- Steel industry

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- Tunnel ventilation

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- UPS

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- Water/wastewater treatment

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- Welding equipment

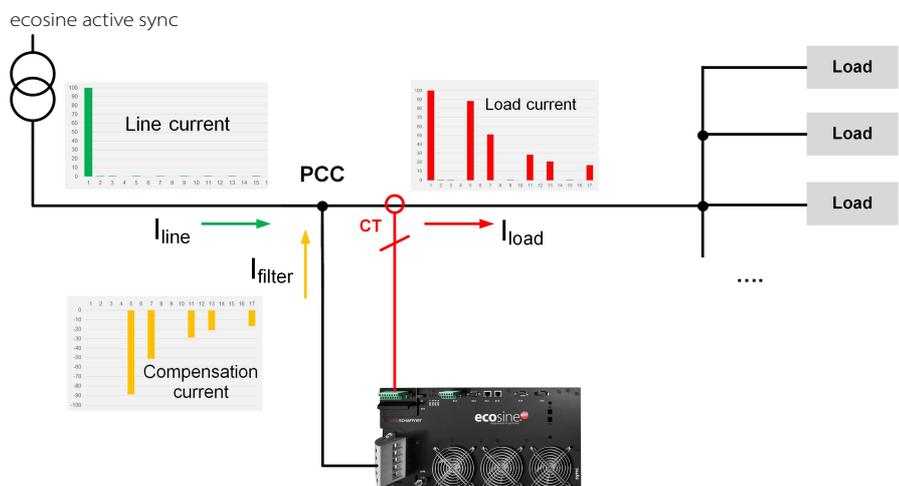
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- Wind turbines

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- Machines and Automation

## Typical electrical schematic



## Technical specifications of ecosine active sync power module

<b>Number of phases (system input)</b>	3-phase 3-wire or 3-phase 4-wire
<b>Mains frequency</b>	50/60 Hz $\pm$ 3 Hz
<b>Mains voltage</b>	3-wire: 380 VAC $\pm$ 15%-480 VAC $\pm$ 10% 4-wire: 380 VAC $\pm$ 15%-415 VAC $\pm$ 10%
<b>Inverter topology</b>	3-level NPC topology, IGBT
<b>Switching frequency</b>	16 kHz
<b>Response time</b>	<100 $\mu$ s
<b>Harmonic mitigation performance</b>	Up to the 50 <sup>th</sup> harmonic
<b>Total harmonic current distortion THDi</b>	<5%
<b>Power factor correction</b>	$\cos \varphi = -0.7 \dots 1 \dots 0.7$ (inductive and capacitive compensation)
<b>Dimensions of a single unit</b>	440 mm x 420 mm x 222mm (w x d x h)
<b>Rated phase mitigation current</b>	60 A
<b>Rated neutral conductor mitigation current</b>	180 A
<b>Overload capability (Amp for 10 ms)</b>	150 A
<b>Current transformer placement</b>	Mains side or load side
<b>Current transformer ratio</b>	xx:5 A or xx:1 A
<b>Color</b>	NCS S9000-N matt
<b>Mounting</b>	Wall-mounting (book or flat) or 19"-rack mounting
<b>Weight of a single unit</b>	44 kg
<b>Cooling type</b>	Air cooling
<b>Required air flow per module</b>	270 m <sup>3</sup> /h
<b>Communication interface</b>	Ethernet TCP/IP, Modbus RTU RS 485
<b>Digital I/O</b>	2 DI + 2 DO
<b>Ambient temperature of power modules</b>	0 ... 50°C full performance, up to 55°C with derating of 3% per Kelvin
<b>Power Losses</b>	<1100 W under full mitigation performance (<2.6%) <970 W in typical operation (<2.3%)
<b>Protection class</b>	IP 20 (optional IP 21)
<b>Noise level</b>	<56 to 63 dB A (depending on load situation)
<b>Self-protection</b>	Yes
<b>Overheat protection</b>	Yes
<b>Overvoltage and undervoltage protection</b>	Yes
<b>Recommended fuse protection</b>	100A, e.g. gL or gG
<b>Earthing system</b>	TT, TN-C, TN-S, TN-C-S, IT, corner grounded delta
<b>Altitude</b>	<1000 m without derating; Up to 4000 m with derating 1% / 100m
<b>Ambient conditions</b>	Pollution degree 2 Relative humidity <95% non-condensing, 3K3 Temperature: Storage 55°C, 1K3, 1K4, Transportation -25°C to 75°C, 2K3
<b>Approval</b>	CE, RoHS, UL
<b>Design standards</b>	IEC 61000-4-2, 4-4, 4-5, 4-6 EN 61000-3-11, 3-12 EN 61000-6-2 EN 55011 EN 62477-1 EN 61800-3

## Technical specifications of ecosine active sync cabinet version

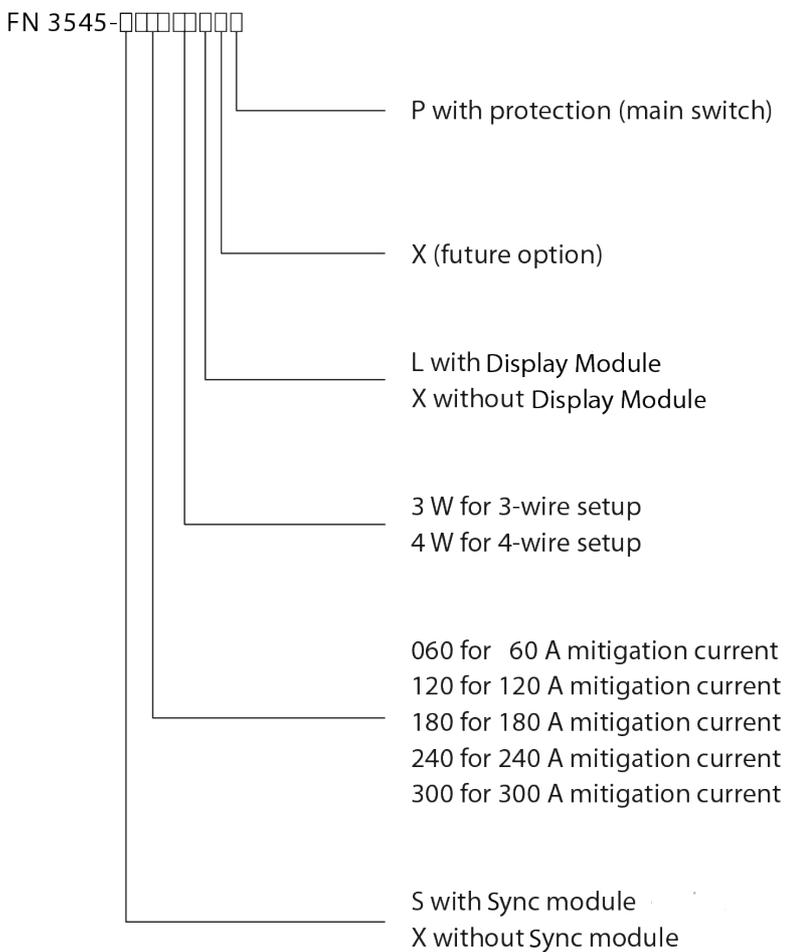
<b>Number of phases (system input)</b>	3-phase 3-wire or 3-phase 4-wire					
<b>Mains frequency</b>	50/60Hz ±3 Hz					
<b>Mains voltage</b>	3-wire: 380 VAC ±15%-480 VAC ±10% 4-wire: 380 VAC ±15%-415 VAC ±10%					
<b>Inverter topology</b>	3-level NPC topology, IGBT					
<b>Switching frequency</b>	16 kHz					
<b>Response time</b>	<100 µs					
<b>Harmonic mitigation performance</b>	Up to the 50 <sup>th</sup> harmonic					
<b>Total harmonic current distortion THDi</b>	<5%					
<b>Power factor correction</b>	cos φ = -0.7 ... 1 ... 0.7 (inductive and capacitive compensation)					
<b>Dimensions cabinet</b>	600 mm × 600 mm × 2328 mm (w × d × h)					
<b>Number of Modules</b>	0*	1	2	3	4	5
<b>Rated phase mitigation current</b>	0 A	60 A	120 A	180 A	240 A	300 A
<b>Rated neutral conductor mitigation current</b>	0 A	180 A	360 A	540 A	720 A	900 A
<b>Overload capability (for 10 ms)</b>	0 A	150 A	300 A	450 A	600 A	750 A
<b>Weight</b>	180 kg	224 kg	268 kg	312 kg	356 kg	400 kg
<b>Power Losses full mitigation performance</b>	200 W	<1300 W	<2400 W	<3500 W	<4600 W	<5700 W
<b>Power Losses typical operation</b>	200 W	<1170 W	<2100 W	<3100 W	<4000 W	<5000 W
<b>Current transformer placement</b>	Mains side or load side					
<b>Current transformer ratio</b>	xx:5 A or xx:1 A					
<b>Color</b>	RAL 7035					
<b>Mounting</b>	Floor mounting					
<b>Cooling type</b>	Air cooling					
<b>Required air flow</b>	270 m <sup>3</sup> /h × nb of modules + 100 m <sup>3</sup> /h					
<b>Communication interface</b>	Ethernet TCP/IP, Modbus RTU RS485					
<b>Digital I/O</b>	2 DI + 2 DO					
<b>Ambient temperature</b>	0 ... 40°C full performance, up to 50°C with derating of 3% per Kelvin					
<b>Protection class</b>	IP 54					
<b>Noise level</b>	<75 dB A (depending on load situation)					
<b>Self-protection</b>	Yes					
<b>Overheat protection</b>	Yes					
<b>Overvoltage and undervoltage protection</b>	Yes					
<b>Earthing system</b>	TT, TN-C, TN-S, TN-C-S, IT, corner grounded delta					
<b>Altitude</b>	<1000 m without derating; Up to 4000m with derating 1% / 100m					
<b>Ambient conditions</b>	Pollution degree 2 Relative humidity <95% non-condensing, 3K3 Temperature: Storage 55°C, 1K3, 1K4, Transportation -25°C to 75°C, 2K3					
<b>Approval</b>	CE, RoHS, UL (pending)					
<b>Design standards</b>	IEC 61000-4-2, 4-4, 4-5, 4-6 EN 61000-3-11, 3-12 EN 61000-6-2 EN 55011 EN 62477-1 EN 61800-3					

\*parameters of cabinet only configuration

### Ecosine active sync power module versions and options

Designation	Description
<b>FN 3530</b>	Power Module 60A, 380-480 VAC, 3-wire
<b>FN 3531</b>	Power Module 60A, 380-480 VAC, 3-wire with CT Module
<b>FN 3540</b>	Power Module 60A, 380-415 VAC, 4-wire
<b>FN 3541</b>	Power Module 60A, 380-415 VAC, 4-wire with CT Module
<b>FN 3532</b>	DPP Double Power Pack 120A, 380-480 VAC, 3-wire
<b>FN 3542</b>	DPP Double Power Pack 120 A, 380-415 VAC, 4-wire
<b>CTM</b>	CT Module
<b>LCD</b>	Display Module
<b>Patch Cable Set</b>	Patch cable set sync module
<b>KITIP21 400V</b>	Ecosine active sync IP 21 cover KIT
<b>SYNC300A</b>	Sync module for ecosine active sync - connecting up to 5 power modules

### Ecosine active sync cabinet versions and options



## Ecosine active sync cabinet version selection table

### Cabinet selection without sync module

Designation	Voltage	Sync Module	Mitigation Current	3-/4-wire Setup	Power Module	LCD	Protection (Main Switch)
FN 3545-X0603WXXP	380-480 VAC	No	60 A	3-wire	1 x FN 3531	No	Yes
FN 3545-X0603WLXP	380-480 VAC	No	60 A	3-wire	1 x FN 3531	Yes	Yes
FN 3545-X0604WXXP	380-415 VAC	No	60 A	4-wire	1 x FN 3541	No	Yes
FN 3545-X0604WLXP	380-415 VAC	No	60 A	4-wire	1 x FN 3541	Yes	Yes
FN 3545-X1203WXXP	380-480 VAC	No	120 A	3-wire	2 x FN 3531	No	Yes
FN 3545-X1203WLXP	380-480 VAC	No	120 A	3-wire	2 x FN 3531	Yes	Yes
FN 3545-X1204WXXP	380-415 VAC	No	120 A	4-wire	2 x FN 3541	No	Yes
FN 3545-X1204WLXP	380-415 VAC	No	120 A	4-wire	2 x FN 3541	Yes	Yes
FN 3545-X1803WXXP	380-480 VAC	No	180 A	3-wire	3 x FN 3531	No	Yes
FN 3545-X1803WLXP	380-480 VAC	No	180 A	3-wire	3 x FN 3531	Yes	Yes
FN 3545-X1804WXXP	380-415 VAC	No	180 A	4-wire	3 x FN 3541	No	Yes
FN 3545-X1804WLXP	380-415 VAC	No	180 A	4-wire	3 x FN 3541	Yes	Yes
FN 3545-X2403WXXP	380-480 VAC	No	240 A	3-wire	4 x FN 3531	No	Yes
FN 3545-X2403WLXP	380-480 VAC	No	240 A	3-wire	4 x FN 3531	Yes	Yes
FN 3545-X2404WXXP	380-415 VAC	No	240 A	4-wire	4 x FN 3541	No	Yes
FN 3545-X2404WLXP	380-415 VAC	No	240 A	4-wire	4 x FN 3541	Yes	Yes
FN 3545-X3003WXXP	380-480 VAC	No	300 A	3-wire	5 x FN 3531	No	Yes
FN 3545-X3003WLXP	380-480 VAC	No	300 A	3-wire	5 x FN 3531	Yes	Yes
FN 3545-X3004WXXP	380-415 VAC	No	300 A	4-wire	5 x FN 3541	No	Yes
FN 3545-X3004WLXP	380-415 VAC	No	300 A	4-wire	5 x FN 3541	Yes	Yes

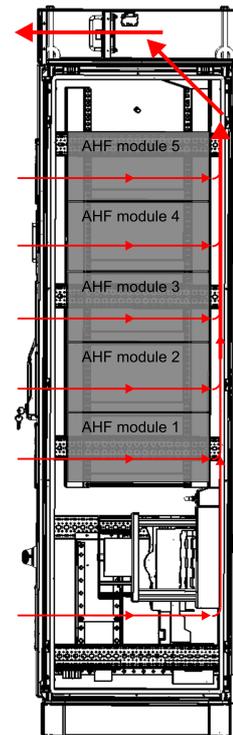
### Cabinet selection with sync module

Designation	Voltage	Sync Module	Mitigation Current	3-/4-wire Setup	Power Module	LCD	Protection (Main Switch)
FN 3545-S0603WXXP	380-480 VAC	Yes	60 A	3-wire	1 x FN 3530	No	Yes
FN 3545-S0603WLXP	380-480 VAC	Yes	60 A	3-wire	1 x FN 3530	Yes	Yes
FN 3545-S0604WXXP	380-415 VAC	Yes	60 A	4-wire	1 x FN 3540	No	Yes
FN 3545-S0604WLXP	380-415 VAC	Yes	60 A	4-wire	1 x FN 3540	Yes	Yes
FN 3545-S1203WXXP	380-480 VAC	Yes	120 A	3-wire	2 x FN 3530	No	Yes
FN 3545-S1203WLXP	380-480 VAC	Yes	120 A	3-wire	2 x FN 3530	Yes	Yes
FN 3545-S1204WXXP	380-415 VAC	Yes	120 A	4-wire	2 x FN 3540	No	Yes
FN 3545-S1204WLXP	380-415 VAC	Yes	120 A	4-wire	2 x FN 3540	Yes	Yes
FN 3545-S1803WXXP	380-480 VAC	Yes	180 A	3-wire	3 x FN 3530	No	Yes
FN 3545-S1803WLXP	380-480 VAC	Yes	180 A	3-wire	3 x FN 3530	Yes	Yes
FN 3545-S1804WXXP	380-415 VAC	Yes	180 A	4-wire	3 x FN 3540	No	Yes
FN 3545-S1804WLXP	380-415 VAC	Yes	180 A	4-wire	3 x FN 3540	Yes	Yes
FN 3545-S2403WXXP	380-480 VAC	Yes	240 A	3-wire	4 x FN 3530	No	Yes
FN 3545-S2403WLXP	380-480 VAC	Yes	240 A	3-wire	4 x FN 3530	Yes	Yes
FN 3545-S2404WXXP	380-415 VAC	Yes	240 A	4-wire	4 x FN 3540	No	Yes
FN 3545-S2404WLXP	380-415 VAC	Yes	240 A	4-wire	4 x FN 3540	Yes	Yes
FN 3545-S3003WXXP	380-480 VAC	Yes	300 A	3-wire	5 x FN 3530	No	Yes
FN 3545-S3003WLXP	380-480 VAC	Yes	300 A	3-wire	5 x FN 3530	Yes	Yes
FN 3545-S3004WXXP	380-415 VAC	Yes	300 A	4-wire	5 x FN 3540	No	Yes
FN 3545-S3004WLXP	380-415 VAC	Yes	300 A	4-wire	5 x FN 3540	Yes	Yes

## Cooling specification of ecosine active sync cabinet

Parameter	Values
Protection category	IP 54
Default color	RAL 7035
Required air flow per module	270 m <sup>3</sup> /h
Maximum air flow per cabinet	1400 m <sup>3</sup> /h
Air flow through fuse section	100 m <sup>3</sup> /h
Area - air inlet per module	Min. 450 cm <sup>2</sup>
Area - air duct channel behind power modules	Min. 370 cm <sup>2</sup>
Max. length of air duct channel behind power modules	Max. 1200 mm
Min. space in air duct channel behind modules	Min. 70 mm
Area - air duct channel in the roof	Min. 900 cm <sup>2</sup>
Max. length of air duct channel in the roof	Max. 800 mm
Distance air inlet filter rear to front of power module	Min. 45 mm

## Side view into cabinet with direction of air flow



## Ecosine active sync cabinet options

Designation	Description
Cabinet 380-480 VAC IP54 3W	IP 54 Cabinet 600 x 600 x 2328 3-wire (w/o modules) 480 V
Cabinet 380-415 VAC IP54 4W	IP 54 Cabinet 600 x 600 x 2328 4-wire (w/o modules) 415 V
Plinth panel 100	Cabinet plinth panel 100 mm
Plinth panel 200	Cabinet plinth panel 200 mm

## Technical specification for Sync module

Input voltage	22,0...27,0 VDC
Nominal current	<1 A
Dimensions	440 mm x 200 mm x 87 mm (w x d x h)
Weight	3.0 kg
Protection class	IP 20 (optional IP 21)
Digital I/O	3 DI, 2 DO, 4 DI/O (programmable) 2 relays NO/NC - 2 relays NO with common COM (250 VAC/3A)
Ambient conditions	Pollution degree 2 Relative humidity < 95%, non-condensing, 3K3 Temperature: storage 55°C, 1K3, 1K4, transportation -25°C to 75°C, 2K3
Approval	CE, RoHS

## Front view of cabinet with SYNC300A



## Ecosine active sync - Display Module LCD

### Function

The display module is used to monitor the measured values of the three-phase network and to change the filter parameters. One display module fits for all power modules and can be used in any of the system setups, whether it is single power module, Double Power Pack or cabinet version.

### Picture of Display Module



### Mounting types



## Ecosine active sync - modular system approach

The intelligent and modular system approach of ecosine active sync series offers tailored and most efficient filter system solutions:



### Ecosine active sync – 60 A wall – IP20

- | 1 ecosine active sync power module incl. CT module

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- | 1 display module

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- | Wall-mount (book or flat mounting possible) or Rack-mount (inside slide-in-technology cabinet)

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### Ecosine active sync double power pack (DPP) – 120 A – IP20

- | 2 ecosine active sync power modules

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- | 1 CT module

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- | 1 High Speed Bus patch cable

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- | 1 display module

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- | Master-Slave architecture

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- | Wall-mount (book or flat mounting possible) or Rack-mount (inside slide-in-technology cabinet)

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### Ecosine active sync – 60 A – IP54

- | 1 ecosine active sync power module incl. CT module

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- | 1 display module

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### Ecosine active sync – 120 A – IP54

- | 2 ecosine active sync power module incl. CT module

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- | 1 display module

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### Ecosine active sync – 180 A – IP54

- | 3 ecosine active sync power module incl. CT module

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- | 1 display module

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### Ecosine active sync – 240 A – IP54

- | 4 ecosine active sync power module incl. CT module

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- | 1 display module

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### Ecosine active sync – 300 A – IP54

- | 5 ecosine active sync power module incl. CT module

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- | 1 display module

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### Sync Module – master communication module for ecosine active sync – IP20

- | Flexible installation with current transformers on mains or load side; one simple CT connection point for all modules

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- | Intelligent load and energy management

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- | Simple and modular installation (wall-mount or rack-mount); recommended for 180 A and more

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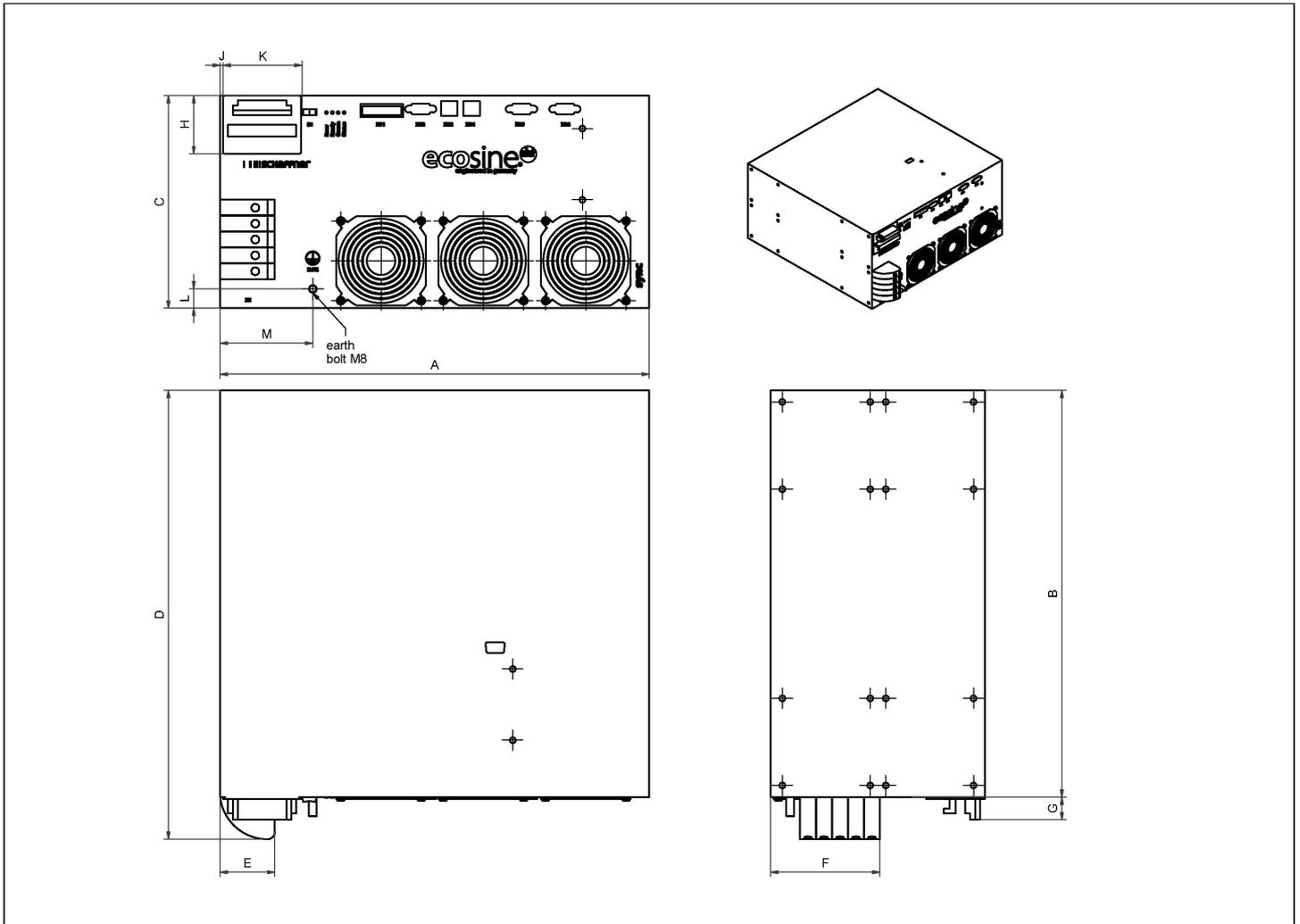
- | Easy filter scalability and extension of mitigation current beyond 300 A; one sync module can connect and coordinate up to 5 power modules (5x60A) in parallel; higher mitigation current rates are possible by paralleling the sync modules, e.g. for 480 A active harmonic filter, 2 sync modules and 8 power modules are required

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- | Available as part of the ecosine active sync cabinet (see selection table) or as an option for later upgrade or wall-mount

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## Mechanical data of power module

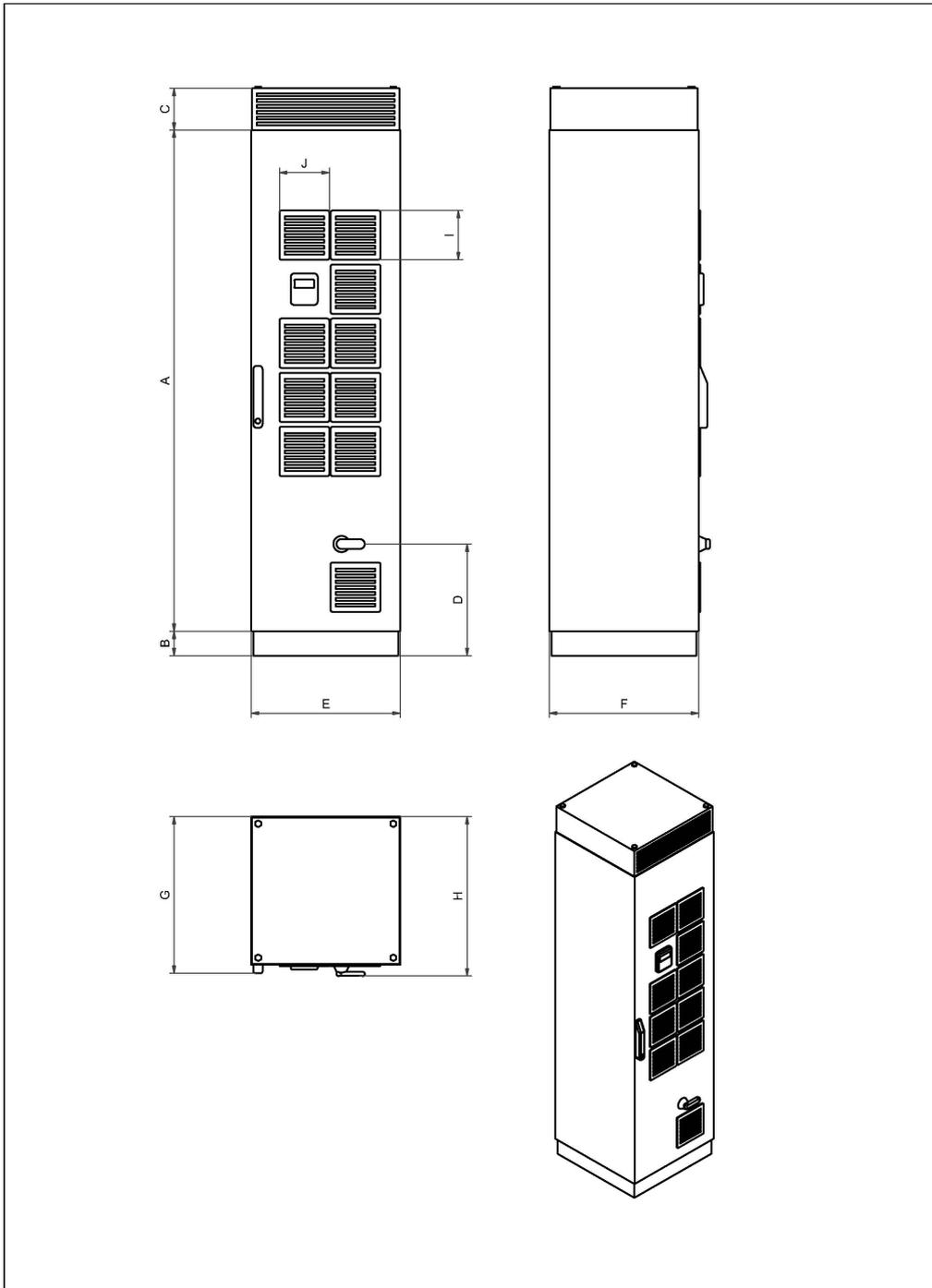


## Dimensions

	Size [mm]	[in]
<b>A</b>	440	17.32
<b>B</b>	420	16.54
<b>C</b>	219.5*	8.64
<b>D</b>	463.5	18.25
<b>E</b>	56	2.20
<b>F</b>	112	4.41
<b>G</b>	23.5	0.93
<b>H</b>	60	2.36
<b>J</b>	3	0.12
<b>K</b>	80	3.15
<b>L</b>	20	0.79
<b>M</b>	95	3.74

\* Module height: 5 rack units

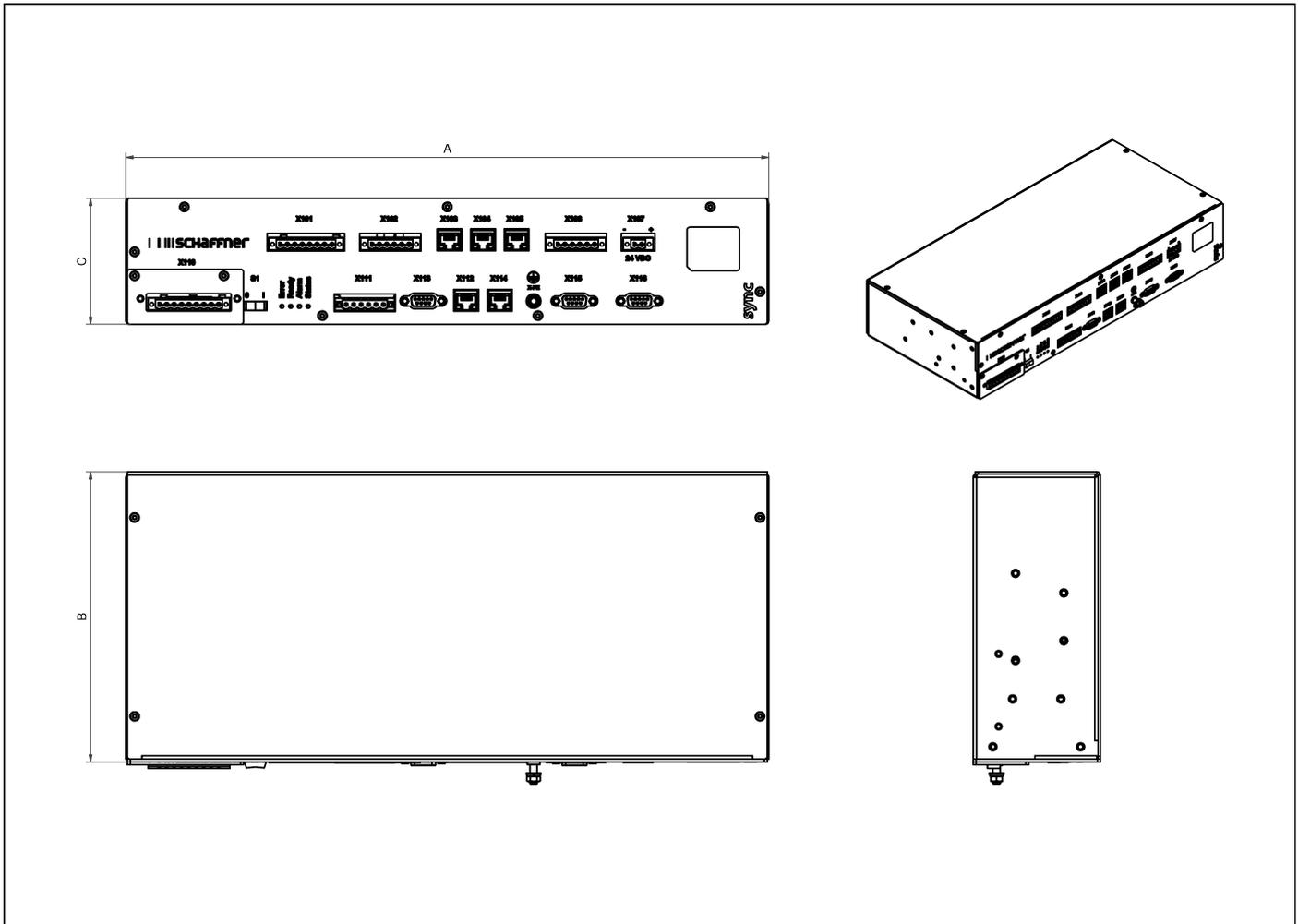
## Mechanical data of cabinet



## Dimensions

	Size [mm]	[in]
<b>A</b>	2057	81
<b>B</b>	100	3.94
<b>C</b>	171.2	6.74
<b>D</b>	458.3	18.04
<b>E</b>	606.7	23.9
<b>F</b>	608	23.9
<b>G</b>	642.5	25.3
<b>H</b>	653.7	25.7

## Mechanical data of sync module



## Dimensions

	Size	
	[mm]	[in]
<b>A</b>	440	17.32
<b>B</b>	200	7.88
<b>C</b>	87	3.43



## Headquarters, global innovation and development

### Switzerland

#### Schaffner Group

Industrie Nord  
Nordstrasse 11e  
4542 Luterbach  
T +41 32 681 66 26  
[info@schaffner.com](mailto:info@schaffner.com)



## Sales and application centers

### China

#### Schaffner EMC Ltd. Shanghai

T20-3 C, No 565 Chuangye Road,  
Pudong district  
201201 Shanghai  
T +86 21 3813 9500  
[cschina@schaffner.com](mailto:cschina@schaffner.com)  
[www.schaffner.com.cn](http://www.schaffner.com.cn)

### Finland

#### Schaffner Oy

Sauvonrinne 19 H  
08500 Lohja  
T +358 10 567 2855  
[finlandsales@schaffner.com](mailto:finlandsales@schaffner.com)

### France

#### Schaffner EMC S.A.S.

16-20 Rue Louis Rameau  
95875 Bezons  
T +33 1 34 34 30 60  
F +33 1 39 47 02 28  
[francesales@schaffner.com](mailto:francesales@schaffner.com)

### Germany

#### Schaffner Deutschland GmbH

Schoemperlenstrasse 12B  
76185 Karlsruhe  
T +49 721 56910  
F +49 721 569110  
[germanysales@schaffner.com](mailto:germanysales@schaffner.com)

### India

#### Schaffner India Pvt. Ltd

REGUS WORLD TRADE CENTRE  
WTC, 22nd Floor Unit No 2238, Brigade  
Gateway Campus, 26/1, Dr. Rajkumar Road  
Malleshwaram (W)  
560055 Bangalore  
T +91 80 67935355  
[indiasales@schaffner.com](mailto:indiasales@schaffner.com)

### Italy

#### Schaffner EMC S.r.l.

Via Ticino, 30  
20900 Monza (MB)  
T +39 039 21 41 070  
[italysales@schaffner.com](mailto:italysales@schaffner.com)

### Japan

#### Schaffner EMC K.K.

Taiju-Seimei Sangenjaya Bldg.  
1-32-12, Kamiuma, Setagaya-ku  
154-0011 Tokyo  
T +81 3 5712 3650  
F +81 3 5712 3651  
[japansales@schaffner.com](mailto:japansales@schaffner.com)  
[www.schaffner.jp](http://www.schaffner.jp)

### Singapore

#### Schaffner EMC Pte Ltd.

#05-09, Kg Ubi Ind. Estate  
408705 Singapore  
T +65 6377 3283  
F +65 6377 3281  
[singaporesales@schaffner.com](mailto:singaporesales@schaffner.com)

### Spain

#### Schaffner EMC España

Calle Caléndula 93, Miniparc III, Edificio E  
El Soto de Moraleja, Alcobendas  
28109 Madrid  
T +34 917 912 900  
F +34 917 912 901  
[spainsales@schaffner.com](mailto:spainsales@schaffner.com)

### Sweden

#### Schaffner EMC AB

Östermalmstorg 1  
114 42 Stockholm  
T +46 8 5050 2425  
[swedensales@schaffner.com](mailto:swedensales@schaffner.com)  
[www.schaffner.com](http://www.schaffner.com)

### Switzerland

#### Schaffner EMV AG

Industrie Nord  
Nordstrasse 11e  
4542 Luterbach  
T +41 32 681 66 26  
[switzerlandsales@schaffner.com](mailto:switzerlandsales@schaffner.com)

### Taiwan R.O.C.

#### Schaffner EMV Ltd.

20 Floor-2, No 97, Section 1, XinTai 5th Road  
22175 XiZhi District New Taipei City 22175  
T +886 2 2697 5500  
F +886 2 2697 5533  
[taiwansales@schaffner.com](mailto:taiwansales@schaffner.com)  
[www.schaffner.com.tw](http://www.schaffner.com.tw)

### Thailand

#### Schaffner EMC Co. Ltd.

Northern Region Industrial Estate  
67 Moo 4 Tambon Ban Klang  
Amphur Muangng P.O. Box 14  
51000 Lamphun  
T +66 53 58 11 04  
F +66 53 58 10 19  
[thailandsales@schaffner.com](mailto:thailandsales@schaffner.com)

### United Kingdom

#### Schaffner Ltd.

5 Ashville Way, Molly Millars Lane  
Wokingham  
RG41 2PL Berkshire  
T +44 118 9770070  
F +44 118 9792969  
[uksales@schaffner.com](mailto:uksales@schaffner.com)

### USA

#### Schaffner EMC Inc.

52 Mayfield Avenue  
Edison, New Jersey  
T +1 732 225 9533  
F +1 732 225 4789  
[usasales@schaffner.com](mailto:usasales@schaffner.com)  
[www.schaffnerusa.com](http://www.schaffnerusa.com)

#### Schaffner North America

6722 Thirlane Road  
24019 Roanoke, Virginia  
T +1 276 228 7943  
F +1 276 228 7953

#### Schaffner North America

823 Fairview Road  
24382 Wytheville, Virginia  
T +1 276 228 7943  
F +1 276 228 7258

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