

## Reactive Power and Harmonic Compensation

# StacoSine® Active Harmonic Filter



StacoSine®  
Wall Mount Unit

### Product Highlights

- Immediately improves electrical system efficiency
- Reduces operations and maintenance costs
- Dynamically corrects a wide spectrum of harmonic orders, graphics analyzer and display
- Global or selectable harmonic parameters
- Quick, easy installation, with virtually no downtime
- No need for complex site analysis
- Stand-alone and multi-integrated systems, ideal for use with drives and MCCs
- Voltage ratings from 208 to 480 VAC, step-up transformer utilized for 600 VAC and higher voltages
- 25 to 300 amp ratings, parallel up to (6) six individual units
- UL 508, cUL complete assembly
- Enclosures NEMA 1 standard, with NEMA 12, 3R and other ratings available, including open-chassis type

### Harmonic Problems

With the increased presence of electronics on power distribution systems, disruptive anomalies are created, and harmonics can become a problem. Some equipment that can be large contributors to harmonics are:

- Fluorescent Lamps
- Computers and Peripherals
- Welding Machines
- Uninterruptible Power Supplies (UPS)
- AC/DC Variable Speed Drives
- Frequency Converters
- DC Power Systems/Chargers

Staco Energy Products has taken traditional "passive" harmonic filtering equipment to a new level with **StacoSine**, an active based harmonic filter technology.

### The StacoSine Active Harmonic Filter

Active harmonic filters use power electronics to monitor the nonlinear load and dynamically correct every harmonic order from the 3rd to the 51st order, while the controller

calculates and displays up to the 31st order—the more critical range of harmonics. By injecting a compensating current into the load, the sine wave is restored, attenuating harmonic levels at the point of installation. StacoSine meets or exceeds Total Demand Distortion (TDD) limits specified in table 10.3 of the IEEE 519 Standards. One set of 2000:1 current transformers CT's are standard. Consult factory for other CT ratings.

The **StacoSine's** high speed process cancels high frequency output current, while it ultimately determines the precise value of injected load current. **StacoSine's** IGBT PWM power electronics platform has been designed to operate at levels that continuously adapt to rapid load fluctuations. With its efficient operation and small physical size, it is ideal for a wide variety of industrial and commercial environments.

### Why StacoSine is A Better Choice

With other harmonic mitigation solutions, expensive and time-consuming site data collection, power quality surveys and computer generated studies are usually needed. Most harmonic filters are designed to accommodate just one or a few harmonic orders. The **StacoSine** corrects a full range of harmonic orders, and will not create a resonance condition with other existing equipment, so only minimal up-front analysis is required. The **StacoSine** can be easily and conveniently added in parallel with other active filters, to accommodate future facility expansions or equipment additions. Virtually no time is lost for installation, supporting the important uptime operation of your facility.

The rating (size) of the **StacoSine** is based on nonlinear load requirements (corrective current), not both linear and nonlinear, like traditional filter equipment. That means that you can install a **StacoSine** system at a reduced ampere rating, which will lower initial capital costs.

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Inherent in the StacoSine is the ability to correct a proportional amount of corrected power factor/reactive compensation. For applications where high levels of power factor correction are also necessary, Staco Energy Products can provide a "hybrid" system, which integrates active filters with our traditional power factor correction modules, providing the highest level of system efficiency.

A door mounted LCD graphic multifunctional display/analyzer with 8-function keypad means easy operation and maintenance programming of the active filter, along with: waveform data, spectrum data (up to the 31st order), system management and networking capability. The controller allows for global (all harmonic orders) or selectable (specific harmonic orders) and settable VAR correction for maximum flexibility.

**StacoSine** products are available as stand-alone systems, or they can be integrated with other power quality and power distribution equipment, including motor control centers and switchgear. Application engineered designs and higher ampere ratings can be easily accommodated.

Harmonic mitigation increases electrical capacity and stabilizes the electrical system, while power factor correction increases power efficiency and reduces electric utility costs. Problem solved ...with **StacoSine** and Staco Energy Products.

### Active Filtering and Power Generation

Installing an active harmonic filter can benefit on-site power, emergency power, and distributed generation/energy. Technologies such as reciprocating (diesel and natural gas) engine-generators, microturbines, fuel cells, solar/ photovoltaics, and wind turbines can have improved system performance and reliability, especially during start-up and load transfers. In addition, **StacoSine** will alleviate problematic, disruptive and potentially damaging harmonics from the total load or distribution system. The **StacoSine** performs the same, regardless of impedance, and regardless of using the AC line, on-site power, or even the output of a UPS or flywheel. When power factor correction capacitors are incorporated, size requirements may be reduced, saving up-front costs.

Newer technologies use power electronics for system operation and control. Though efficient in and of themselves, these devices are the primary cause of harmonics produced in an electrical system. The **StacoSine** helps assure continuous power, especially where energy and efficient power delivery is critical.

Staco Energy Products can further enhance your power quality solutions with bundled packages including voltage regulation, surge/sag, ride-through, uninterruptible power (UPS), and power factor / harmonic correction. Staco Energy's integrated assembly can help reduce the cost and quantity of installed equipment, make interconnections easier, and create a more complete system dimension.

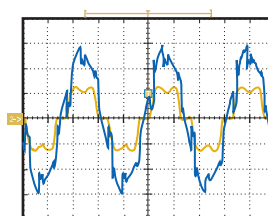
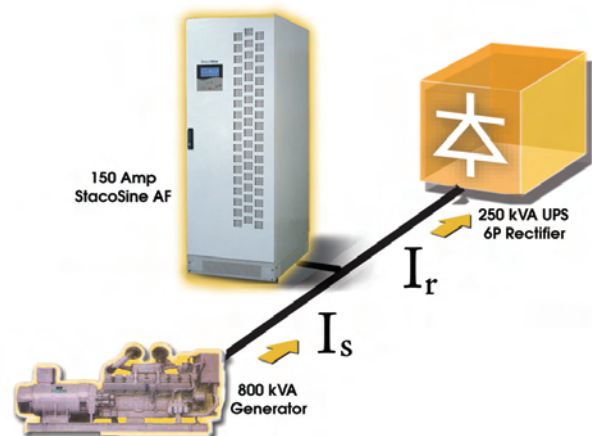
### A Real Solution

The StacoSine behaves like a harmonics current generator. It measures the harmonics generated from a nonlinear load and cancels the harmonics with a newly generated, opposite phase shifted harmonic current of the same amplitude (AC/DC/AC). This allows it to:

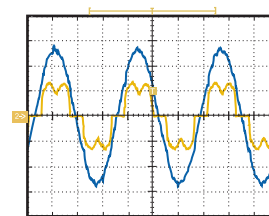
- Eliminate all harmonic currents from nonlinear loads
- Compensate reactive power factor of lagging loads
- Act as a damping resistor to prevent harmonic resonance

### Example of StacoSine's Active Harmonic Filtering

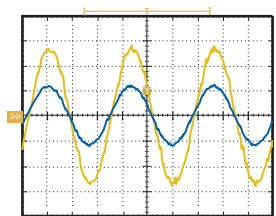
A large 3 phase UPS with a 6-pulse rectifier creates heavy harmonic feedback of 30 - 40% THD into Mains or an emergency generator. The StacoSine is designed to work with the UPS, and mitigates harmonics to less than 5%.



V &  $I_s/I_r$  Without StacoSine  
THDV = 17.4%



V &  $I_r$  With StacoSine  
THDV = 3.1%, THDIr = 30.0%



V &  $I_s$  With StacoSine  
THDI = 2.5%

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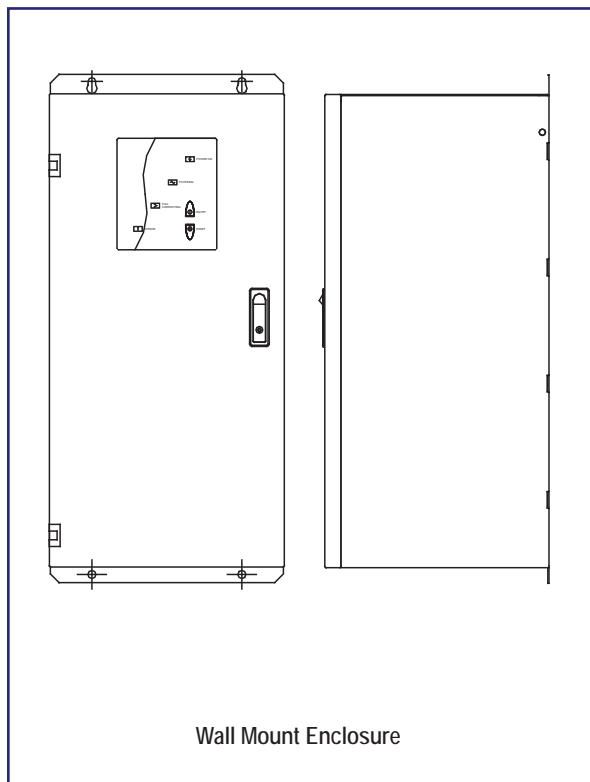
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## Reactive Power (kVAR)

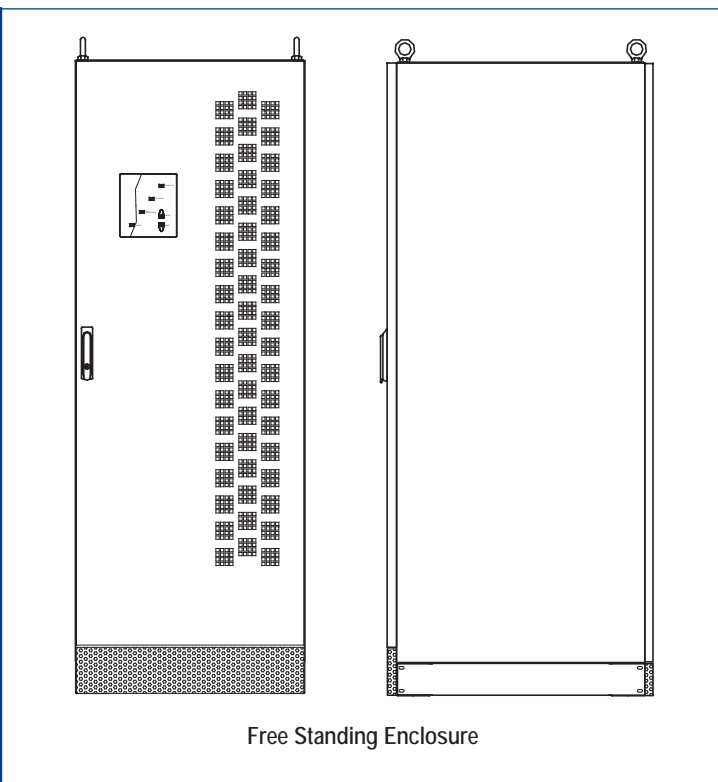
Voltage	AF-0025	AF-0050	AF-0100	AF-0150	AF-0200	AF-0300
208V	2.9	5.8	11.6	17.3	23.1	34.4
220V	3.2	6.5	13.0	19.4	25.9	38.6
380V	9.9	19.7	39.5	59.2	79.0	118.4
480V	15.6	31.3	62.5	93.8	124.8	187.2

## Nominal Reactive Current (Amperes) at 60 Hz

Voltage	AF-0025	AF-0050	AF-0100	AF-0150	AF-0200	AF-0300
208V	8	16	32	48	64	96
220V	8.5	17	34	51	68	102
380V	15	30	60	90	120	180
480V	18.8	37.4	75	113	150	226



Wall Mount Enclosure



Free Standing Enclosure

## Mechanical Specifications

	Ampere Rating					
	25 Amp AF-0025	50 Amp AF-0050	100 Amp AF-0100	150 Amp AF-0150	200 Amp AF-0200	300 Amp AF-0300
Operating Temperature (Fahrenheit)	+32° F to +104° F					
Equipment Storage Temperature	-4° F to 158° F					
Operating Altitude	< 3281 Ft.					
Operating Relative Humidity	< 95% non-condensing					
Weight (lbs) Wall Mount	121	154	NA	NA	NA	NA
Weight (lbs) Freestanding	NA	NA	595	661	1,190	Consult Factory

## Enclosure Dimensions (Inches)

Wall Mount Enclosures			
NEMA 1	H	W	D
25/50 Amp	34.65	16.14	15.35
Free Standing Enclosures			
NEMA 1	H	W	D
100/150 Amp	75.98	23.62	31.89
200 Amp	75.98	47.24	31.89

## Specifications

General Specifications						
Controller/Display	DSP Design (Global or Selectable Cancellation) LCD display, graphics analyzer					
Switching Speed	20 kHz					
Loss of Power	Configurable Restart					
Overload	Units Cannot Be Overloaded					
Cooling	Fan Cooled					
Units used in Parallel	Up to 6 units can be used in Parallel					
Communications	RS232 (standard), RS422, RS485, RJ45, USB, TCP/IP (optional)					
Soft Start	10 sec					
	25A	50A	100A	150A	200A	300A
Heat-losses	550W	950W	2000W	3000W	4100W	6100W
Audible Noise from 1 meter	60 dBA	60 dBA	63 dBA	63 dBA	65 dBA	65 dBA
Filter Performance	3rd to 51st Order					
Electrical Specifications						
Line Voltage	208 - 480 V +/- 15% (step-up transformer for higher voltages)					
System Frequency	50/60 Hz, +/- 3 Hz					
Phase/Wires	3 Phase 3 wire (3 phase 4 wire consult factory)					
Compensating Current in Phase	25 Arms	50 Arms	100 Arms	150 Arms	200 Arms	300Arms
Steady State Response	<40 ms detection time at 100% step load					
Control Topology	Fully digital with DFT ( <i>discrete fourier transform</i> ) algorithm (Response Time <20 ms)					
Inrush Current	Less than rated current					
Current Limitation	At full correcting					
Input Fuses	200 kaic protection, class J					
Disconnect Switch	Use of external device, review local NEC					
Current Transformers (Standard)	2,000 : 1, 20 va, 400 hz					
Standards						
Safety	UL508/cUL / EN50178					
EMI	FCC Part 15 / EN55011					
Surge Immunity	ANSI C62.41, IEEE587 / EN61000-4-5					
Harmonic Guidelines	IEEE519-1992 / EN61000-3-4					
Enclosure	NEMA 1 textured gray finish (NEMA 12/3R optional, Seismic rating consult factory)					



StacoSine Free Standing Unit

Digital Control Panel

*Represented Locally By:*

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