

AXPERT-i-sine

MULTI-FUNCTIONAL ACTIVE HARMONIC FILTER



“True Harmonics Solution”

High harmonics escalate complications which affect all power distribution networks in industrial, commercial, telecom and medical applications.

Most of the power converting equipments or facilities can generate harmonic current. Axpert-i-sine, the Multi-Functional Active Harmonic Filter, designed with intelligent control algorithm, dynamically changes the switching frequency to optimize the performance and efficiency of these equipments. The performance of Axpert-i-sine is less affected by supply voltage harmonic distortion and it provides selective harmonic attenuation up to 51st order.

Amtech offers both 3-Phase, 3-Wire as well as 3-Phase, 4-Wire Active Harmonic Filters. Whenever there are single phase non-linear loads like computers, there is an accumulation of triplen harmonic current in neutral. Our 3-Phase, 4-Wire Active Harmonic Filters are the best choice for such applications.

Monitor Continuously - Attenuate Immediately

Principle of Harmonics Suppression

AXPERT-i-sine 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).

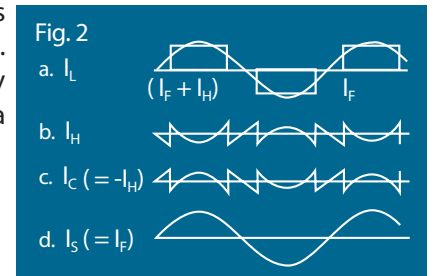
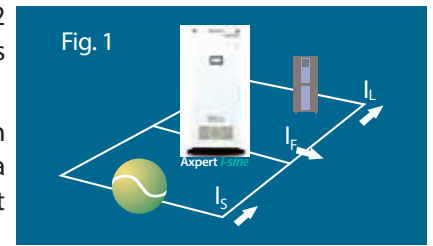
$$(I_L = I_F + I_H)$$

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 in the load current are cancelled by the effect of active filter and source current I_S remains only to I_F , which is a sinusoidal wave (Fig. 2).

This can be clearly explained by the expression below:

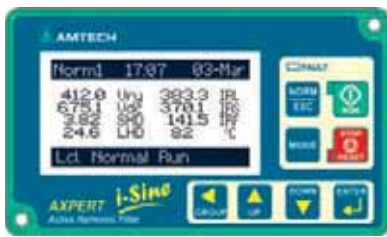
$$I_L = I_F + I_H, I_C = -I_H$$

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

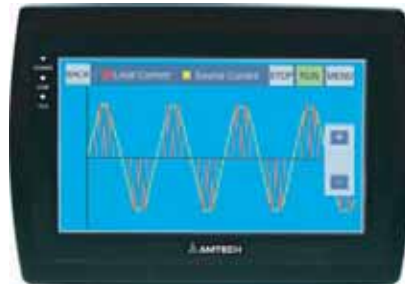


Monitoring & Signaling

Standard Graphical 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 and functional keys with 8-selectable parameters on single screen make it easy to operate and program.

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

- Load, source & Axpert-i-sine
- Monitoring of all metering parameters like V, I, F, kVA, PF, 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
- Reactive power 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)
- 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 Prevents possible harmonic resonance
- Best accuracy. Does not require detailed network analysis
- Automatic PF compensation, leading as well as lagging, optimum utilization of power capacity and reduction in kVA demand
- Adaptive to increase in harmonics current due to additional loads being added
- More immunity to input voltage distortion
- Overload condition is prevented
- Easy maintenance
- User-friendly operation
- Facilitates networking ability and remote monitoring
- Selective harmonics elimination by digital programming
- Minimum insertion loss resulting in efficient operation

Standard Specifications

Electrical															
Input power source ⁽¹⁾	415 VAC, 3-Phase, 3-Wire, 50 Hz					415 VAC, 3-Phase, 4-Wire, 50 Hz					600 VAC, 3-Phase, 3-Wire, 50 Hz				
	Voltage -15% & 10%, Frequency 5%														
AMT-AHF-XXX-4/5-1N ^(2, 3 & 4)	030	060	100	150	200	300	060	100	150	200	100	150	200	220	
Filter current in phase I _F (Arms)	30	60	100	150	200	300	60	100	150	200	100	150	200	220	
Max. peak filter current (Apk)	75	145	240	360	480	720	145	240	360	480	280	360	480	530	
Heat loss (Watt)	≤1200	≤2000	≤3000	≤5000	≤6100	≤7000	≤2100	≤3100	≤5150	≤6250	≤4300	≤6000	≤8000	≤8500	
Control Functions															
Control method	Digital Fast Fourier Transform with Hysteresis current control														
Harmonic filtering	Harmonics orders up to 51 st (non zero sequence)														
Harmonic order selection	Global / Selective compensation from 3 rd to 51 st order with settable amplitude														
Harmonic attenuation ratio ⁽⁵⁾	Better than 97% at rated current														
P. F. improvement Load balancing	Automatic P. F. improvement up to the unutilized capacity of filter Load balancing between line-to-line														
Max. switching frequency	18 kHz														
Transient response time	Less than one power cycle														
Reaction	78 uSec														
Operation Specifications															
Digital inputs	5-Programmable sequence inputs, sink / source changeable														
Digital outputs	4-Programmable sequence outputs, open collector type														
Potential free contacts	3-Programmable relays with 1-NO, 1-NC for 5A @ 240 VAC Programmable between 12 different options														
Programmable analog outputs	2-Programmable analog current outputs IO1 & 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 faults like over current fault, timed over current fault, adjustable over current fault, DC bus over voltage fault, DC bus under voltage fault, earth fault, over temperature fault and external fault with individual enable and disable														
Display Indications															
Display and keypad module	Digital Operation Panel 128 x 64 Graphical LCD with white back light LED, 8-key Keypad, 3-Status indicating LED for Run, Stop, Fault; Real Time Clock. THDv, Line frequency, DC bus voltage, PF, DPF, kW, kVA, kVAR, V _{L-L} Current of Filter / Load / Source side for each phase, THDI of Load and Source side														
TFT module (optional)	TFT Touch screen graphical display Display current waveform of Filter / Load / Source side for each phase														
Communication															
Network connectivity	RS-485 for PC Interface with Modbus-RTU protocol and Wi-Fi connectivity as standard Optional Profibus-DP (slave), DeviceNet, ControlNet, Ethernet, CANopen														
Protective Specifications															
Protective function	1. Over current					7. Phase loss									
	2. Adjustable over current					8. Ground fault									
	3. Timed over current					9. External fault									
	4. DC bus over voltage					10. Charging fault									
	5. DC bus under voltage					11. EEPROM fault									
	6. Over temperature					12. CT Detection fault									
Fault history	Last ten faults - with status at time of fault - are stored in memory														
Electronic thermal overload	120% overload for 60 seconds, above 100% harmonic current is limited by software														
Environment															
Installation location	Indoor (consult Amtech for outdoor applications)														
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	≤72dB @1 m (3.28 ft)														
Altitude (above sea level)	1000 m (3300 ft) w/o derating, [derate 1% per 100 m (330 ft) above 1000 m (3300 ft)]														
Model derating with temperature	Above 40° C (104° F), derate the output current by 3% /1° C (1.8° F) Maximum up to 55° C (131° F) temperature														
Humidity	0 ~ 95% maximum, non condensing														
Mechanical Specifications															
Color	RAL 7035														
Protection class	IP 31 (consult Amtech for higher protection requirements)														
Dimensions	A	A	B	B	B	B	B	B	B	B	B	C	C	C	
Approximate weight in kg [lb]	80 [176.4]	90 [198.4]	272 [599.6]	280 [617.3]	320 [705.4]	430 [948]	95 [209.4]	280 [617.3]	320 [705.5]	335 [738.5]	275 [606.3]	360 [793.7]	470 [1036]	470 [1036]	
Installation	A = Wall/Floor mounting, B, C = Floor mounting														
Dimensions (W X DX H) in mm [inch]	A = 515 X 410 X 975 [20.3 X 16.1 X 38]					B = 600 X 600 X 1995 [23.6 X 23.6 X 78.5]					C = 800 X 600 X 2195 [31.5 X 23.6 X 86.4]				
Reference Standard															
Harmonic	IEEE 519-1992, G5/4-1, GB/T 14549-93, IEC 61000-3-2, IEC 61000-3-4														
Safety	IEC 50178														

1. Products for 60 Hz power supply frequency are also available on request.

2. Above 300A requirement, multiple units will be connected in parallel. Up to 40 units can be connected in parallel. Contact Amtech for any other requirement and more details.

3. The -4 is for 415 input supply and -5 is for 600V supply.

4. The -1N in the part number defines the neutral current capacity equal to the rated filter current; For higher neutral current rating, consult Amtech. This is only applicable for the 3-Phase, 4-Wire system.

5. Minimum 3 % line reactor is required in series with higher di/dt load.

6. All performance specifications are valid at nominal ratings.

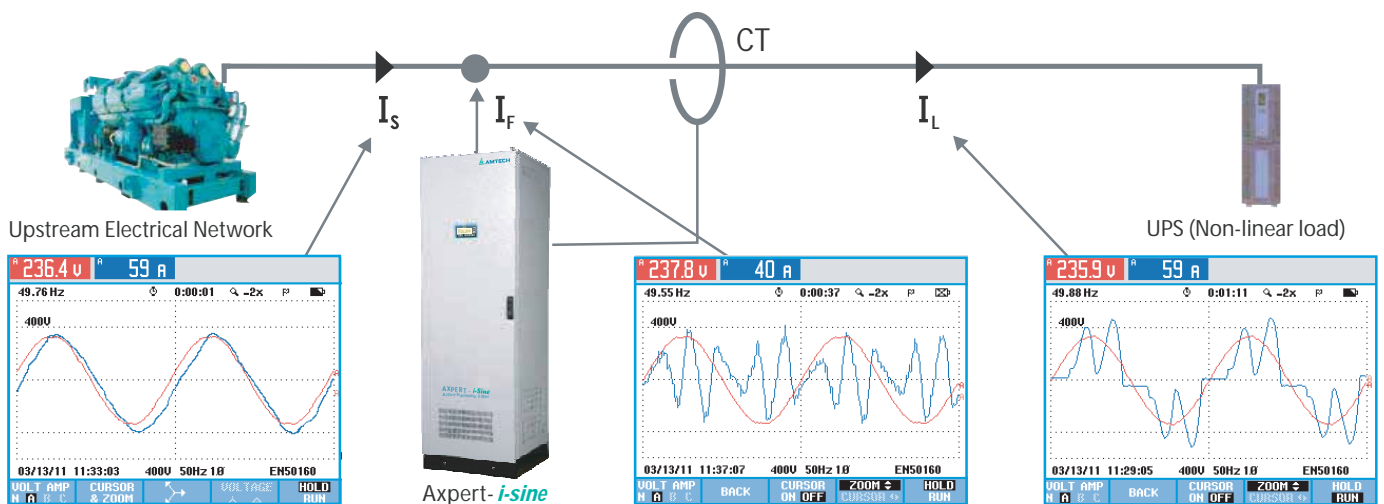
Applications

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 multifunctions.

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

Case Study

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



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.: AEI/AHF03-18



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