Vertiv™ Liebert® AF4

ANN powered Active Harmonic Filters

About Vertiv

Vertiv brings together hardware, software, analytics, and ongoing services to ensure its customers' vital applications run continuously, perform optimally and grow with their business needs. Vertiv solves the most important challenges faced by today's data centers, communication networks, and commercial and industrial facilities with a portfolio of power, cooling, and IT infrastructure solutions and services that extends from the cloud to the edge of the network. Headquartered in Columbus, Ohio, USA, Vertiv employs around 20,000 people and does business in more than 130 countries. For more information, and for the latest news and content from Vertiv, visit Vertiv.com.

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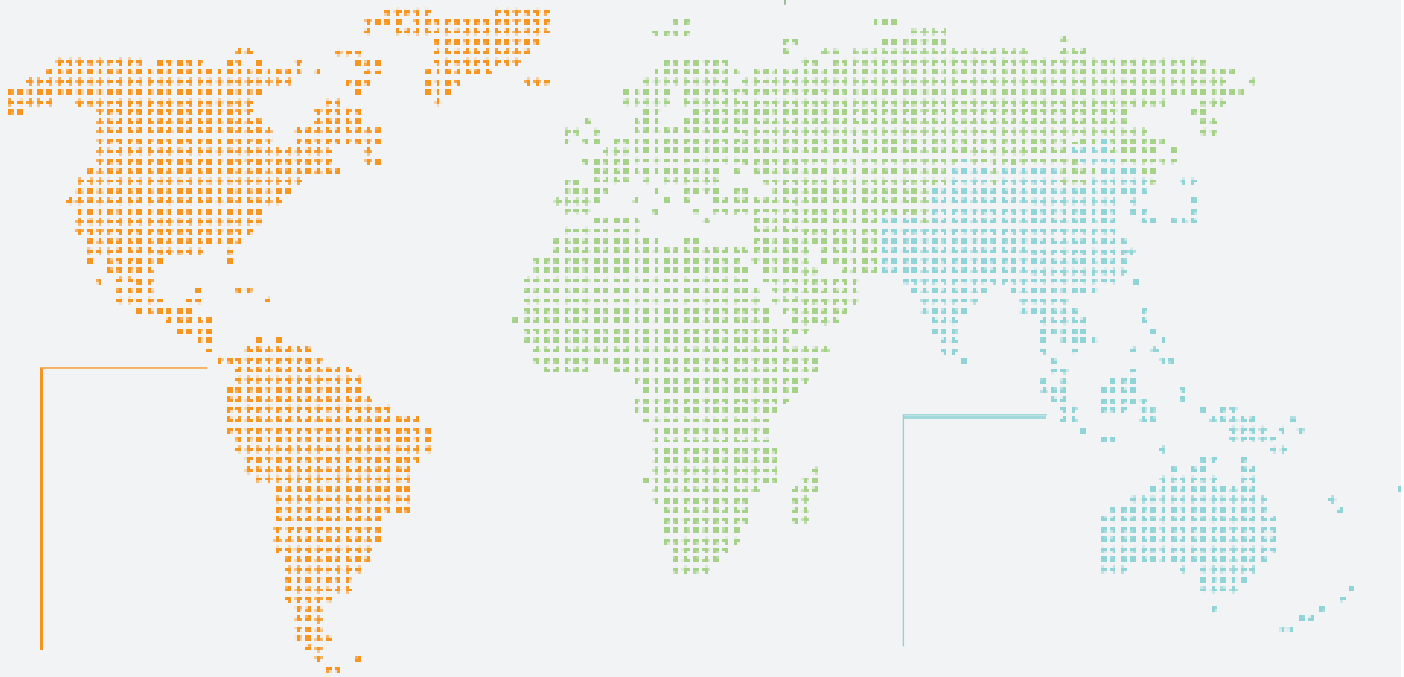
OUR PURPOSE

We believe there is a better way to meet the world's accelerating demand for data - one driven by passion and innovation.

OUR PRESENCE

GLOBAL PRESENCE
Manuf. and Assembly Locations **24**
Service Centers **220+**
Service Field Engineers **3,500+**
Technical Support/Response **220+**
Customer Experience Centers/Labs **19**

EUROPE, MIDDLE EAST AND AFRICA
Manuf. and Assembly Locations **10**
Service Centers **65+**
Service Field Engineers **650+**
Technical Support/Response **100+**
Customer Experience Centers/Labs **5**



AMERICAS
Manuf. and Assembly Locations **10**
Service Centers **80+**
Service Field Engineers **1,600+**
Technical Support/Response **90+**
Customer Experience Centers/Labs **5**

ASIA PACIFIC AND INDIA
Manuf. and Assembly Locations **4**
Service Centers **75+**
Service Field Engineers **1,250+**
Technical Support/Response **30+**
Customer Experience Centers/Labs **9**

Importance of Power Quality

Power quality is related to the quality of power being supplied and/or consumed. It must be maintained during the following conditions:

- The State Electricity Board (EB) or Utility provides a sinusoidal voltage at the rated magnitude and rated frequency to its consumers.
- Consumers draw sinusoidal current that is in phase with the input supply voltage.

EB can assure power quality from its side only when its consumers do meet certain power quality standards (such as IEEE 519-1992 and/or IEEE 519-2014). Recently, several EBs across the globe have started imposing strict regulations on the quality of current, a customer can draw from the supply lines to maintain a healthy power distribution system.

Harmonic and Reactive Currents

The power electronic devices (such as variable frequency drives-VFDs, phase-controlled rectifiers, choppers, battery chargers, etc.) and other major electrical loads in the industries draw current that has three main components:

- Active current at rated frequency
- Reactive current at rated frequency
- Harmonic currents at higher frequencies (commonly at multiples of rated fundamental frequency).

Among these three parts, the active current is responsible for the actual work done in the factory/plant, while the remaining two parts are just circulating between EB and load, and do not contribute to any useful work.
These two non-active currents, however, have a significant impact on the other connected loads and distribution system.

- Reactive current is responsible for the poor plant power factors and attracts penalties from EB.
- Harmonic currents cause adverse effects on other loads in a plant and EB voltage quality.

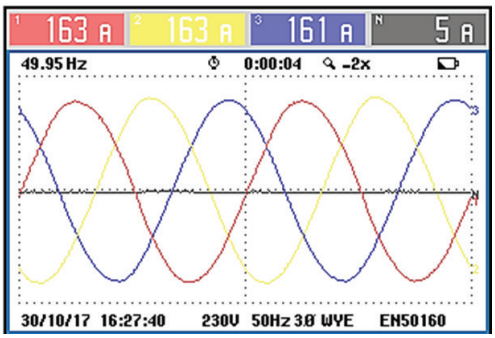
Vertiv™ Liebert® AF4

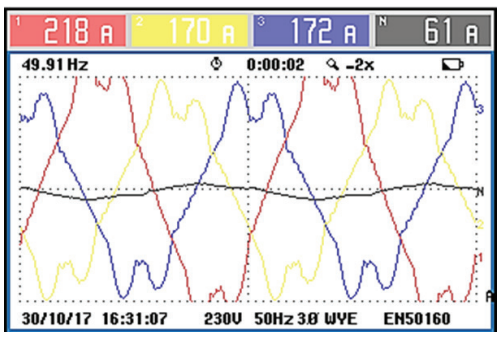
Vertiv proudly introduces its first product line-up "Vertiv™ Liebert® AF4" an Active Harmonic Filter (AHF) to cater to the present industrial needs. Vertiv™ Liebert® AF4 is a high-speed Insulated-Gate Bipolar Transistor (IGBT) based device that is connected in parallel to the plant and performs the following [regardless of the loading condition]:

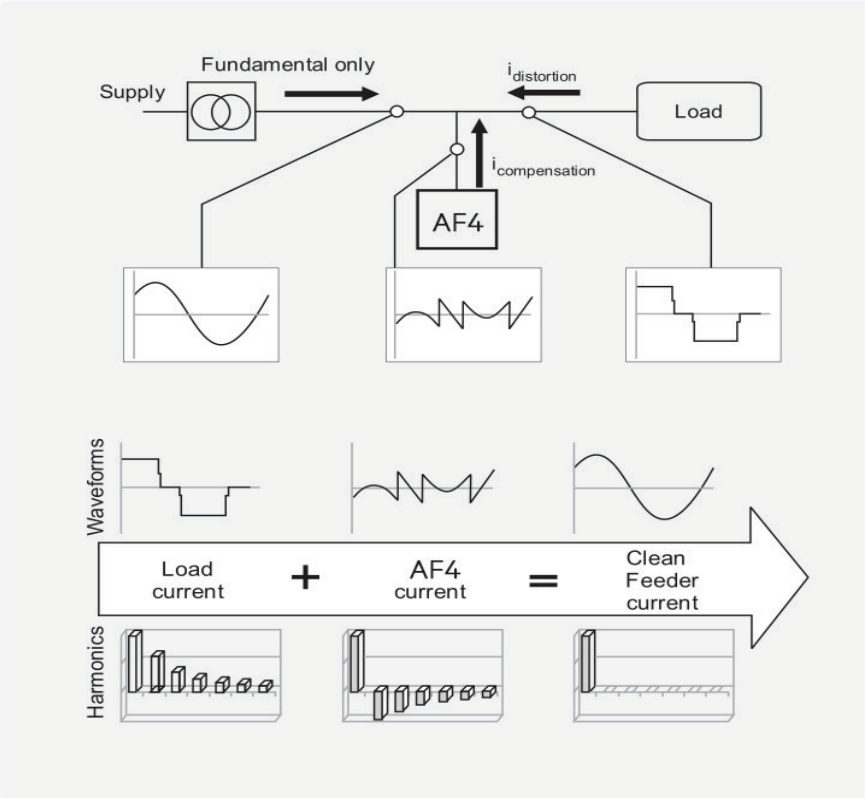
- Cancels the load generated current harmonics.
- Maintains unity power factor operation.
- Ensures balanced three-phase source currents.
- Compensates neutral current (only with 3P4W version).

Operating Principle

- Vertiv™ Liebert® AF4 identifies the downstream load current composition (such as active, reactive, harmonics, and unbalanced components) using an intelligent artificial neural network (ANN) based control technique and cancels the unwanted components at the load end through precise control of IGBTs.
- Based on the selective harmonic compensation, Liebert® AF4 computes the magnitude of individual harmonic, fundamental reactive, and unbalanced currents that are to be compensated.
- As long as the compensation requirements are within the rating of Liebert AF4 capacity, it compensates all the unwanted current components, in case the requirement is higher than its rated capacity, compensation current is dynamically limited to i-Sine AHF capacity using inbuilt real-time current limiting algorithm.
- Thanks to our closed-loop adaptive ANN control philosophy, Liebert AF4 dynamically compensates the unwanted components of load current even when the load changes frequently.

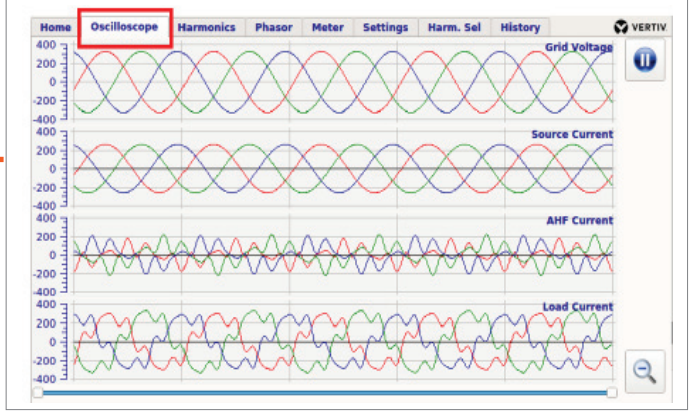




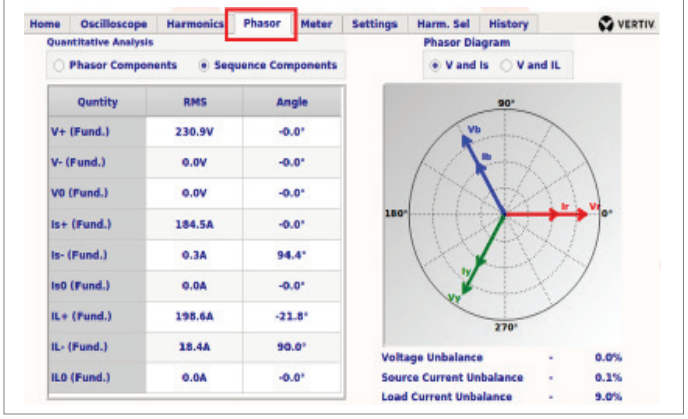


Adaptive Display with Multidimensional Insights

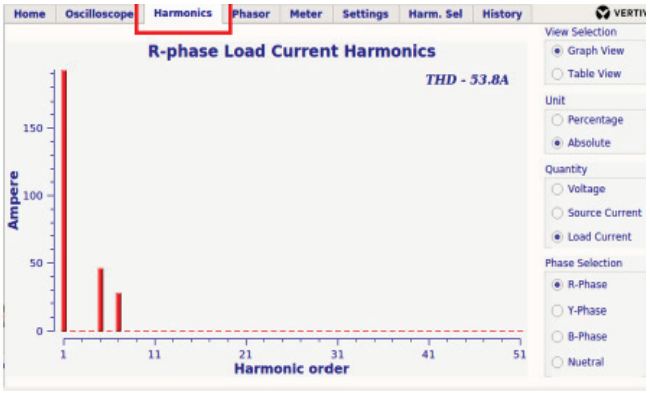
Embedded Oscilloscope that enables to monitor the real time waveforms



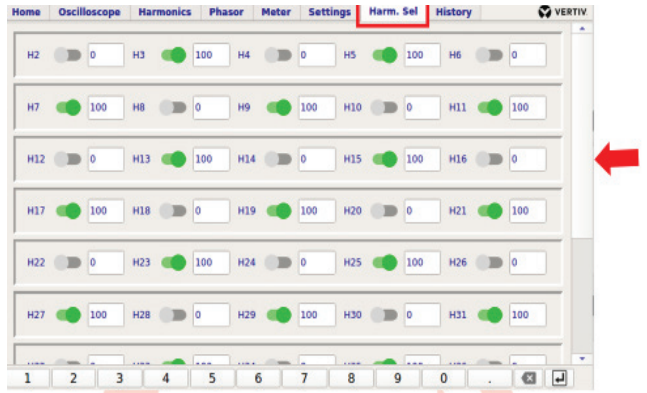
Phasor tab provides real-time phasor diagrams as well as sequence components analysis



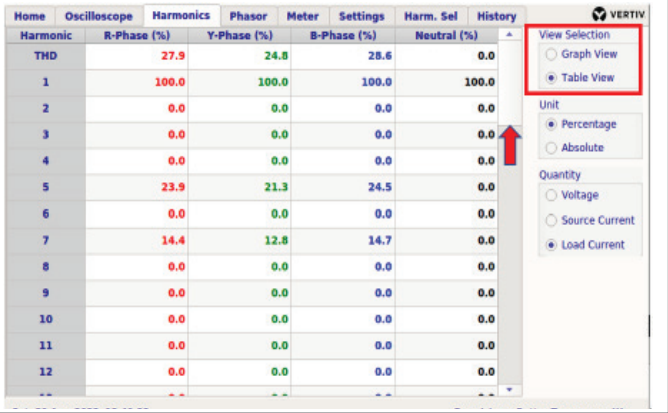
Harmonics tab is designed for real-time analysis of individual harmonics present in the load as well as source current waveforms



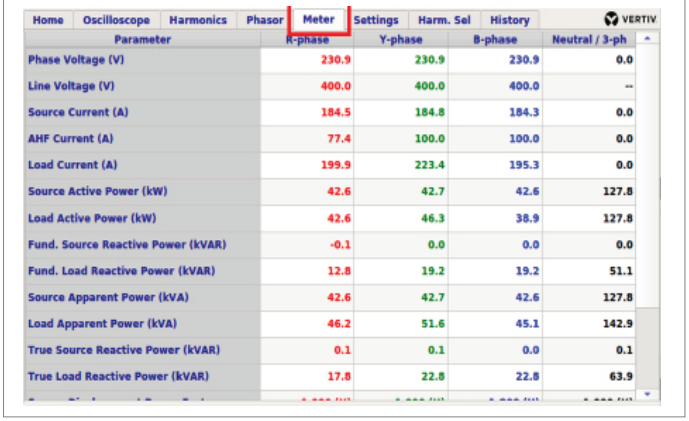
It allows the user to prioritize the harmonic order to be compensated by the AF4



User has the flexibility to select and visualize the parameters which are to be monitored



Meter tab shows various electrical parameters of R, Y, and B phase



Key Features and Benefits

Harmonic Mitigation

Vertiv™ Liebert® AF4 assures the plant current THD to stay below the limits specified by the IEEE 519-1992 with full dynamic compensation.

Power Factor Control

Vertiv™ Liebert® AF4 ensures unity power factor operation of the plant. Fully dynamic compensation adaptive to load changes.

Wide Range of Harmonic Selection

Ability to cancel all odd harmonics up to 51st order. These harmonics are individually selectable/ programmable with on limitation.

Vertiv™ Liebert® AF4 (200 A)

Current Balancing

Vertiv™ Liebert® AF4 assures the plant current drawn from the EB to be balanced and sinusoidal.

Optimum Design

Light in weight, compact in size, quiter in operation, and best in the performance.

No Prerequisite

Vertiv™ Liebert® AF4 in general, does not require the installation of input chokes with VFDs, as long as the load current THD is below 40%.

Energy Efficiency

Vertiv™ Liebert® AF4 consists of an intelligent **on the fly** real-time internal switching loss minimization technique to enhance the internal energy.

Vertiv™ Liebert® AF4 (300 A)

Neutral Current Compensation

A 3P4W Vertiv™ Liebert® AF4 fully supports the load neutral current locally, and assures zero neutral current on the source/EB side.

Technical Specifications

Model		Vertiv™ Liebert® AF4						
Ratings (A)		**30 A**	**60 A**	**100 A**	**150 A**	**200 A**	**300 A**	**400 A**
Dimension (W x D x H) mm	3P3W	560 x 540 x 750 mm	600 x 640 x 1000 mm	600 x 640 x 1000 mm	700 x 750 x 1325 mm	700 x 750 x 1425 mm	1150 x 750 x 1500 mm	1150 x 750 x 1500 mm
Weight		85 kg	120 kg	138 kg	210 kg	240 kg	410 kg	460 kg
Dimension (W x D x H) mm	3P4W	560 x 540 x 775 mm	600 x 640 x 1000 mm	700 x 750 x 1325 mm	700 x 750 x 1425 mm	700 x 750 x 1650 mm	-	-
Weight		95 kg	132 kg	190 kg	244 kg	260 kg	-	-
Plant Input Conditions								
System Voltage (RMS)		350-460 V						
Fundamental Frequency (Hz)		50 ± 5%						
System Configuration		3P3W and 3P4W *(Single-phase option available)*						
Product Specification								
Power Semiconductor Devices		IGBTs						
Peak Compensating Current		2.2 time RMS Value *(No need of over sizing with VFD loads)*						
Harmonic Compensation Range		All odd harmonics up to 51st order						
Selective Harmonic Compensation		From 0% to 100% for all 51 Harmonics *(No limit on the number of harmonics selection at a time)*						
Reactive Power Compensation		Any power factor (inductive to capacitive). Full dynamic control.						
Harmonic Attenuation Factor		More than 97% at rated load						
Load Current Balancing		Yes						
Cooling		Forced Air Cooling						
Cable Entry		Bottom						
Mounting		Floor Mounting						
Ingress Protection Level		IP20						
Control System								
Controller Type		Digital control						
Control Method		Based on Adaptive Artificial Neural Networks (ANN) *(Ultra-fast computation)*						
Dynamic Response Time		100 Micro-seconds						
User Interface								
HMI Display Type		7-inch Capacitive Touchscreen Display						
Remote Monitoring		MODBUS/Through Instaview software on USB port						
Additional Details								
Operating Temperature Range		0 °C to 50 °C *(No derating required in the entire operating range)*						
Active Power Loss		Less than 3%						
Parallel Operation		Yes						
Short-circuit protection		Yes						
Color		RAL7021						
Noise Level		<65 dB						

*Conditions apply
*Specifications are subject to change without any further notification.

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