



POWER QUALITY SOLUTIONS

# APEX *Active Filter*

*Active harmonic filtering  
and dynamic reactive power  
compensation solution*

*• Modern • Modular • Compact*





## Achieving Power Quality

Power quality can impact overall company performance but is easily overlooked. Active harmonic filters respond quickly and effectively to balance out power system variations. This enables higher process reliability, longer equipment life, reduced energy losses and improves productivity. Active harmonic filters provide a quick return on your investment. They also make it easy to comply with global power quality standards and demanding grid codes.

The rise of non-linear and other challenging loads as well as sensitive operations present unique network power quality challenges. Stricter grid codes and power quality standards safeguard electrical system reliability for smooth industrial and commercial processes. Harmonic distortion, voltage variation, poor power factor and unbalanced load are key elements that test the reliability of modern electrical systems and induce overall greater system losses.

## Active Harmonic Filters

Apex Active Filters provide dynamic reactive power compensation and harmonic filtering. They provide an efficient solution for power quality applications in commercial and industrial facilities as well as in infrastructure.

Our design includes a state-of-the-art controller built on a modern 3-level IGBT-Inverter topology with a 7" touch-screen user interface and modular technical design. This combination results in a fast, reliable and compact device that is easy to operate and complies with all standard communication protocols.

### CUSTOMER BENEFITS

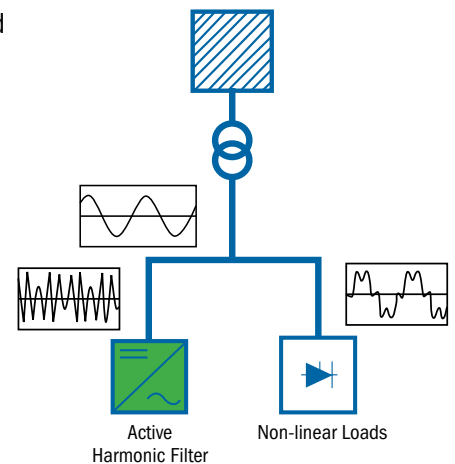
- **Energy savings**
- **Higher productivity**
- **Reliable plant operation at reduced maintenance costs**
- **Longer life for electrical & process equipment**
- **Create additional capacity in existing electrical network**
- **Quick return on investment**

### Excellent Harmonic Mitigation

Active harmonic filters connect parallel to loads. They sense the harmonic distortions created by non-linear loads in the network and provide effective real-time response to cancel the distortion. They also ensure compliance with the harmonic distortion limits specified in IEEE 519, G5/4, IEC 61000 3-2 and 3-4 and other power quality standards and recommendations.

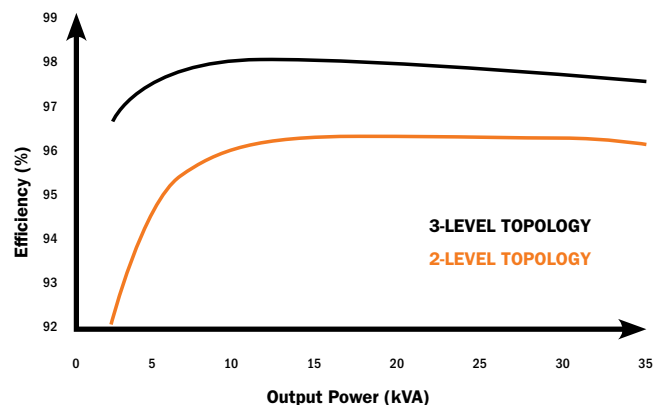
## Functions

Along with cancelling harmonic distortion, active harmonic filters solve several other power quality challenges. Our Selective Operation Mode allows you to tailor the functionality to specific performance levels. Easily configure power factor improvements by injecting fundamental reactive power. Unlike conventional technologies, our real time response ensures that reactive power feeds efficiently to fast fluctuating loads such as welding machines, cranes and more. It mitigates voltage variations and flicker. Even unbalanced loads in a 3-phase system, such as spot welding, can also be addressed.



### 3-Level Topology

Apex Active Filters feature a modern 3-level topology that provides several benefits over conventional 2-level filters. In 3-level topology, the switching frequency and voltage stress are distributed among the two IGBTs. Reduced stress extends the lifetime of the power electronics and achieves excellent efficiency and lower losses. These reduce the overall cost of ownership compared to conventional solutions.





## Compact Design For Ease of Integration

Apex Active Filters are extremely compact, which allows easy integration into variable speed drives (VFDs) or capacitor bank enclosures. Modules ship as stand-alone wall mounted designs with a NEMA 1 rating. We can deliver the filters in an enclosed version with a NEMA 1 or NEMA 12 rating.

### Automatic Voltage & Frequency Sensing and Smart Operation Mode

Our advanced features include automatic voltage and frequency sensing, which simplifies the order and delivery processes. A built-in Smart Operation Mode automatically turns off the IGBTs and fans under low load conditions, reducing operational losses and extending filter life.

### Unlimited Scalability

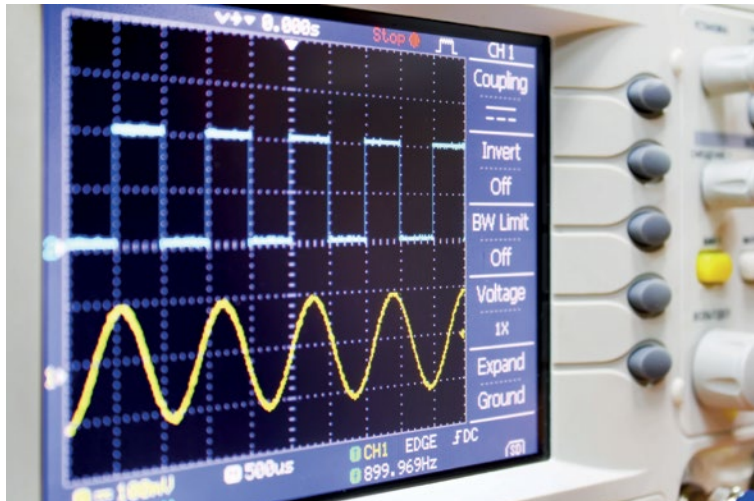
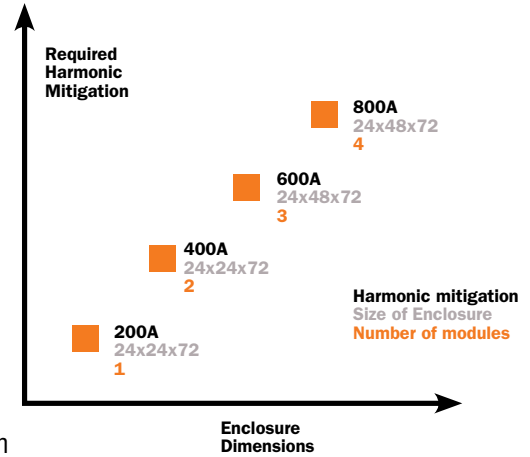
Apex Active Filters provide unlimited scalability, giving facility engineers flexibility to handle additional loads. In either open-loop or closed-loop connections, achieve higher harmonic compensation capacity by simply adding active harmonic filters modules in parallel. There are no technical limitations.

### Low Noise

Pollution comes in many forms. While harmonics pollute the power system, high audible noise disturbs people working in close proximity. Our filters with 3-level topology produce lower audible noise than other active filters. The design utilizes high switching frequency and special inductor core material. Apex filters can be installed spaces where silence is vital.

### Wide Range of Harmonic Mitigation Solutions

The system voltage range is 200V up to 480V, but with the use of a step down or step up transformer, the modules can work in lower or medium voltage applications.





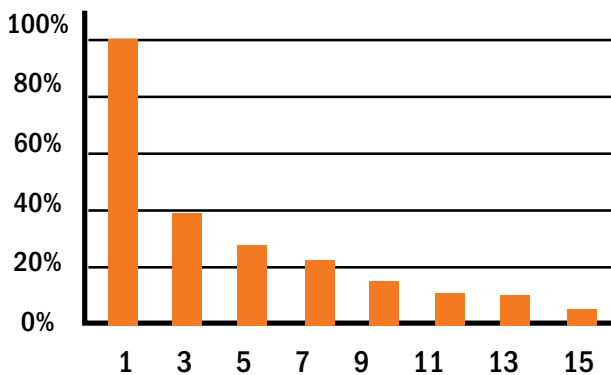
## Easy Commissioning

A sophisticated 7" Human Machine Interface (HMI) touchscreen is included with each Apex Active Filter. The built-in Commissioning Wizard makes device commissioning simple and hassle-free. When first connected to a network, the active filter automatically senses system voltage and the frequency. Then the Commissioning Wizard steps the user through each parameter for a successful activation.

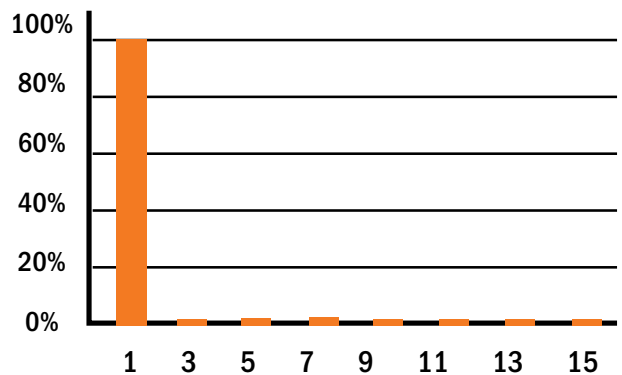
## Comprehensive Monitoring & Reporting

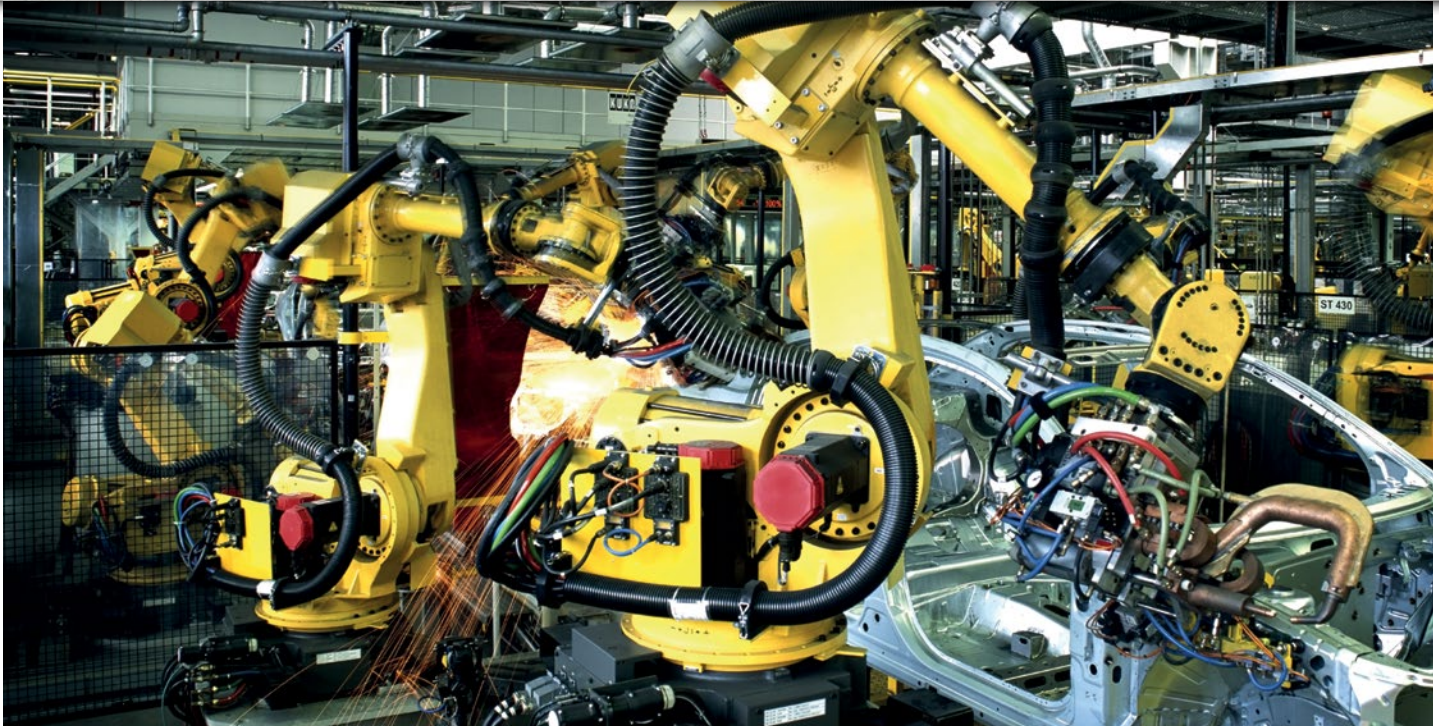
Advanced monitoring & reporting features include comprehensive 30-day power quality reports. Before and after analysis provides you harmonic distortion data from both supply and load sides. Even monitor and control your device remotely. SCADA systems connect to Apex filters via Modbus TCP. This opens up possibilities for Internet of Things (IoT) applications.

**Harmonic spectrum before active filter**



**Harmonic spectrum AFTER active filter**





## *Applications In Industries*

In manufacturing, Variable Frequency Drives (VFDs) are used extensively to save energy in motor control. However, they create a major source of network harmonic distortion. Apex filters provide quality power benefits to a variety of industries:

- Paper industry
- Food & beverage
- Automotive
- Oil & gas
- Chemicals
- Pharmaceuticals
- Textiles & clothing
- Steel mills
- Cement
- Microelectronics
- Any industrial process with AC or DC drives

## *Commercial Buildings*

In modern commercial buildings, the source of harmonic distortion is often equipment built with Switch Mode Power Supplies (SMPS) and Uninterrupted Power Supply (UPS) systems. Single-phase loads can cause triplen harmonics which accumulate in the neutral wire. 4W Apex Active Filter models cancel harmonics in neutral as well as in 3-phase.

- Data centers
- Hospitals and healthcare facilities
- Telecom facilities
- Airports
- Shopping centers
- Scientific laboratories
- Amusement parks
- Multi-family residential buildings
- Remote radar locations

## *Infrastructure*

Fans, pumps, compressors and other heavy loads in modern infrastructure are often controlled by VFDs to save energy. Harmonic distortion in these settings are significantly high, often exceeding the limits defined in global power quality standards. Apex Active Filters effectively bring distortion within desired limits and compliance.

- Water treatment plants
- District cooling plants
- Tunnels
- Commuter train stations
- Traction
- Wind & solar farms



## ***Voltage Variations Control Caused by Dynamic Loads***

Dynamic loads, such as welding machines and cranes, demand real time reactive power compensation to avoid voltage destabilization. Conventional power factor correction solutions fail to meet the needs in real-time. Apex Active Filters inject reactive power in real time to ensure stable voltage as well as remove voltage unbalance in the network.

## Stepless Dynamic Reactive Power Compensation

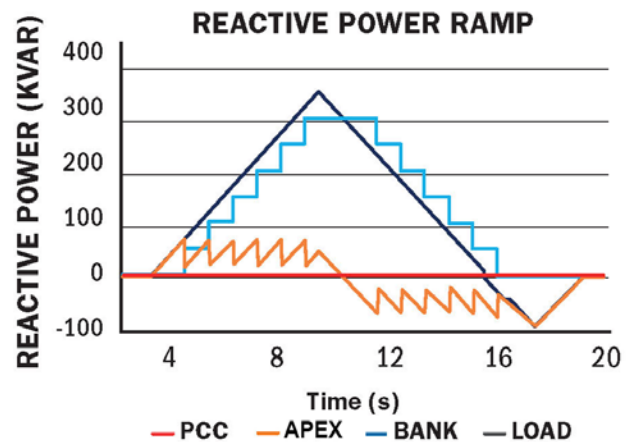
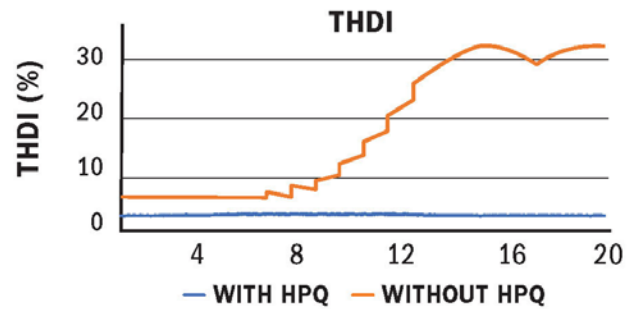
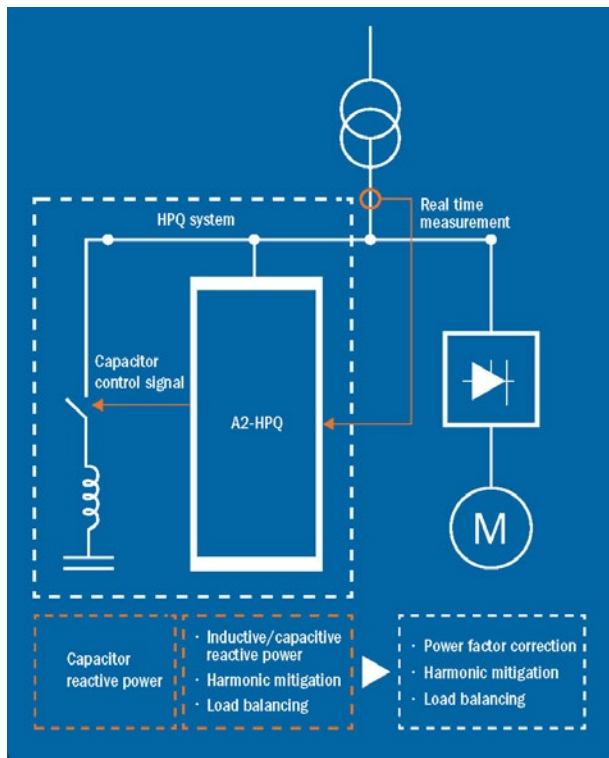
Apex Active Filters offer a unique upgrade option. The Hybrid Power Quality (HPQ) feature is a software extension which adds a capacitor bank controller to the active filter.

This controls the detuned capacitor steps to provide most of the capacitive reactive power needs, while the combined module fine tunes the reactive power or leading power factor compensation. It allows the module to filter out harmonic currents and symmetrize any unbalanced loads in the system at the same time. Each HPQ-upgraded Apex Active Filter can control up to 6 individual capacitor steps. By adding modules, the HPQ system can always maintain the target power factor through the achieved stepless reactive power control.

With stepless reactive power control and thyristor switched capacitors, the HPQ upgraded filter can always maintain the target power factor. It provides an ideal solution to compensate loads, which require both dynamic reactive power and harmonics compensation, such as DC drives in heavy lifting equipment or rolling mills.

### The HPQ ultimate all-in-one solution provides:

- Stepless power factor correction
- Harmonic Mitigation
- Unbalance correction
- Leading power factor compensation
- 1:1 step ratio
- 6 steps/module





# ACTIVE HARMONIC FILTER

## Technical Specifications

TYPE	APEX-50	APEX-100	APEX-150	APEX-200
Normal Current Capacity	50-A	100-A	150-A	200-A
<b>ELECTRICAL RATINGS</b>				
Nominal Voltage	3W: 200VAC - 480 VAC, 4W: 200 - 400 VAC			
Rated Frequency	50/60 Hz (Auto Frequency Sensing)			
Max Neutral Wire Current	150-A	300-A	450-A	600-A
Network (3-wire / 4-wire)	3W / 4W			
<b>SYSTEM FEATURES</b>				
Response Time	Reaction time <50 us / Response time <100 us (1x network cycle in selectable mode)			
Inverter Topology	3-level NPC topology			
Switching Frequency	20 kHz			
Controller	Real time digital control with FFT + Each module has independent controller. In case of parallel modules installation, the failure of one module would not interrupt the operation of remain modules.			
Harmonics Filtering	2nd to 50th harmonics. Fully selectable and programmable up to 25th harmonic order in "selectable" mode (standard deliveries).			
Filtering Performance	Typically, <5% THDi even with most complex loads.			
Load Balancing Capacity	Programmable 0...100 % * IN of the module			
PF Correction Capacity	Programmable 0...100 % * IN of the module (lagging/leading)			
Operation Modes	All harmonics / All harmonics but not fundamental / Selectable harmonics			
Smart Operation Modes	AutoStart, AutoAck, Stand-by			
Parallel Modules	Unlimited scalability. Load is shared evenly between parallel modules			
Certifications	CE, UL, RoHS 2			
<b>CONNECTIONS</b>				
CT-locations	Network / load side			
Minimum CT accuracy class	1.0 or better			
CT-primary/secondary	Primary: no limitations. Secondary: Load currents: 1A/5A, auxiliary currents: 5A.			
Digital Inputs	5 pcs potential free programmable ports. 3 pcs operational inputs selectable from the HMI in standard deliveries.			
Digital Outputs	6 pcs potential free programmable ports. 4 pcs operational outputs selectable from the HMI in standard deliveries.			
<b>INTERFACES AND HMI</b>				
HMI / Display	7" touch screen with multilingual graphical HMI			
Connections for HMI	1...7 module connections in one HMI. Unlimited number of HMIs			
Communication Capability	Ethernet, USB, Modbus TCP/IP			
Software Update	Ethernet/USB-drive			
Monitoring and Reporting	On-site & remote monitoring capabilities. Waveforms & spectrums from both load & network sides. Diagnostic services			
<b>MECHANICAL FEATURES</b>				
Protection Degree	Pollution degree 2 / Conformal coating on all PCBAs			
Enclosure Material	Galvanised steel			
Cooling Method	Forced air by temperature-controlled fans			
Losses	<2.3%			<2.5%
Typical Noise at Full Load	60 db	64 db	67 db	68 db
Dimension (WxDxH)	8.85 x 19.68 x 33.46 inches		8.85 x 19.68 x 45.27 inches	
Weight	155 lbs	155 lbs	243 lbs	243 lbs
<b>INSTALLATION AND OPERATION</b>				
Temperature	5-40° C, without derating. Max ambient temperature 50° C			
Altitude Without Derating	<1000 m, without derating			
Humidity	Maximum 85% RH, non-condensing (operation) + Maximum 95% RH, non-condensing (storage)			
Main Cable Entry	Top / Bottom			



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