

# SD700FA

**SD700**  
Series

## Active Filter



- Ranging from 230Vac to 690Vac
- Modular units from 100A to 630A
- Accurate and dynamic harmonic cancellation (THDi)
- Power factor control ( $\cos \phi$ )
- Active Voltage regulation system to support grid stabilization
- Temperature controlled cooling and 50°C operation - iCOOL
- Totally sealed electronics IP54 without dust filters
- Easy front access to the main components (FFA)

At a growing rate, Industries and Commercial facilities are embracing new LED-based lighting, motor control devices, power sources and other non-linear loads that introduce harmonic pollution into the electrical distribution system. This harmonic current content leads to a poor power quality causing electrical equipment overload, wear and tear.

SD700FA active harmonic filter (AHF) injects reactive and harmonic current to improve displacement power factor ( $\cos \phi$ ), harmonic distortion (THDi) and voltage stabilization in your electrical distribution system. The 3-wire SD700 FA AHF monitors the load current or the line current at the point of interconnection, and injects the inverse current wave that cancels the harmonic distortion. SD700FA includes the most accurate dynamic harmonic cancellation algorithms offering a high performance at any load condition to comply with IEEE519.

SD700FA is designed to last under the most demanding environments by integrating a modular design, unique iCOOL system for 50°C operation, an easy front access for servicing, and totally sealed and conformally coated electronics.

Rugged design and accurate harmonic cancellation suitable for IEEE519 compliance



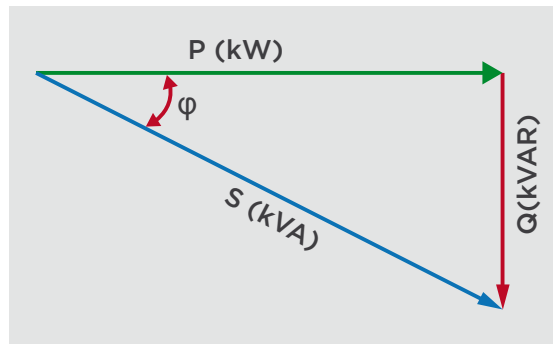
## INTRODUCTION TO POWER FACTOR

- **Active Power (P):** Is the power used by a device to produce useful work. It is expressed in Watt or KiloWatt (kW).
- **Reactive Power (Q):** Is the power that does not produce work but is needed in an alternating-current transmission system to support the transfer of active power over the network by temporarily storing energy in inductive and capacitive elements. It is expressed in var or KiloVar (kVAr).
- **Apparent Power (S):** is the power resulting by the vector sum of both the active and reactive power. It is expressed in Volt Amperes or KiloVolt Amperes (kVA).

$$S \text{ (kVA)} = \sqrt{P \text{ (kW)}^2 + Q \text{ (kVAr)}^2}$$

- **Displacement Power Factor (cos φ):** Is the cosine of angle between active and apparent power. When the DPF reaches unity, it means that all the fundamental current that flows through the electrical equipment produces work. This factor does not consider harmonic currents.

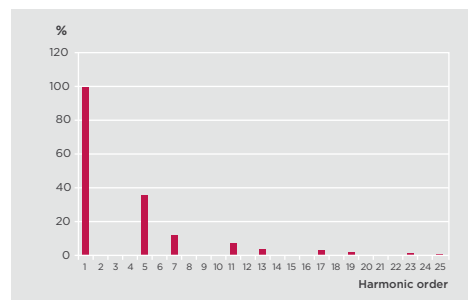
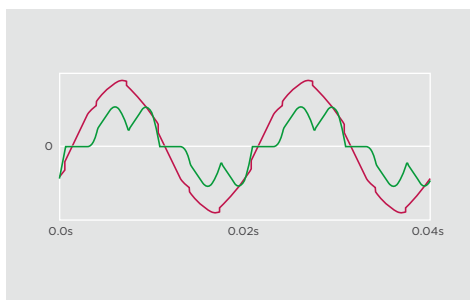
$$\cos \varphi = \frac{P \text{ (kW)}}{S \text{ (kVA)}}$$



**Current harmonics are multiple of the fundamental frequency** (50Hz or 60Hz) current. This perturbation is caused by non-linear loads such as power supplies, LED-lamps, computers, televisions, variable speed drives, rectifiers and others.

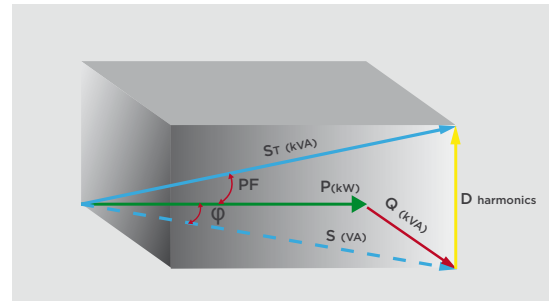
- **Total Harmonic Current Distortion THD (%):** This ratio quantifies the harmonic content in a specific current waveform. The ratio expresses the relation between the RMS value of each harmonic and the fundamental current in percentage. IEEE519 defines THD as below:

$$\text{THD} = \sqrt{\frac{\sum_{n=2}^{\infty} I_n^2}{I_1^2}}$$

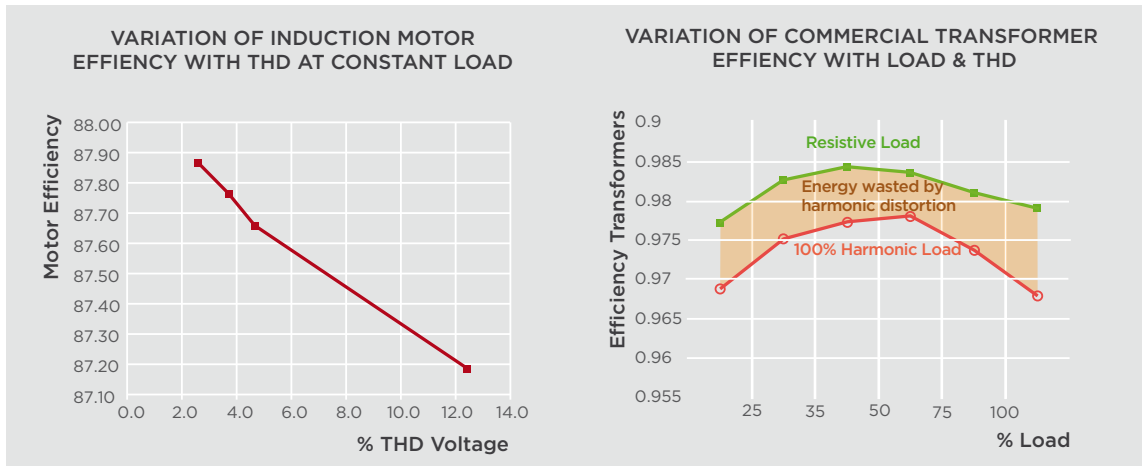


• **Power factor (PF):** Is the ratio that measures the efficiency of the electrical system considering the harmonic disturbance. As DPF, when the PF reaches unity it means that all the current that flows through the electrical equipment produces work.

$$PF = \frac{1}{\sqrt{1+THDi^2}} \cdot \cos \phi = \frac{I_{50Hz}}{I_{rms}} \cdot \cos \phi$$

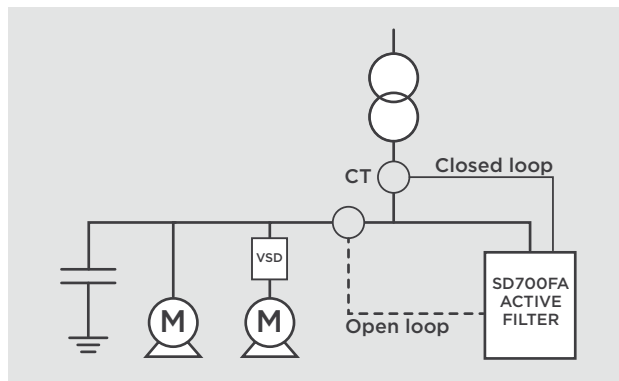


Poor power quality has many inconveniences leading amongst others to wear and tear, equipment failure, transformer and wiring overheating and losses, and motor efficiency decreasing.



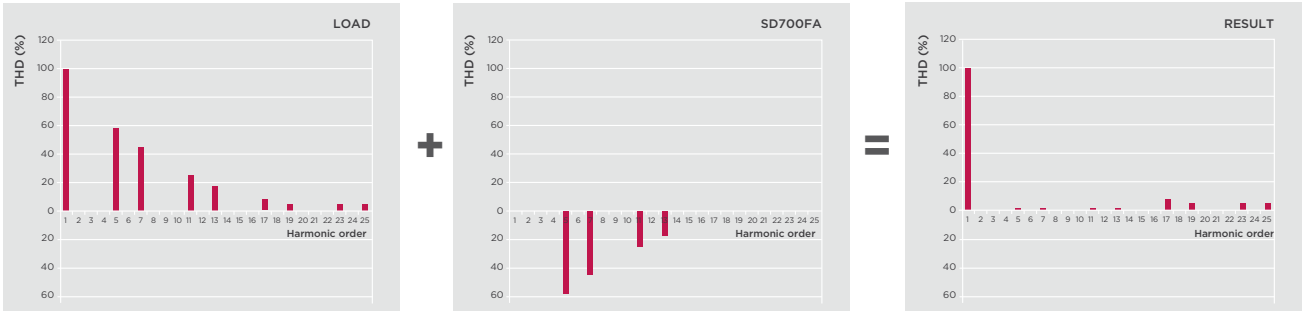
## HARMONIC CANCELLATION

SD700FA can run in open loop or closed loop configuration, increasing the installation possibilities in retrofit projects. An open loop configuration measures the load current and injects the inverse current harmonic wave form that cancels the harmonic distortion. On the contrary, a closed loop configuration measures the line current at the point of interconnection and injects inverse current harmonic to reach the target established by the user.

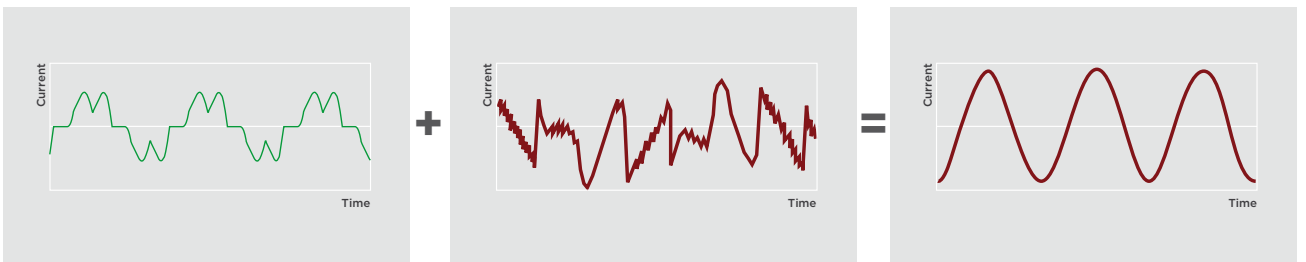


The SD700FA can work with two harmonic cancellation algorithms: selective and full spectrum.

By setting the **selective harmonic cancellation** you will be able to compensate in perfect opposite phase up to 6 individual harmonics simultaneously. SD700FA working at a 4kHz switching frequency allow the user to cancel up to the 13th harmonic. Be aware that the higher the harmonic order the higher the required switching frequency thus leading to a less efficient unit due to an increase of the switching losses. Power Electronics will support you to select and adjust the unit to get the most from your facilities.

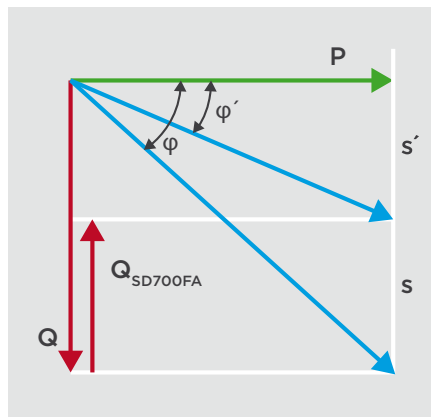


By setting the **full spectrum harmonic cancellation** the unit will not be focused on a specific harmonic number. Any harmonic content will be cancelled by injecting an opposite phase current wave form that results from subtracting the fundamental (50Hz) current wave.



## POWER FACTOR CORRECTION

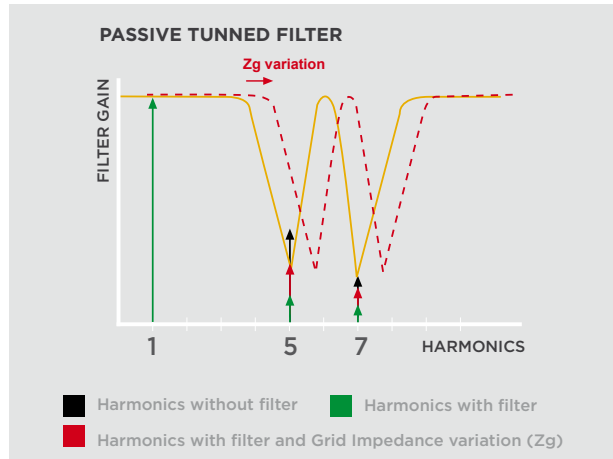
SD700FA implements a dynamic algorithm that controls the reactive current injection to keep a specific displacement power factor ( $\cos \phi$ ) at any load condition.



When installing capacitor banks in a network polluted with harmonics it magnifies the effects by:

- Reducing the network impedance and therefore increasing the THDv.
- Creates a low impedance path to harmonics that overloads and overheats the bank. This inconvenience can lead to reduced life of the capacitors.

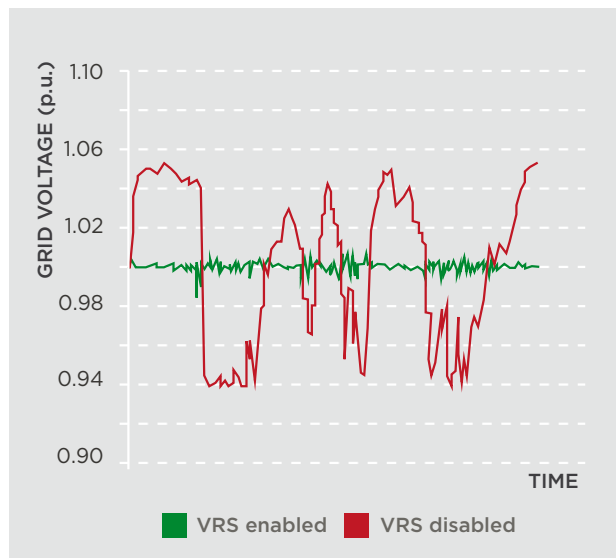
One of the most extended alternatives is the installation of heavy, costly and inefficient tuned passive filters that can only inject leading reactive current (kVar) and can only mitigate a single harmonic number.



SD700FA IS YOUR SAFEST AND MOST RELIABLE SOLUTION THAT CAN AT THE SAME TIME CONTROL THE HARMONIC CONTENT AND THE DISPLACEMENT POWER FACTOR, WITH NONE OF THE INCONVENIENCE THAT TRADITIONAL SOLUTIONS HAVE.

### VOLTAGE REGULATION SYSTEM (STATCOM)

The SD700FA can perform reactive power control to stabilize the grid voltage. By enabling the full reactive current injection from pure lagging to pure leading, it is able to support grid operators under transitory low voltage or high voltage conditions.



## TECHNICAL CHARACTERISTICS

INPUT	Nominal voltage <sup>[1]</sup>	230Vac, 380-480Vac, 525Vac, 690Vac ( $\pm 10\%$ ); (3phase - 3 wires)
	Compensation capacity per phase (Arms)	100A - 630A
	Frequency	50Hz ( $\pm 5\%$ ), 60Hz ( $\pm 6\%$ )
	Power switching devices	IGBT 4kHz Configurable
	Efficiency	$\geq 97\%$
	Current transformers	Any ratio from 250 to 10,000 A primary with 5A secondary
N° transformers / configuration	2 or 3 required / Open loop or Close loop	
FEATURES	Harmonic filtering algorithms	<ul style="list-style-type: none"> <li>•Selective harmonic cancellation: 6 simultaneous harmonics up to 13th harmonic</li> <li>•Full spectrum harmonic cancellation. All harmonic cancellation up to 50th harmonic</li> </ul>
	Reactive power control	Static and Dynamic Adjustable Displacement Power Factor (DPF)
	Dynamic grid support	Voltage Regulation System (VRS) (Optional) Low Voltage Ride Through (Optional) - UPS supply required
ENVIRONMENTAL CONDITIONS	Degree of protection	IP20 (IP54 electronics)
	Cooling	Temperature controlled axial fans
	Operation/ storage temperature <sup>[2]</sup>	-10°C to 50°C continuous / -20°C to 70°C
	Altitude	1000m; >1000m 1%Pn per 100m, Max.3000m
	Relative humidity	<95% non condensing
EMC	C3 Second environment (Industrial), C2 optional	
HARDWARE	Digital inputs	6 programmable, Active high (24Vdc), Isolated power supply 1 PTC input
	Digital outputs	3 programmable changeover relays (250Vac, 8A or 30Vdc, 8A)
	Analogue input	2 programmable differential inputs. 0 - 20mA, 4 - 20mA, 0 - 10Vdc and $\pm 10$ Vdc (Optically isolated)
	Analogue outputs	2 isolated programmable outputs: 0 - 20mA, 4 - 20mA, 0 - 10Vdc and $\pm 10$ Vdc
	Encoder inputs (optional)	Two differential encoders input. Voltages inputs from 5 to 24Vdc
	User power supply	+24Vdc user power supply ( Max 180mA) regulated and short-circuit protected +10Vdc user power supply (Max 2 potentiometers R= 1 k $\Omega$ ) regulated and short-circuit protected
	I/O extension board (optional)	4 Digital Inputs: Programmable inputs and active high (24Vdc). Optically isolated. 1 Analogue Input: Programmable and differential input. 5 Digital Outputs: programmable multi-function relays. 1 Analogue Output: Programmable outputs in voltage / current.
	External power supply (optional)	24 V External Power Supply, Fault Relay integrated
COMMUNICATION INTERFACE	Standard hardware	USB port, RS232 port, RS485 port
	Optional hardware	Optical fiber, Ethernet
	Standard protocol	Modbus-RTU
	Optional protocol	Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open, N2 Metasys Gateway,
	Interface	Alphanumeric Display, PowerComms desktop SW tool available
REGULATION	Certification	CE
	Electromagnetic compatibility	EMC Directive (2004/108/CE), IEC/EN 61800-3
	Design and construction	LVD Directive (2006/95/CE), IEC/EN 61800-2 General requirements, IEC/EN 61800-5-1 Safety, IEC/EN 60146-1-1 Semiconductor converters

NOTES [1] Other configurations consult Power Electronics.  
[2] Switching frequency 4kHz.

## ORDERING INFO

SD700 Series	Model		Output Current <sup>[1]</sup>		Input Voltage		Degree of protection	
SD7	FA	ACTIVE HARMONIC FILTER	100	100A	5	380-480Vac	5	IP54
			...	...	7	525Vac		
			630	630A	6	690Vac		

NOTE [1] Consult Power Electronics to guarantee the compatibility of the selected filter.