# SineWave THM active harmonics conditioners

**from 20 to 480 Amps**

**N E W**

BY MGE UPS SYSTEMS

MERLIN GERIN

# harmonic pollution: well worth thinking about

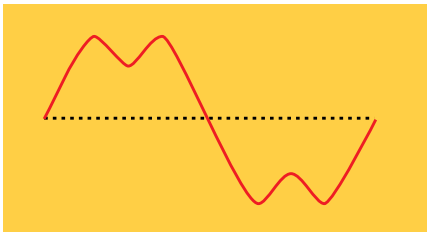
*Harmonic pollution is a relatively new phenomenon which affects all electrical networks in industrial plants, offices and homes.*
*No modern environment can escape this pollution which is caused by "nonlinear" or "distorting" loads such as personal computers, servers, fluorescent tubes, air conditioning units, variable speed drives, arc lights, static rectifiers, microwave ovens, TVs, halogen lamps, etc.*

*industry and telecommunications are two environments highly polluted by harmonics*

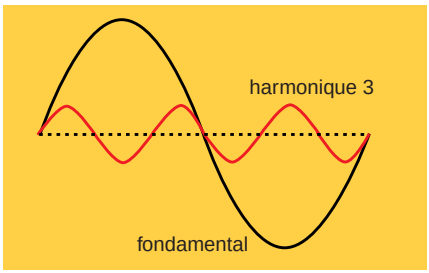
## invisible, costly pollution

Nonlinear loads absorb currents.
All currents are made up of:

- the basic sinusoidal current (50 Hz, for example) called the fundamental, (F),
- sinusoidal "polluting" currents which are multiples of F (2F, 3F, 4F, 5F, ... nF) called harmonics.



*example of current polluted by 3rd harmonic*




*breakdown of the above current into the fundamental + the 3rd harmonic*

These harmonics are increasingly polluting the voltages used by production facilities, pumping stations, data processing systems, telecommunication switchboards, TV studios, etc. and consume a significant proportion of available current.

This gives power users three types of problem:

- **impact on the electrical installation** with significant overheating in alternators, transformers, capacitors and cables ... The hidden costs of accelerated ageing in this type of equipment can be extremely high.
- **impact on utilisation of equipment** with unexplained power outages and malfunctions in equipment sensitive to power quality. These failures cost money and reduce the effect of capital investment - with a negative effect on the bottom line!
- **impact on available electrical power** as the current consumed by harmonics is totally lost and can cause up to 30% over-consumption. Utility bills soar even though there is less power available.

## existing standards

Three sets of standards designed to reduce the spread of harmonic pollution now apply.
These are:

- **standards for equipment**
  - IEC 1000-3-2 or EN 61000-3-2 for low voltage appliances absorbing currents of under 16 A,
  - IEC 1000-3-4 or EN 61000-3-4 for low voltage appliances or installations absorbing currents exceeding 16 A.
- **standards for mains supply quality**
  - EN 50160 defines the voltages supplied by utility low voltage networks,
  - EEEI 519 (Recommended Practices for Harmonics Control in Electrical Power Systems) is a joint recommendation by utility operators and subscribers to limit the impact of non-linear loads through a joint effort to reduce harmonics.
- **compatibility standards between electrical networks and products**
  - IEC 1000-2-2 and recommendations by CIGRE (Conférence Internationale des Grands Réseaux Electriques) for public low voltage networks,
  - IEC 1000-2-4 for industrial installations using low and medium voltage.

Utilities actively encourage preventive actions to reduce electricity quality depreciations, and overheating, and to increase the power factor.

PES

BUREAU VERITAS 1828

CENELEC

# the best way to neutralise harmonics: active harmonics conditioners

*There are several solutions for limiting the harmonic currents of distorting loads.*
*The best known include the installation of interconnected passive filters, the installation of several parallel medium section cables and the connection of polluting loads and sensitive receivers to an isolation transformer at the head of each sub-system ...*
*All these solutions have two major drawbacks - they are specific to existing installations and the addition or suppression of loads can totally invalidate the initial investment, and they are often difficult to install.*

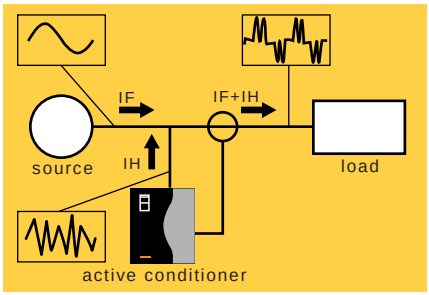
## what makes active conditioners different?

The main advantages of active conditioners is that they continue to guarantee efficient harmonic compensation even when changes are made to the installation. They are also exceptionally easy to use as they feature:

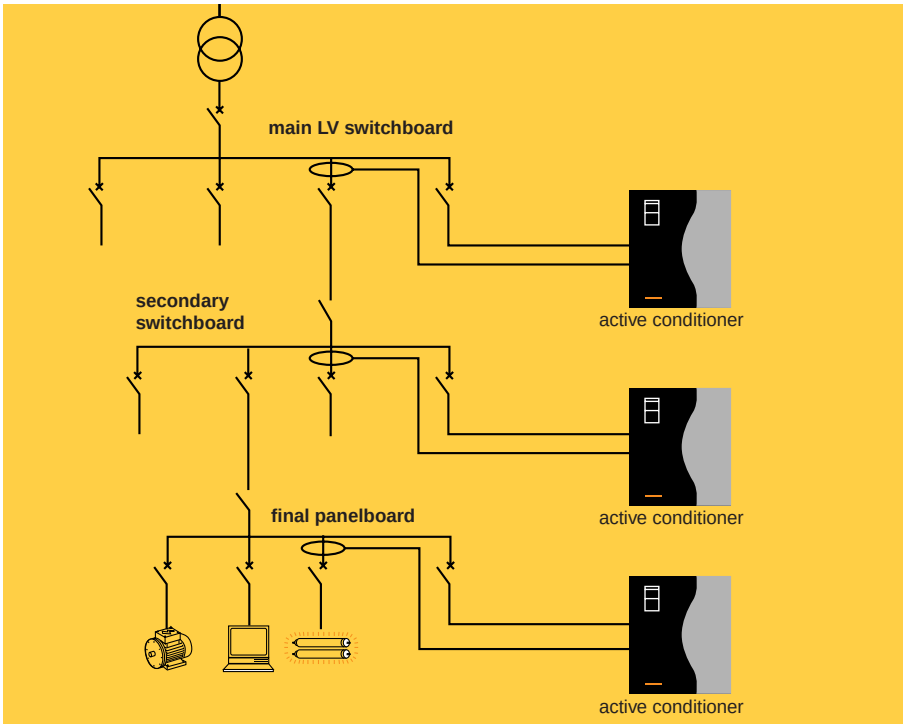
- auto-configuration to harmonic loads whatever their order of magnitude,
- elimination of overload risks,
- compatibility with electrical generator sets,
- connection to any point of the electrical network,
- several conditioners can be used in the same installation to increase depollution efficiency (for example when a new machine is installed).

## how do active conditioners work?

Active conditioners analyse the harmonics drawn by the load and then inject the same harmonic current to the load with the appropriate phase. As a result, the harmonic currents are totally neutralised at the point considered. This means they no longer flow upstream and are no longer supplied by the source.




*basic diagram for parallel conditioner*




*low voltage diagram showing possible "connection" points for active conditioners depending on the compensation level required*

## where should active conditioners be installed?

Treating harmonics requires accurate, in-depth knowledge of the installation. In new installations we recommend calculating global harmonic distortion for various key points during the design phase. In existing installations it is often best to have an expert audit the site and prepare a full diagnosis. In all cases it is essential to define the main objective:

- **either compliance with standards**
In this case, the active conditioner must be placed upstream from the installation (with an "injection" point close to the utility supply network),

- **or reduction in pollution level within the installation**
In this case the solution is to neutralise harmonics as close as possible to the main nonlinear loads.
Active conditioners should be located downstream (in the secondary switchboard or final distribution boards).

# SineWave THM active conditioners the market leader in harmonic control

*SineWave™ is the first 2nd generation active harmonics conditioner. We have unique experience in this field backed by a powerful, international development programme and the experienced gained from the 1st generation conditioners launched in 1994.*


*SineWave™ active harmonics conditioners are remarkably compact*

*For installations from 10 to 2000 kVA, SineWave™ gives you the tomorrow's performance - today!*

## impressive harmonic attenuation

Using state-of-the-art technologies, SineWave™ reduces harmonic currents by a factor of 10 which, depending on the type of loads, can rise to a factor of 20.
Compensation covers 2nd to 25th order harmonics allowing a wide regulation span to cover every type of load.
Additionally, you can choose between two operating modes :

- global compensation,
- pre-selected order of compensation.

## improvements to cos φ

SineWave™ also improves cos φ and the power factor and saves on energy costs.

## easy installation

Specific architecture and carefully selected mechanical components make the SineWave™ an industry reference for integration. These units are extremely compact. For example, the 30 A unit only requires a space of 94 $dm^3$. This means you can install SineWave™ units on walls, in switchboards and in panelboards.
SineWave™ units are compatible with every 3-phase power network and automatically handle single and three phase loads, data processing equipment, fluorescent lighting, variable speed drives, etc.
To enhance compensation at a given point in the installation they can be connected in parallel. Up to four SineWave™ active conditioners can be installed in parallel or mounted in series if your system changes.

## unrivalled operator-friendliness.

Located on the front panel of the SineWave™ unit the man/machine interface (MMI) is written in seven standard languages (English, French, German, Spanish, Italian, Dutch and American). It provides :

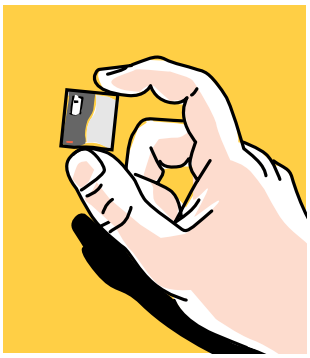
- assistance with commissioning and maintenance,
- parameter control (display language, harmonic compensation type),
- operation (reports, audits, alarms and controls).

The detachable Man / Machine Interface has a 3 metre lead to enable, for example, installation on the front panel of the SineWave™ unit housing.
Additionally, dry contacts and optional

# all categories savings champion

## the ideal rating at the lowest price

SineWave™ units are extremely flexible and there is no need to buy oversized unit. You can always add on to your SineWave™ solution to cover future requirements. This means unbeatable economic solutions for the extraordinary benefits they offer.



## extended equipment life

The reduction in effective current by SineWave™ units prolongs equipment service life by up to 30 %.

## no expensive surprises

Once your current is cleaned up you are protected from surprises such as malfunctions in critical applications and fines from utility operators for not respecting standards.
SineWave™ units contribute to service continuity too.

## lower electricity bills

Reducing harmonics also reduces kVA consumption. This means you can probably down-scale your utility contract. By improving the cos φ, you also reduce absorbed kVA and avoid penalties from power suppliers due to excessively low cos φ factors. Return on investment is rapid and in some cases pay-back can be within two years.

*SineWave™ man-machine interface, all the data in 7 languages*

RS 485 serial connections are available for remote control.

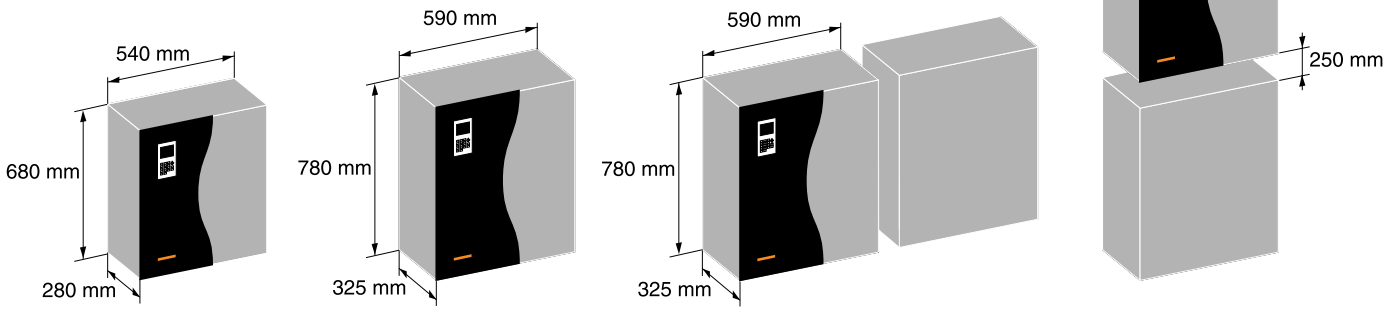
## exceptional operating reliability, safety and security

SineWave™ units use thoroughly tested circuit layouts and state-of-the-art technologies such as fast IGBT transistors and DSP (Digital Signal Processing) components. This design totally protects the unit from overloads.
If the demand for harmonic compensation exceeds its rated capacity, conditioning continues up to the maximum limit.
By reducing effective current consumption, SineWave™ units eliminate risks of power failures and cable heating. In this way they contribute to improving operating safety and security.

# trouble-free installation

## the smallest active conditioner on the market

One of the major advantages of SineWave™ is that it can be fitted anywhere. This feature is essential in existing installations where the space in low voltage systems, process controllers, motor control equipment and technical rooms is often difficult to find.




weight : 65 kg
**SW 20, SW 30**

weight : 110 kg
**SW 45, SW 60**

weight : 220 kg
**SW 90, SW 120**

## easy connection: a few practical hints

SineWave™ units are extremely easy to install. They require 3-phase electrical power with or without neutral and the insertion of the measurement sensor into the polluted power supply.

leave sufficient clearance to enable the circulation of cooling air

preferably use a twisted pair to connect current sensors

install SineWave™ units vertically

install SineWave™ units in plant or electrical rooms

do not place SineWave™ units near heating elements

shield low level signal wires from power cables

“up-through” ventilation

# SineWave™: the industry reference in harmonic compensation

## technical specifications

| model | SW20 | SW30 | SW45 | SW60 | SW90 | SW120 |
|---|---|---|---|---|---|---|
| **per phase compensation capacity** | 20 A rms | 30 A rms | 45 A rms | 60 A rms | 90 A rms | 120 A rms |
| **compensation capacity in the neutral (1)** | 60 A rms | 90 A rms | 135 A rms | 180 A rms | 270 A rms | 360 A rms |
| **AC input supply** | | | | | | |
| nominal voltage (2) | 400 V - 20 +15% | | | | | |
| nominal frequency | 50Hz, 60 Hz, ±8% | | | | | |
| number of phases | 3 phases with or without neutral (operation is possible on unbalanced or single phase loads) | | | | | |
| current transformers | rating from 300/1 to 4000/1 | | | | | |
| **technical specifications** | | | | | | |
| harmonic current compensated | orders 2 to 25, global compensation or specified harmonics | | | | | |
| rate of harmonic reduction | THDI load/THDI network greater than 10 at nominal conditioner capacity | | | | | |
| current compensation of cos φ | up to 1.0 | | | | | |
| response time | < 40 ms | | | | | |
| overload | limitation to nominal current, continuous operation within these limits | | | | | |
| inrush current | < twice nominal peak current | | | | | |
| losses | 1000 W | 1300 W | 2100 W | 2600 W | 4200 W | 5200 W |
| noise leve (ISO 3746) | < 55 dBA | < 55 dBA | < 60 dBA | < 60 dBA | < 65 dBA | < 65 dBA |
| colour | RAL 9002 | | | | | |
| **environmental conditions** | | | | | | |
| operating temperature | 0 to 40°C continuous, < 25°C recommended | | | | | |
| relative humidity | 0 to 95% non condensing | | | | | |
| operating altitude | < 1000 m | | | | | |
| **reference standards** | | | | | | |
| construction and safety | EN 50091-1 | | | | | |
| design | IEC146 | | | | | |
| protection | IP 30 according to IEC 529 | | | | | |
| **electromagnetic compatibility** | | | | | | |
| conducted and radiated emission | EN 55011 Class A | | | | | |
| immunity to electrostatic discharges | IEC 1000-4-2 level 3 | | | | | |
| immunity to electromagnetic fields | IEC 1000-4-3 level 3 | | | | | |
| immunity to impulse waves | IEC 1000-4-4 and IEC 1000-4-5 levels 4 | | | | | |

*(1) maximum capacity on PC type load and on balanced 3-phase network*
*(2) 208 V, 220 V and 480 V voltages are available upon request*

## features

- compensation of the harmonics: global or selected harmonics (parameter control)
- compensation of the displacement factor (cos φ) (parameter control)
- parameter control of load type: data processing, rectifier,...
- compensation of the power factor
- IGBT technology and control by DSP circuit
- 3 LEDs to show operation statuts
- 7 language alphanumeric display
- diagnostic and maintenance system
- configuration and parameter control menu
- dry contacts for remote signalling
- remote control (lockable)
- complies with IEC standards and EC marking
- redundancy and parallel configuration
- wide range of current transformers
- Optional Jbus / RS 485 communication interface

# the absolute weapon for fighting harmonics: “Total Harmonics Management” (THM)

## manage your harmonics before they manage you

If you can no longer live with the threat from harmonics, you can relax as now there is a global solution - “Total Harmonics Management“ (THM).
THM starts with an accurate harmonic pollution audit for every point in your installation and then develops a flexible, high-performance solution with guaranteed results.

## THM is only a phone call away

Just call your local MGE UPS SYSTEMS service centre.

- an expert audits every point in your installation from your low voltage panel to the final panelboards and records the results. He notes down all the limitations and your specific requirements.
- a detailed report is written including a proposal for a solution based on SineWave™ active harmonic conditioner units.

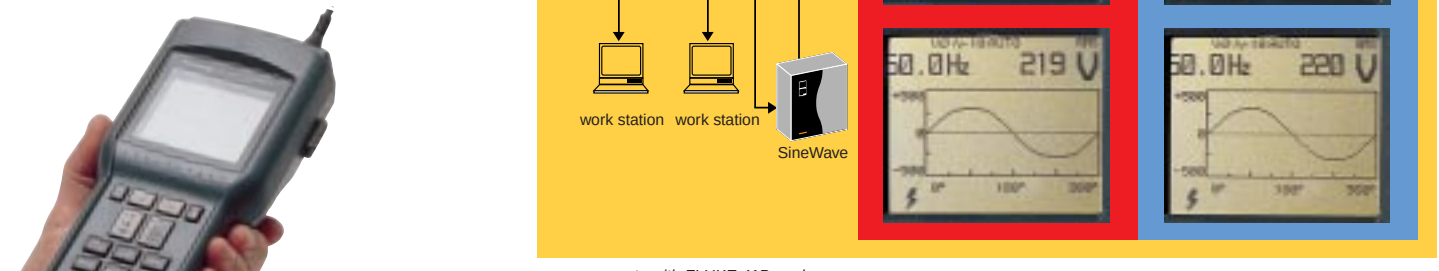
This offer defines:
- the equipment needed and the cost,
- the time required for installation,
- the new harmonic distortion value guaranteed at different points in the installation.

Once you have received the report, all you have to do is decide when you want to start fighting harmonics!

- Installation control and performance monitoring ensure that the guaranteed results are effectively obtained.

## a typical case

The THM expert visits a data processing site protected by a UPS. He measures the current and the voltage at points A and B separated by a long length of cable. After installing the SineWave™ active harmonics conditioner, the expert runs a new audit at A and B.




*measurements with FLUKE 41B analyser*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