

## Liebert AF3

Next Generation Active Harmonic Filter



### Ratings Available

**30, 60, 100, 150, 300 A**

Three phase

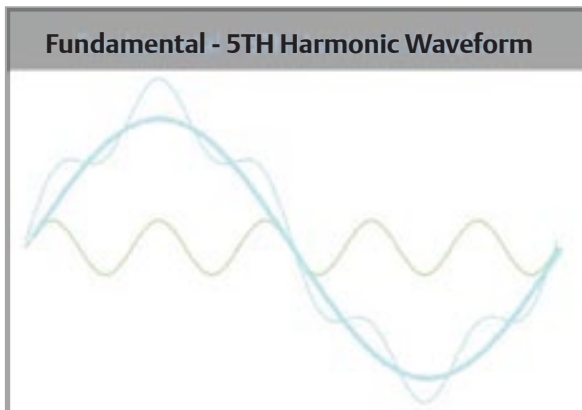
State-of-the-Art active filter, that dynamically cleans up Harmonics and improves Power Factor, for all types of electrical installations. It has dynamic control features and has no resonance effects, no reactive power circulation, no passive components.

# Harmonics - An Overview

## You Need To Be Aware Of Harmonics

During the last few years industries has witnessed an increasing awareness of clean power, power system harmonics and associated problems in low-voltage systems, both in power utilities and consumer segment. Harmonics being one of the major contributors of poor power quality, a better understanding is essential to minimize it's effects.

## What are Harmonics?



### Effect of Harmonics:

- Overheating of Generator, motor, transformer.
- Overvoltage conditions on supply system.
- Increased transformer losses (need to over-size)
- Nuisance tripping of circuit breakers
- Improper operation of microprocessor-based equipment
- Overheating and possible resonance with capacitors
- Re-injection of harmonic currents into the utility network.
- Neutral burnout.
- Insulation breakdown.
- Decreasing Distribution Capacity due to hot cables.

Harmonics are periodic, sinusoidal & integer multiples of fundamental frequency (50 or 60Hz), current or voltage components, present in nonsinusoidal waveform.

It distorts pure sinusoidal waveform and turns it to a non-sinusoidal waveform.

Harmonics can only be measured by electronic measurement devices

## Which Equipment in your facility is responsible?

Harmonics are the by-products of Modern facilities and Electronic equipment. These are often called non-linear loads. Examples of such loads are:

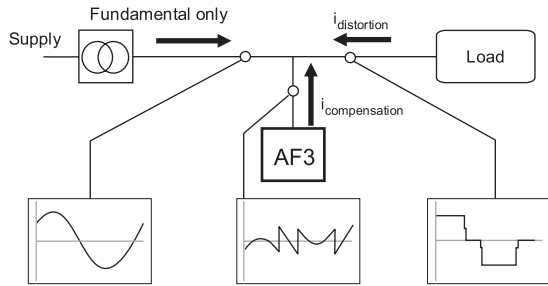
- Servers, Computers, PCs, Printers and other IT Equipment (Having Switch Mode Power Supplies)
- Controlled Rectifiers, Battery Chargers, Uninterrupted Power Supply (UPS) systems
- Phase controlled AC voltage regulators
- Compact Fluorescent Lamps, Fan regulators
- Traction Equipment
- Arc Furnaces or Induction Furnaces, Welding Machines
- Adjustable Speed AC and DC Variable speed motor drives
- PLC, DCS and SCADA systems (SMPS)
- Solid State Heater Controls
- HVDC sending and receiving end equipment



# AF3 - Next Generation Active Filter

## OPERATING PRINCIPLE

Liebert AF3 latest technology to eliminate harmonic injected into the mains supply by non linear loads, as well supplies inductive power demanded by the load, so as to correct input power factor to near unity.

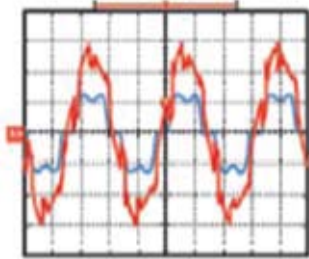
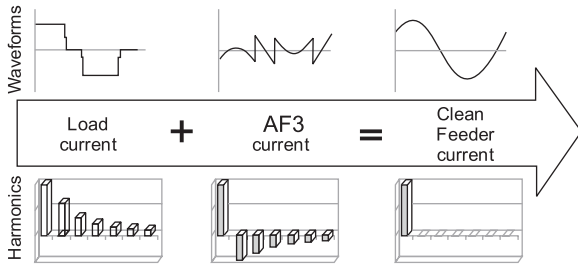


Current harmonic elimination is achieved by sensing load current & extracting harmonic current signal. This and the reactive current signal, together are used to generate a reference for the controlled current source connected at the PCC (point of common connection) of source and load. This results in mains supplying only real power for the load and reactive & harmonics being sourced from the AF3. This is carried out dynamically, so that any change in the load pattern or its nature is immediately responded without any manual intervention.

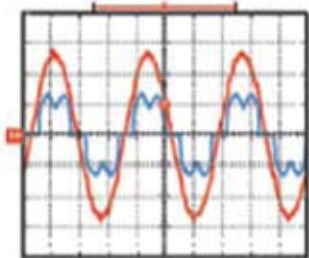
In the following example first figure shows the recorded input current waveform of a six pulse thyristorised rectifier.

Bottom figure shows considerable improvement in the waveform due to AF3 connected in shunt.

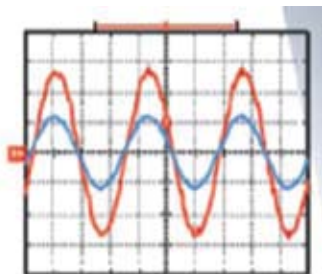
One is with only harmonic correction and the other is with power factor & harmonic correction.



Without Active Filter  
THDi = 27.4% PF = 0.87



Only Harmonic Correction  
THDi = 4.0% PF = 0.92



PF + Harmonic Correction  
THDi = 3.9% PF = 1.00



## Features:

- Synchronous Rotating Reference Frame principle
- 32 bit, DSP control
- PF compensation, leading as well as lagging
- Load Balancing
- Employees high speed IGBTs in power circuit
- Internal CAN Communication
- Closed loop active filter with source current sensing
- High attenuation up to 96 % of individual harmonics
- Programmable selective harmonic elimination
- Required PF can be set from 0.7 to unity
- Selection between PF and harmonic compensation
- Remote monitoring and diagnosis
- Self current limiting, under overloading condition
- Automatic current limit modification with respect to ambient temperature
- Alarm log with date and time stamp for fault diagnosis.
- User friendly PC Interface
- CE Marking

## Value to customer

- Improves reliability of the electrical system, reduces cable and transformer losses.
- Better utilization of distribution Transformer & Generator
- Increases efficiency, capacitor life, PF, uptime.

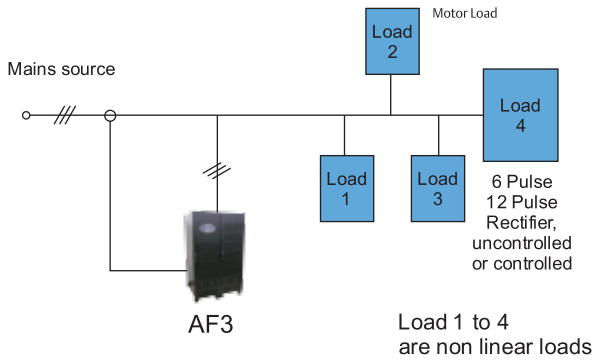


# Freedom From Harmonic Pollution

## Application area

At the input side of Rectifier, AC Drive, UPS, PF Compensation

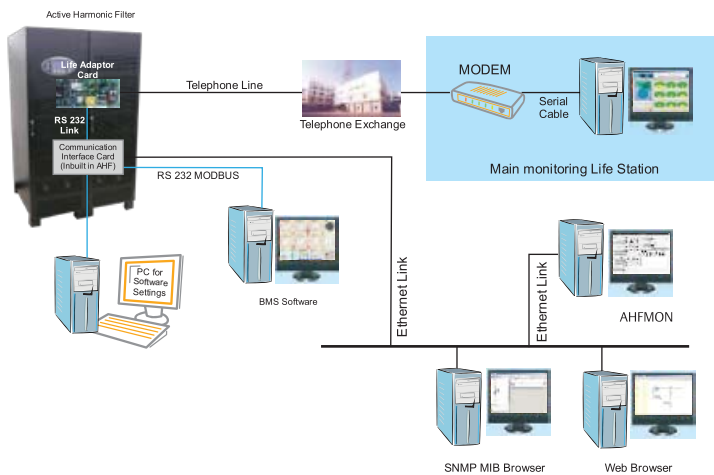
At the source input



## Harmonic & PF Compensation

- To reduce harmonics and improve power factor of UPS, rectifiers, AC & DC drives etc.
- To improve PF of motor loads (i.e. inductive loads)
- Can be used at the output of UPS, to reduce harmonic effects on UPS and increase available capacity. UPS will supply only fundamental and active power.
- Can be used as Hybrid filter i.e. it can be used along with Passive filter & capacitor filter, resulting in reduction of cost and rating of active filter.
- A single unit can be used at the input of multiple UPS

## Connectivity Diagram



## Remote monitoring & Diagnosis

- All front display parameters including wave forms can be monitored through PC.
- Supports MODBUS protocol.
- Life.NET compatibility\* i.e. parameters can be monitored remotely through telephone line
- Potential free contacts for monitoring the status of filter.
- Inbuilt ethernet based TCP/IP, HTTP, SNMP Support\*

\* optional

## OLED based graphic display showing

- Harmonic spectrum upto 64 th harmonic of line current.
- True measurement of line voltage, current, kVA, kW, pf.
- Waveform-Showing real time display visual of line current & voltage
- Harmonics & pf configuration.



Load Current

# SPECIFICATION

Model	AF3 30	AF3 60	AF3 100	AF3 150	AF3 300
Input Voltage range	400 V, 3 Ph + N (+10%, - 15%)				
Input Frequency range	50 Hz (±10%) (60 Hz, Optional)				
Capacity	30 A	60 A	100 A	150 A	300 A
Harmonic Filtering	Non zero sequence 2 <sup>nd</sup> to 50 <sup>th</sup> Hrmonic compensation, (Any 20 Harmonics individually selectable) Attenuation ratio up to 96%				
Power Loss in filter	< 1000 W	< 2200 W	< 3600 W	< 5100 W	< 7200 W
Enclosure Protection	IP 40 (IP 41 optional)				
Approx Weight	120 kg	180 kg	285 kg	285 kg	600 kg
Colour	RAL 7021				
Installation	Floor / Wall mounted	Floor mounting			
	Cable entry from Bottom, Front Side (top entry optional)				
Acoustic Noise Level	< 65 dBA @ 1.0 meter (Ref. ISO 3746)				
Operating Temperature	0 to 40°C				
Relative Humidity	Upto 95% (Non-condensing)				
Interface (Optional)	Remote monitoring through MODBUS, SNMP, Web Browser, Ethernet based monitoring through AHFMON, LIFENET				
Standards	Meets IEEE 519 for compensated harmonic. IEC / EN 62040-2 Category C3, EN 50178				
Potential free contacts	Filter Trip and Filter ON				
Dimensions in mm (W x D x H) + Plinth	600 x 350 x 800 + 100	800 x 600 x 1000 + 150	800 x 600 x 1600 + 150	800 x 600 x 1600 + 150	1200 x 900 x 1600 + 150
Current Transformer	500 A : 5 A 15 VA, Class 1 with short link	1000 A : 5 A 15 VA, Class 1 with short link	3000 A : 5 A 15 VA, Class 1 with short link	3000 A : 5 A 15 VA, Class 1 with short link	5000 A : 5 A 15 VA, Class 1 with short link

Note : Consider AF3 N model (available up to 150A ) for Zero Sequence triplen harmonic compensation. Please contact Technical Support Group.  
: Specifications subject to change without prior notice.



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