

Active Harmonic Filter

# ***lora* x3**

100 A - 1000 A



Fuji Electric has decades of global experience and expertise in solving harmonic issues. IORA X3 is the latest generation Active Harmonic Filter with advanced 3 level technology for mitigation of harmonics problems with the lowest energy losses.

### **Highlights of IORA X3**

#### **Flexibility**

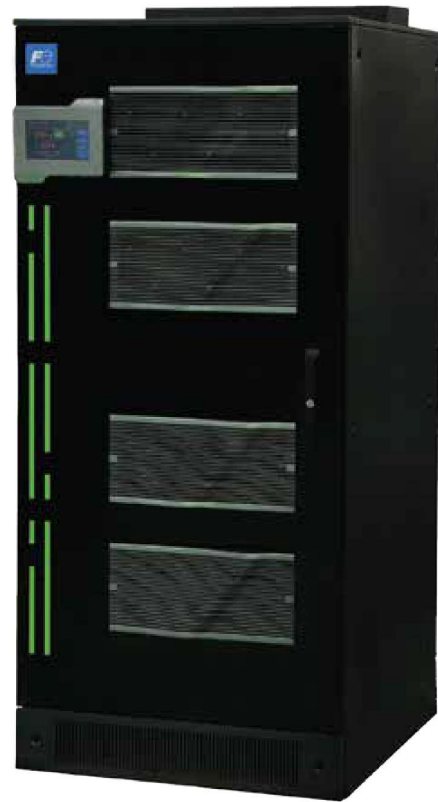
- Modular Construction
- Top or Bottom Cable Entry
- Increase the installed capacity upto 4000A
- Upto to 4 Systems in parallel
- Power Factor & Harmonic Correction to meet IEEE 519 standards, Auto adjustable based on connected load
- Elimination of harmonics up to 50<sup>th</sup> order
- Neutral Harmonic current compensation (Optional)
- Standard IP20 protection, available options-IP31, IP42, IP54, IP55

#### **Reliability**

- Power module & Control Module are totally independent with a mechanical separation between PCB's and heat producing power semiconductor components
- Continuous Operation upto 40° C

#### **Total Cost of Ownership**

- Very low losses of upto 2% with advanced 3 level topology



#### **Applications**

- Oil and Gas Industry (Onshore and Offshore)
- Steel Industry
- Foundries
- Textile Industry
- Water and Waste Water Industry
- Cement Industry
- Automotive Industry
- Process Plants
- Pulp and Paper Industry
- HVAC & Tunnel Ventillation System
- Printing Industry
- Offices and Commercial Buildings.
- Data Centers
- UPS Systems, Lifts and Advanced Lighting Systems
- Variable Frequency Drives

**Working Principle**

IORA X3 is a state-of-the-art Active Harmonic Filter(AHF). The harmonic mitigation is achieved by sensing the source current and supplying the harmonic current required by the load. The digital signal processor (DSP) determines the amplitude to be injected in the opposite phase angle for each harmonic order. This signal along with fast acting IGBT's injects the required harmonic current into the power circuit. This action happens instantaneously restoring sine wave of the supply current and attenuating the harmonic levels at the point of installation.

The IORA X3 can also be used to improve power factor. Correction for displacement PF is achieved by calculating the phase shift of the fundamental current from the voltage of the supply on a per cycle basis. The DSP then calculates the amplitude and phase shift required for correcting the displacement power factor. The IGBT's are then directed to inject fundamental current at the proper phase shift to improve the PF in real time even for dynamic load conditions.

**User benefits**

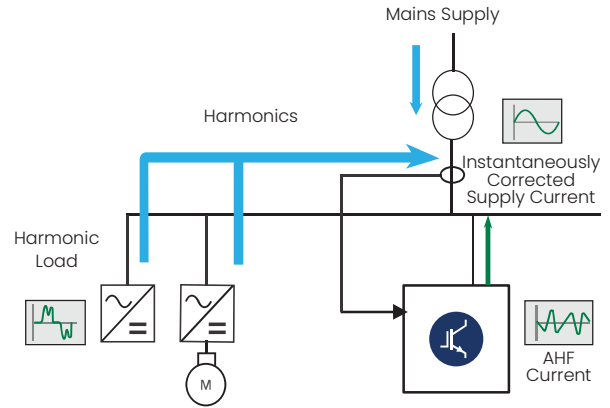
Knowing the damaging effects of harmonic pollution on power utility sources, power distribution companies and electricity boards are bringing restrictions on the percentage harmonic distortion that can be injected in to the supply lines.

By reducing harmonics, one can improve the power quality, and increase the efficiency of the electrical distribution system. Power savings of 10 to 30% is possible to achieve, depending on the application.

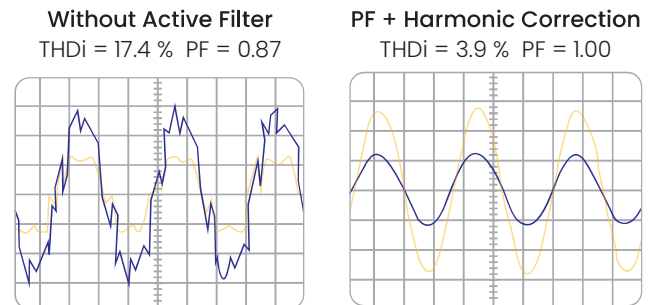
The new power triangle is important to understand as many electricity board are using KVAhr billing. The KVA(S) is increased due to harmonic distortion(D) and so it is important to reduce harmonics to reduce KVA consumption.

$$KVA (S) = \sqrt{P^2+Q^2+D^2}$$

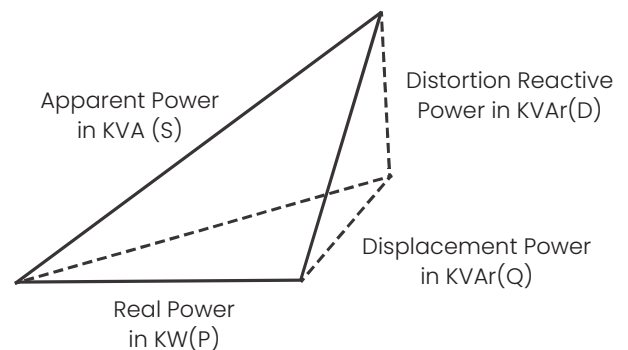
■ **Typical Connection of AHF**



■ **Typical Performance of AHF**



■ **New Power Triangle**



### Scalability

Basic modules of 125A, 150A and 250A, can be paralleled to get the desired rating, enabling vertical modularity of upto 1000A and horizontal modularity of upto 4000A (4 units of 1000A).

### Unparalleled High Performance

The IORA X3 is designed for continuous operation at 40°C ambient temperature with special attention to details in component selection and design to improve reliability and life under demanding conditions. Complexity of control wiring within the AHF has been simplified using CANBUS communication protocol for higher reliability and trouble free operations.

IORA X3 series incorporates advanced 3 level technology. The Fuji Electric 3 level topology is more advantageous than conventional 3 level topology as losses can be reduced.

Power module & Control Module are totally independent with a mechanical separation between PCB's and heat producing power semiconductor components.

N+1 redundant fans ensures improved reliability and performance of the AHF.

### Flexibility

Flexible design of IORA X3 allows the connection of current transformer at load level(Open Loop) or at source level(closed loop) for better attenuation of harmonics of upto 96%.

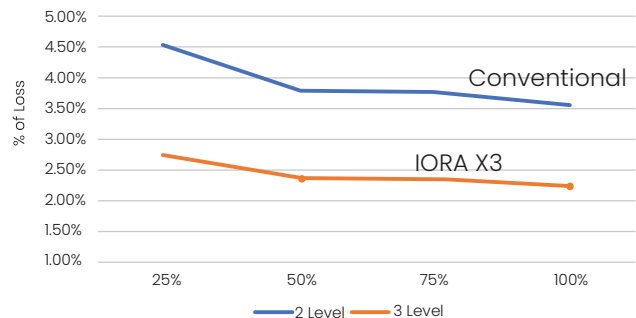
Selective harmonic elimination function of the harmonic filters gives the flexibility to select the harmonics from 2<sup>nd</sup> to 50<sup>th</sup> to be eliminated. With this feature the particular harmonics which are causing damages can be kept under control.

Compatible for top or bottom cable. Option of outdoor installation with enhanced IP protection levels of IP54/55 is available.

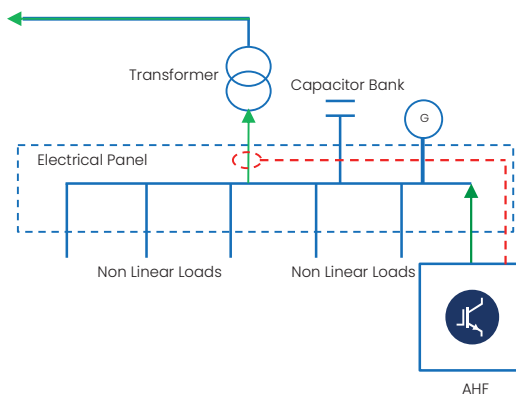
### Modular Construction of IORA X3



### Power Loss of IORA X3



### Closed Loop with Source Current Sensing



### User interface with Advance Graphic Display

Use of 7 inch SVGA color display enhances the user experience while interfacing with IORA X3 AHF. Colorful viewing of different waveforms and setting various parameters can be done by use of this touch sensitive display. With this, almost every detail about the power supply can be monitored and logged for corrective action.

#### ■ User Friendly HMI



### Communication Options

The optional communication modules provide the extra capability of Modbus to fulfill all the possible communication demands required by customers.

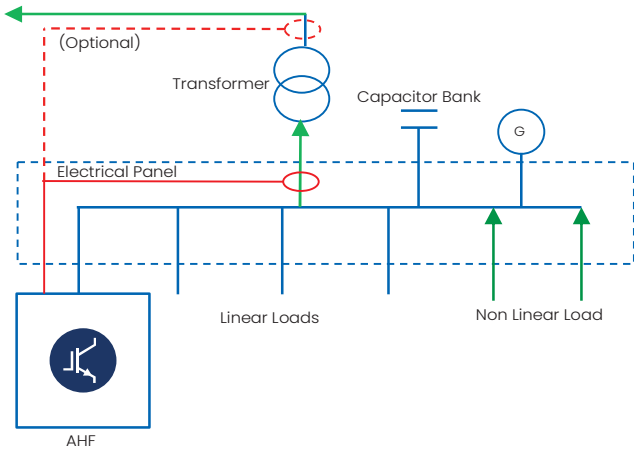
#### ■ User Interface Communication



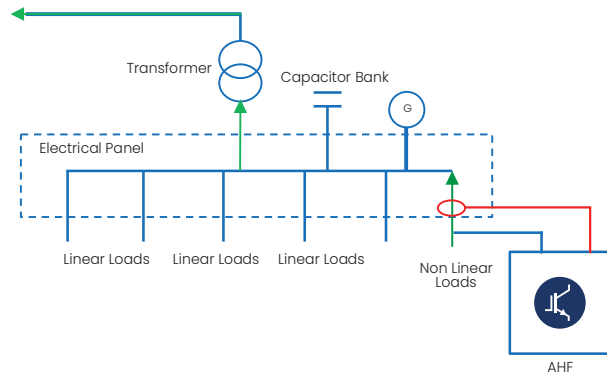
IORA X3 Features	User Benefits
Modular Construction, Unique Design Concept	Basic modules of 125A,150A or 250 A, which can be paralleled to get the desired rating in a single unit and units can be paralleled horizontally for additional capacity.
Advanced DSP	Excellent attenuation even at low load levels, hence overall better performance even when the load is dynamic in nature.
Selective harmonic elimination methods with CT connection options at the load as well at the source	Flexible design, hence particular harmonics which are causing damages can be kept under control.
Works upto 690 VAC (Optional)	Using external auto transformer (optional).
Ethernet based remote monitoring and 7 inch SVGA touch screen display	Enhanced monitoring and control of filter.
Lower audible noise	Suitable for installing near servers inside data center. It helps to curtail down harmonics where they are generated.
Compact in size	Saves space, reduces installation cost.
Compliant to protection up to IP 55 (optional)	Ideal for the harsh industrial environments and outdoor applications.

**Connection Principle of Active Filter**

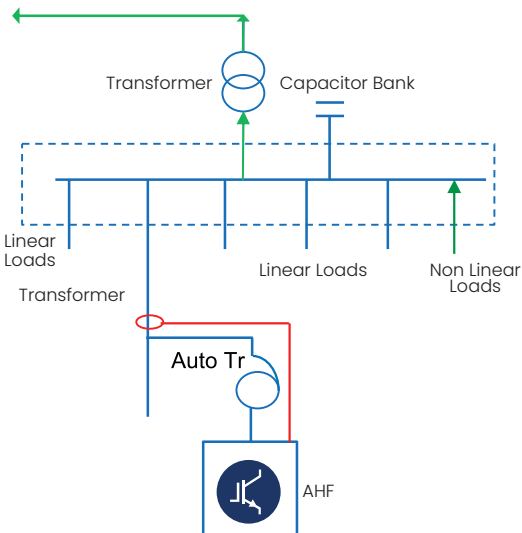
■ **Common Active Filter**



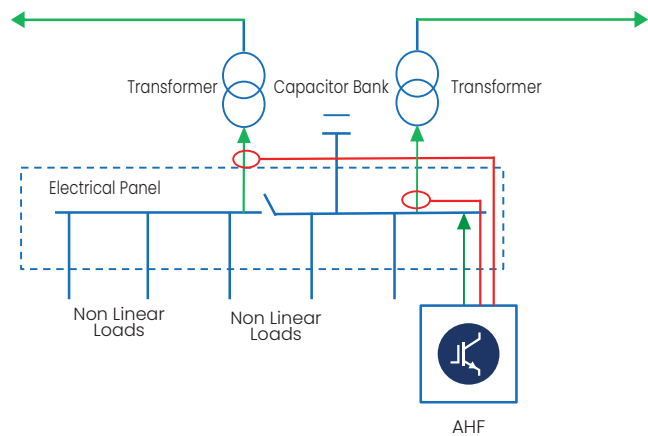
■ **Decentralised Active Filter**



■ **De-Centralised Active Filter for different Voltages**



■ **Common Active Filter for Redundant Transformers**



**Technical Specification**
**IORA X3**

100 A - 1000 A

Active Harmonic Filter

Series	IORA X3											
Model	100	125	150	250	300	375	450	500	600	750	1000	
<b>Electrical Specifications</b>												
Utility connection method	3 Phase, 4 Wire											
Utility Frequency	50 / 60 Hz, ± 5%											
Utility Voltage V1	400 V AC + 10%, -15%											
Filter Current I1 (A)	100	125	150	250	300	375	450	500	600	750	1000	
Parallel Combination	Maximum 4 units of same power rating											
Filter Power Loss	up to 2.5% of Equipment Rating									up to 2%		
Power Protection for Filter	MCCB and Fast Acting Semiconductor Fuses											
Cooling	Forced Air Cooling											
Cable Entry	Bottom			Top or Bottom								
Harmonic Range	2nd to 50th order											
Harmonics Selection	Selection of any 20 Harmonics											
Harmonic Attenuation Ratio	up to 96% at rated current											
Response Time	< 100 micro seconds											
Correction Time	< 20 milli seconds											
Reactive Current Compensation	Yes											
Priority Selection	Yes (PF and harmonics)											
Load Balancing	Yes											
<b>User Interface</b>												
Remote Monitoring	IORAMON On Ethernet Port (Optional) RS 485, modbus TCP/IP											
User Parameter Settings	From The System Display											
Communication	RS 485 / Modbus RTU / Modbus TCP / IP											
<b>Environmental</b>												
Protection Class	IP-20 (IP-31, IP42, IP54/55 optional)											
Operating Temperature	0 to 40°C (up to 50°C with derating)											
Storage Temperature	0 to 70°C											
Relative Humidity	95% (Non condensing)											
Altitude	1000 m without Derating											
Color	RAL 7035 Texture Finish											
Noise Level @ 1 m (Ref :ISO 3746)	< 65 db					< 68 db						
<b>Dimensions in mm</b>												
Height	1160			1810					1815			
Width	620			1000					1400			
Depth	450			850					960			
Standard	Meets IEEE 519 for compensated Harmonics											

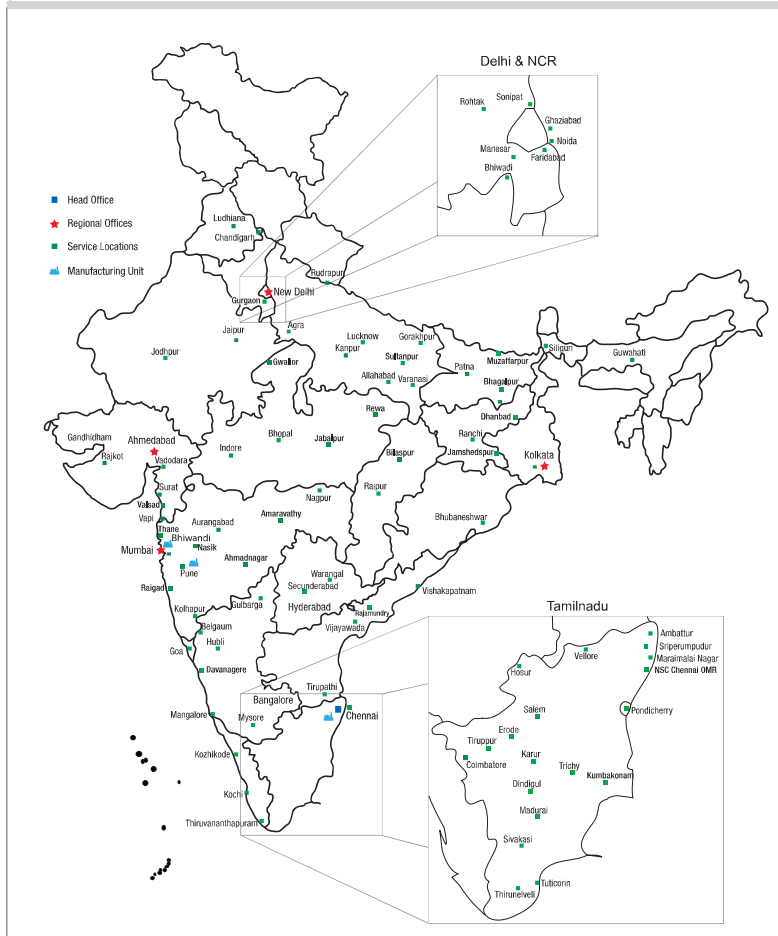
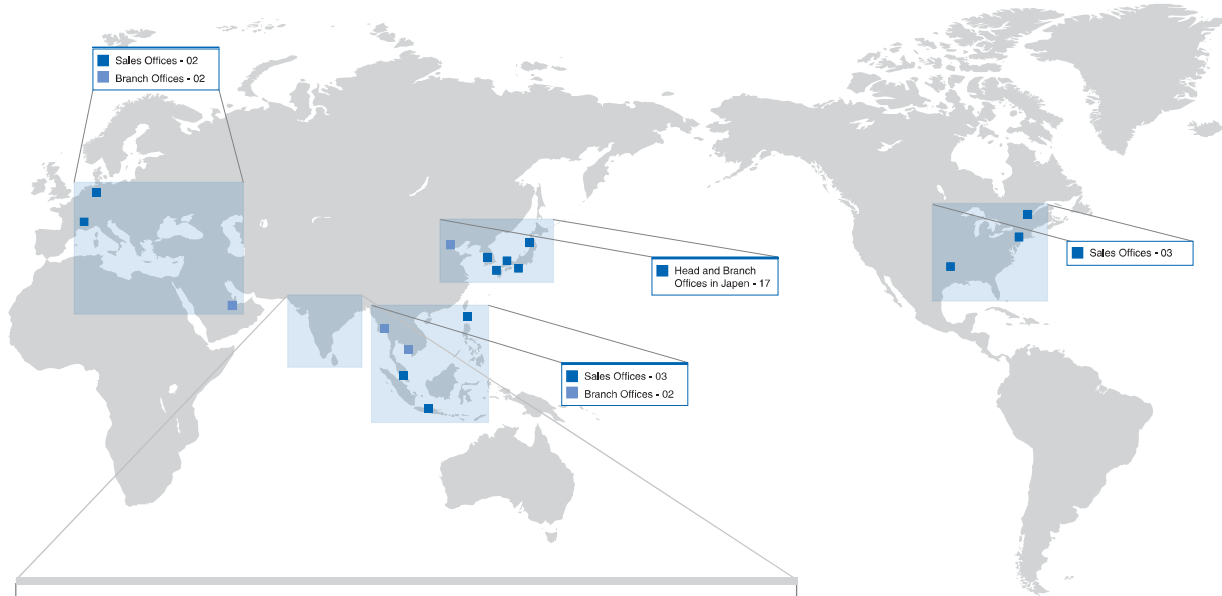
**■ Open Door View of IORA X3**

\*Specifications are subject to change



\*customized rating available on request

**Global Presence**



**Product Offerings**

- Online UPS (1-800 KVA)
- Servo Controlled Voltage Stabilizer (Oil Cooled / Air Cooled)
- Active Harmonic Filter
- Static Transfer Switch
- Isolation Transformer
- Solar Inverter
- Medium Voltage / Low Voltage VFD
- Instrumentation
- Factory Automation
- Process Automation (PLC/HMI/SCADA)

**Service Offerings**

- Comprehensive Annual Maintenance Contracts (CAMC)
- Annual Maintenance Contracts (Labour - AMC)
- AMC for Third Party Power Products
- Battery Replacement Services
- Power Audits
- Stabilizer Retrofits
- Rental UPS and Stabilizers
- Stabilizer Oil Replacement
- Remote Monitoring

FE/IOIRA X3 /02/2023

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