

MaxSine active filter

For active compensation of harmonic currents and reactive power.

There is an increasing number of electrical equipment with non-linear voltage-current characteristics connected to the network. Harmonic currents produced by them cause harmonic voltages in network impedances, which add to the fundamental system voltage resulting in voltage distortion.

This voltage distortion is experienced by all electrical equipment connected to the network, leading to higher thermal loading of motors, transformers, capacitors, switch-gear and cabling. Some of the electrical equipment develops a more audible noise when supplied with distorted voltage. Sensitive electronic protection, control and ripple control systems are not likely to operate properly when supplied with distorted voltage.

The most effective way to eliminate harmonics is MaxSine active filter.

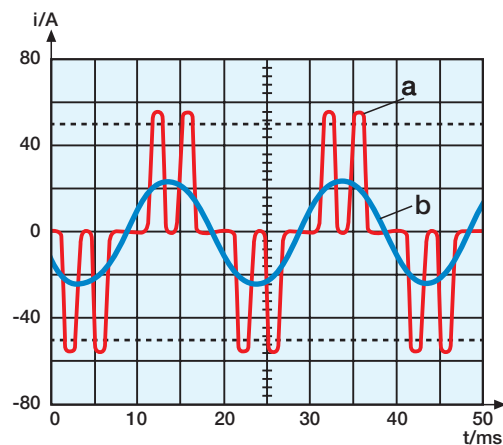
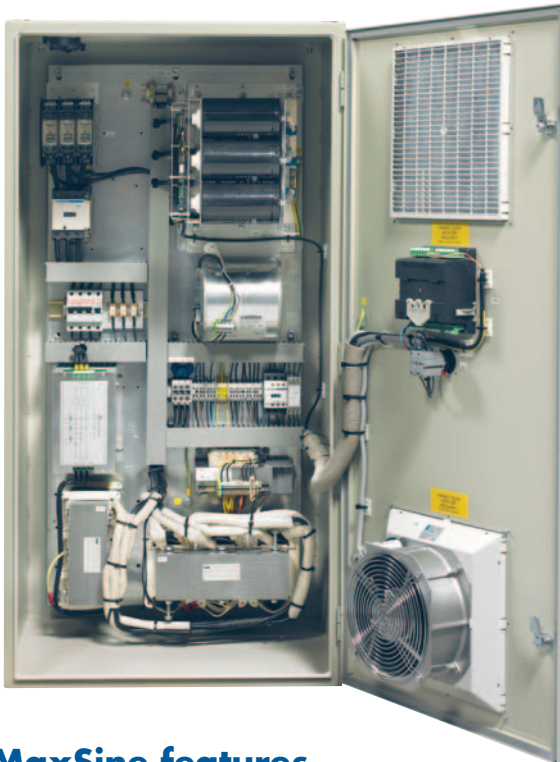


Figure 1:
Network current of a DC-drive without (a)
and with MaxSine active filter (b).

Active compensation of harmonic currents and reactive power

A variety of solutions exist to eliminate the problems of harmonics. MaxSine's patented Direct Phase Current Control (DPCC) technology together with advanced space vector controlling provides your network with efficient and fast harmonic reduction and reactive power compensation.



MaxSine features

- User interface consists of graphical display and push buttons for easy operation
 - Indication of status information
 - Easy browsing in the menus
 - Viewing of electrical information
 - User friendly setup of the operating parameters
- Measurements shown on display
 - Network voltage and load current
 - Total harmonic distortion
 - Graphical analysis of networks harmonic voltages and currents
- Two isolated inputs for remote control
- Three relay outputs for run / alarm / warning indications
- Two compensation modes
 - Selective 1-25th, fast mode
 - Real-time - Selective, ultra fast mode
- Selection of individual harmonics up to 25th, compensation factor 0-100%

- Selection of fundamental reactive power compensation, compensation factor 0-100%. With 100% the power factor is forced to 1 and the line current becomes balanced
- Global three-phase compensation of current harmonics to approx. 50th harmonics, *ultra fast mode*
- By application of 4-wire technology, the neutral current is eliminated
- Excellent dynamics, response time <1 ms with *ultra fast mode* and 20ms (50Hz) with *fast mode*
- Standby in case of small load current
- PC connection via RS485
- No influence on ripple control systems
- Electronic overload protection
- Can be used in combination with conventional choked capacitor banks
- Applications are economic even for small to medium power ranges

MaxSine is independent of

- the curve form of the current to be compensated
- the dynamics of the current changes
- the phase of the current (inductive/capacitive)
- the direction of the current (generator/load)
- the phase of the load (symmetrical/asymmetrical)
- the quality of the mains voltage
- the network impedance

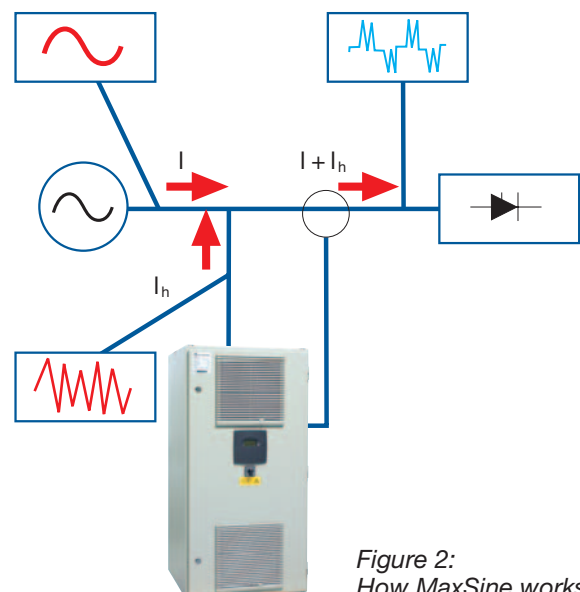


Figure 2:
How MaxSine works

One product - many possibilities

Harmonic filtering

According to figure 2 there is a controlled current source (active filter) connected parallel to a harmonics producing load. This controlled current source produces the same harmonic currents as produced by the load but with opposite phase. Therefore the supply system is loaded with fundamental current only.

Power Factor Correction

MaxSine is able to correct power factor by injecting fundamental reactive current into the network. Compensation factor can be adjusted 0%-100%. With 100% the power factor is forced to 1 and the line current becomes balanced. The operation is independent of the phase shift of the load, capacitive/inductive.

Flicker compensation/active peak leveling

MaxSine active filter can be used to prevent voltage sags caused by large amounts of dynamic reactive load. Such a load causing flickering lasts typically only a couple of periods. An active peak leveling device is developed to also feed active power to network for short period.

Hybrid Dynamic VAR Compensation

is flicker compensation application where nearly half of the requested reactive power is produced by a traditional fixed detuned capacitor bank installed parallel to MaxSine.

Active Front End (Sinus rectifier)

enables power feeding from AC grid to DC and vice versa.

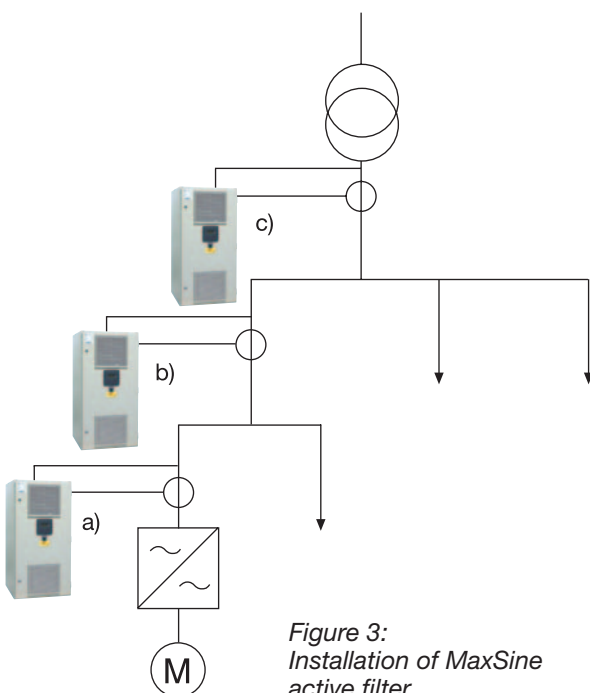


Figure 3:
Installation of MaxSine
active filter

Installation of MaxSine can be made to any point of the network. When measurements are done and harmonic distortion is known in various key points in the network, the selection of compensation method between a) compensation of one certain load, b) compensation of a group of loads or c) central compensation must be made (see figure 3). The most cost-effective solution depends on the type of non-linear loads and network. Rated output of the device defines the fundamental reactive power compensation capacity. 4-wire device is recommended for use when the harmonics current of the neutral exceeds 5 % of phase current.

Data required for dimensioning MaxSine

- Schematic diagram of the system to be compensated
- Rated voltage and frequency
- Harmonic currents
- Reactive power

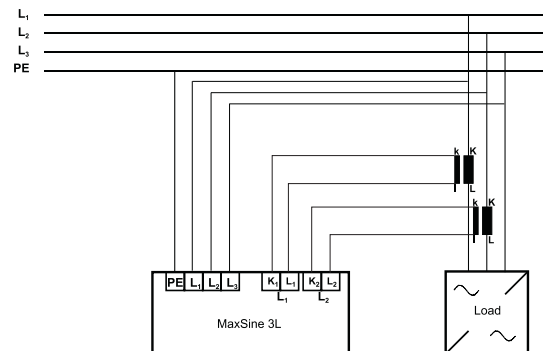


Figure 4:
Connection diagram of MaxSine 3L without
neutral, industry application

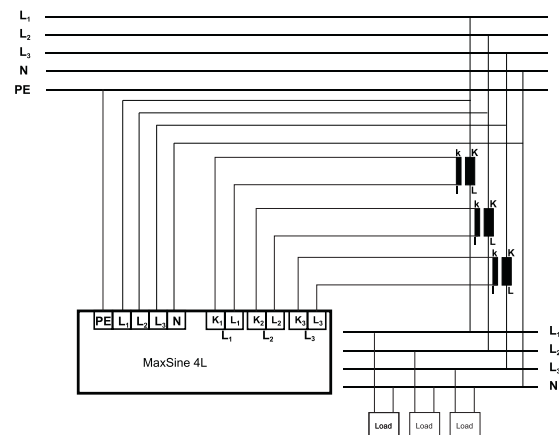


Figure 5:
Connection diagram of MaxSine 4L with
neutral, office application

Designation of devices: MaxSine (a)A-(b)Lx(c)

Compensation power (a=rated output in amperes)	Three-phase connection with (b=4, office applications) or without (b=3, industrial applications) neutral	Factor for dimensioning the neutral c=1 (one) c=2 (two) c=3 (three times phase current capacity)
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MaxSine	Rated output	Line current	Neutral current	Weight	Width	Depth	Height
	at 400V	L1,L2,L3	N				
Type	(kVA)	(A)	(A)	(kg)	(mm)	(mm)	(mm)
MaxSine 25A-3L	17	25	-	130	600	400	1000
MaxSine 50A-3L	35	50	-	150	600	600	1200
MaxSine 100A-3L	70	100	-	240	600	500	1800
MaxSine 60A-4L*2	40	60	120	325	600	500	1800
MaxSine100A-4L*1	70	100	100	350	800	500	2000

Larger power levels are possible by using parallel connection of MaxSine. Also other types are available by request.

Technical data:

Mains voltage:	3 x 400 V +10% -20% (deviations from mains voltage on request)
Frequency:	50/60 Hz ± 2%
Current hysteresis:	approx. 10% of the RMS-value of rated current
Overload capability:	1.2 x I _{RMS} (dynamically)
Switching frequency:	10 kHz (average)
Potential free output contacts:	3 pcs (run/warning/alarm), 2A/250Vac
Response time:	< 1ms, ultra fast mode 20 ms (50Hz), fast mode
CT ratio:	100-3000 / 1 A, class 0,5 requested
Power dissipation:	< 3% of the rated power of the device
Noise level:	< 60 dB
Environmental temperature:	0° - 40°C
Temperature of storage:	-25 ... +55°C (VDE 0160)
Temperature of transport:	-25 ... +70°C (VDE 0160)
Elevation of installation:	< 1000 m above sea level (in case of deviation please contact your supplier)
Atmospheric humidity:	0-85% (no dew)
Cabinet:	2 mm sheet iron, RAL 7035
Degree of protection:	IP41
EMC:	EN 61000-6-2 / EN 50081-2

In line with our policy of on-going product development we reserve the right to alter specifications.