

# AXPERT *i-sine*

## MULTI-FUNCTIONAL ACTIVE HARMONIC FILTER

“ True Harmonics Solution ”



High harmonics is an increasing problem which affects all power distribution networks in industrial, commercial, telecom and medical application. Most of power converting equipment or facilities can generate harmonic current.

Axpert *i-sine* is designed with intelligent control algorithm which dynamically changes the switching frequency to optimize the performance & efficiency. The performance of Axpert *i-sine* is less affected by supply voltage harmonic distortion. Axpert *i-sine* provides selective harmonic attenuation upto 51<sup>st</sup> order.

**Monitor Continuously - Attenuate Immediately**

AN ISO 9001 : 2008 COMPANY

 **AMTECH**

# Principle of Harmonics Suppression

AXPERT *i-sine* AHF provides 3 phase harmonic current compensation.

Figs. 1 and 2 show the operational principle of the active filter, with which a rectifier load is connected.

As shown in fig.1, the active filter is inserted between the load and the source, in parallel to the load. For a six-phase rectifier load, the load current  $I_L$  appears in a form of rectangular waves, as illustrated in Fig. 2. This can be considered a result of synthesis of the fundamental current  $I_F$  and the harmonic current  $I_H$  (Fig. 2).

$$I_L = I_F + I_H$$

The compensation current  $I_C$  of the active filter is controlled so that its intensity is the same as that of the above-mentioned  $I_H$ , and its polarity is just reversed ( $I_C = -I_H$ ). As a result, components of harmonic currents contained in the load current are canceled by the effect of active filter, and source current  $I_S$  remains only to be  $I_F$ , which is a sinusoidal wave (Fig. 2). This can be clearly explained by the expression shown below.

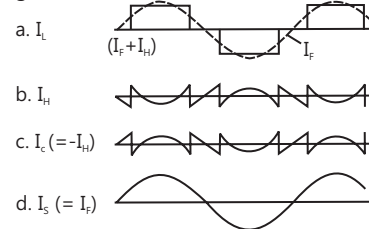
$$I_L = I_F + I_H, I_C = -I_H$$

$$I_S = I_L + I_C = (I_F + I_H) + (-I_H) = I_F$$

Fig.1



Fig.2

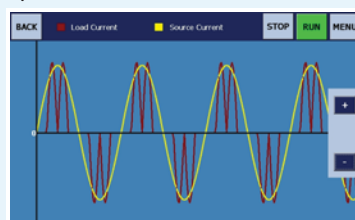


## Monitoring & Signaling

### Standard LCD Display



### Optional Touch screen TFT Panel



Axpert *i-sine* is equipped with a user friendly control panel. Self-explanatory full parameter names, easy navigation of parameters through well organized parameter sets & functional keys, 8-selectable parameters on single screen makes it easy to operate and program.

The optional TFT panel with special white back light offers access to all parameters, waveforms & spectrums for management of both Axpert *i-sine* and system power quality. The graphics TFT display & control panel gives easy access for load, source & Axpert *i-sine*.

- Monitoring of all metering parameters like V, I, F, kVA, P.F., THD
- Control commands & settings
- Waveforms & harmonics spectrum (optional touch screen TFT panel)
- Status & alarms

## Why *i-sine* Active Harmonic Filter?

### FEATURES

- Fast Fourier Transform based harmonic compensation
- Operates with closed loop control
- Harmonics attenuation up to 97% at rated current
- Reactive power compensation
- Harmonics compensation with and without PF compensation
- Ability of parallel operation to increase power capacity
- Voltage-independent harmonic current tracking
- Inherent current limiting
- Shunt connection
- Backlit user interface (optional TFT with touch screen)
- Serial monitoring
- Modbus RTU communication compatible
- Advanced programmable digital I/O interface
- Intelligent control algorithm which dynamically changes the switching frequency to optimize the performance

### BENEFITS

- Programmable selective harmonics elimination
- Best accuracy. Does not require detailed network analysis
- Prevents possible harmonic resonance
- Automatic PF compensation, leading as well as lagging
- Optimum utilization of power capacity
- Adaptive to increase in harmonics current due to additional loads being added
- More immunity to input voltage distortion
- Over load condition is prevented
- Easy for Maintenance
- User-friendly operation
- Remote monitoring can be done
- Facilitates networking ability
- Selective harmonics elimination by digital programming
- Minimum insertion loss resulting in efficient operation

# Standard Specifications

## Electrical

<b>Power Source</b>	415 VAC, 3-Phase 3-Wire, 50 Hz or 60Hz, Voltage $\pm 10\%$ , Frequency $\pm 5\%$					
AMT-AHF-□□□-4	030	060	100	150	200	300
Filter Current in Phase (Arms)	30	60	100	150	200	300
Max Peak Filter Current (Apk)	75	145	240	360	480	720
Heat-loss (Watt)	$\leq 1200$	$\leq 2000$	$\leq 3000$	$\leq 5000$	$\leq 6100$	$\leq 7000$

## Control Function

Control Method	Hysteresis current control
Harmonic Filtering	Harmonic orders 3 <sup>rd</sup> to 51 <sup>st</sup> (Non Zero sequence)
Harmonic order selection	(a) Global compensation from 3 <sup>rd</sup> to 51 <sup>st</sup> order
	(b) Selective compensation from 3 <sup>rd</sup> to 51 <sup>st</sup> order
Harmonic attenuation ratio	Better than 97% at rated current for individual harmonic order
Power factor improvement	Automatic, up to the unutilized capacity of filter
Max. switching Frequency	18 kHz
Transient response time	$\leq 40$ ms

## Operation

Digital Inputs	9-Programmable sequence inputs, sink / source changeable
Digital Outputs	5-Programmable sequence outputs, open collector type
Potential free contacts	3-Programmable relays: 1-NO, 1-NC for 2A @ 240Vac
	Programmable between 10 different options
Programmable analog outputs	2-Programmable analog voltage outputs VO1 to VO2: 0~10Vdc
	2-Programmable analog current outputs IO1 to IO2: 4~20mA
Soft-charge	Through resistor within 5 sec.
Auto start	Yes, AHF can start at power ON condition in local and serial mode.
Auto restart	Adjustable up to ten times for fault like Over current fault, Timed over current fault, Adjustable over current fault, DC bus over voltage fault, DC bus under voltage fault, Earth fault, Temperature fault, External fault

## Display Indications

	Total 80-Character, 4-Line LCD panel, 8-Key keypad, 3-Status indicating LED for Run, Stop and Fault
	THD <sub>v</sub> , Line Frequency, DC bus voltage, PF, DPF, kW, kVA, V <sub>L-L</sub>
	Current of Filter/Load/Source side for each phase, THD, of load and filter side

## Communication

Network connectivity	RS-485 for PC interface with Modbus-RTU protocol as standard
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## Protections

Protective function	Over current	Phase loss
	Adjustable over current	Ground fault
	Timed over current	External fault
	DC bus over voltage	Charging fault
	DC bus under voltage	EEPROM fault
	Over temperature	
Fault history	Last ten faults with status at the time of fault are stored in memory	
Electronic thermal overload	105% Overload for 60 Seconds, above 100% harmonic current is limited by software,	

## Environment

Installation location	Indoor (Consult Amtech for outdoor application)					
Type of cooling	Forced Air Cooling					
Ambient temperature	0°C (32°F) ~ 40°C (104°F)					
Storage temperature	-20°C (-4°F) ~ 70°C (158°F)					
Audible noise	$\leq 72$ @ 1.0m (3ft)					
Altitude (above sea level)	1000m (3300ft) w/o derate, (derate 1% per 100m (330ft) above 1000m (3300ft)					
Model derating with temperature	Above 40°C (104°F), derate the output current by 3% /1°C (1.8°F) maximum upto 50°C (122°F) temperature					
Relative humidity	0~95% max non condensing					
Color	RAL 7035					
Protection Class	IP 31 (Consult Amtech for higher protection requirement)					
Dimensions (W x D x H) (mm [inch])	480x370x1065 [18.9x14.6x42]		600x600x2000 [23.6x23.6x78.7]		800x600x2000 [31.5x23.6x78.7]	
	80 [176.5]	90 [198.5]	330 [727.5]	350 [772]	375 [827]	480 [1058]
Installation	Wall/Floor mounting			Floor mounting		

## Reference standard

Harmonic	IEEE 519-1992, G5/4-1, GB/T 14549-93, IEC 61000-3-2, IEC 61000-3-4
Safety	IEC 50178

\*Above 300A requirement, multiple units will be connected in parallel. Contact AMTECH more detail.

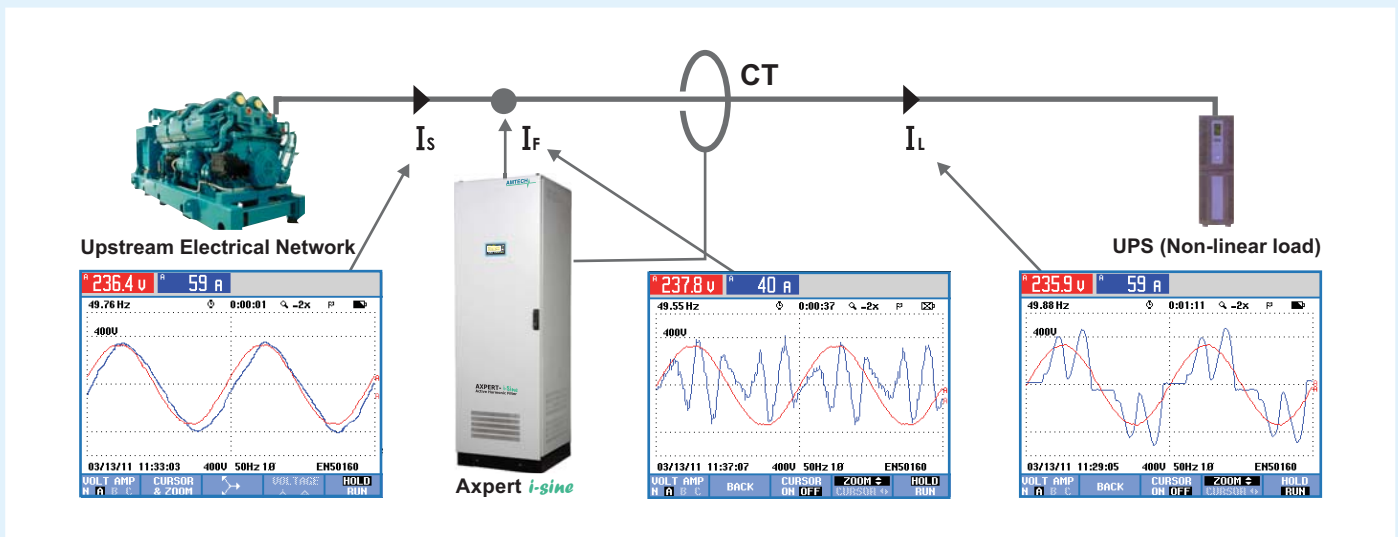
## Applications

Amtech's Multi functional Active Harmonic Filter can compensate for reactive currents of fundamental waves, harmonic currents etc. It finds applications in various scenarios with combination of its multi-functions.

- **Intelligent Buildings:** OA equipment, air conditioners, lighting, UPS, elevators, pumping facilities
- **Factories:** Crane facilities, press machine, machine tools, high frequency induction heating equipment, inverter-incorporated facilities, printing machines, paper machines
- **Public facilities and Others:** City-water and sewage pumping facilities, harbor crane facilities, crane facilities at waste incineration plants, ropeway hoisting machines, amusement parks etc.

## Case Study

Normally 3-phase large UPS with 6-pulse rectifier feedbacks heavy harmonics current of 30%~40% THD into mains or emergency generator. It can cause line voltage distortion or generator malfunction. *i-sine* AHF is well adapted to operate with large UPS to perform very low harmonic feedback, generating less than 5%.



### We also offer following services related to Power Quality

- Detailed Harmonic Audit of Plants
- Total solution for Harmonic mitigation
- Design, supply & commissioning of Harmonic Filters
- Training on Harmonic causes, effects and mitigation technique

CAT.NO. : AEU/AHF01/12

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