

# Active Harmonic Filter

## Reactive Power and Harmonic Compensation

# Boddingtons Power Controls

## ACTIVE HARMONIC FILTER

### Product Highlights

- Dramatically improves power quality
- Reduces over loading of cable, motors and transformers
- Injects equal and opposite Harmonic currents from 3<sup>rd</sup> – 31<sup>st</sup>
- Enables compliance with G5/4
- 25 – 200A ratings 3 and 4 wire
- Voltage ratings 208 – 480 – 50/60Hz
- Straightforward installation as retro-fit with minimal down time
- Reduces THD to less than 5% to meet stringent IEEE 519 and G5/4 Standards
- Most types available on approx 4 week delivery

### Harmonic Problems

With the increased presence of electronics on power distribution systems, disruptive anomalies are created, and harmonics can become a problem. Some equipment that can be large contributors to harmonics are:

- Fluorescent lamps
- Computers and peripherals
- Welding machines
- Uninterruptible power supplies (UPS)
- AC/DC variable speed drives
- Frequency converters
- DC Power Systems/Chargers

BPC has taken traditional “passive” harmonic filtering equipment to a new level – an active based harmonic filter technology.

### Product Highlights

Active harmonic filters use power electronics to monitor the nonlinear load and dynamically correct every harmonic order from the 3<sup>rd</sup> to 31<sup>st</sup>. Additionally, this product has been performance tested to the 51<sup>st</sup> harmonic order, and will operate in a resonance condition, maintaining consistent, maximum performance. By injecting a compensating current into the load, the sine wave is restored, and distortion is dramatically reduced to less than 5% THD, to meet stringent IEEE 519 Standards.



The high speed process cancels high frequency output current, while it ultimately determines the precise value of injected load current. BPCs power electronics platform has been designed to operate at levels that continuously adapt to rapid load fluctuations. With its efficient operation and small physical size, it is ideal for a wide variety of industrial and commercial environments.

### Why this Harmonic Filter is a Better Choice

With other harmonic mitigation solutions, expensive and time-consuming site data collection, power quality surveys and computer generated studies are usually needed. Most harmonic filters are designed to accommodate just one or a few harmonic orders. The Active Harmonic Filter corrects a full range of harmonic order, and will not create a resonance condition with other existing equipment, so only minimal up-front analysis is required. This product can be Easily and conveniently added in parallel with other active filters, to accommodate future facility expansions or equipment additions. Virtually no time is lost for installation, supporting the important uptime operation of your facility.

The rating (size) of this Active Harmonic Filter is based on nonlinear load requirements (corrective current), not both linear and nonlinear, like traditional filter equipment. That means that you can install this product at a reduced ampere rating, which will lower initial capital costs.

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Inherent in this Active Harmonic Filter is the ability to correct a proportional amount of corrected power factor/reactive compensation. For applications where high levels of power factor correction are also necessary, Boddingtons Power Controls can provide a “hybrid” system, which integrates active filters with our traditional power factor correction modules, providing the highest level of system efficiency.

A door mounted LCD graphic multifunctional display with 8 function keypad means easy operation and maintenance programming of the active filter, along with waveform data, spectrum data (up to the 31<sup>st</sup> order), system management and networking capability. The controller allows for global (all harmonic orders) or selectable (specific harmonic orders) or selectable (specific harmonic orders) and settable bar correction for maximum flexibility.

BPC products are available as stand alone systems, or they can be integrated with other power quality and power distribution equipment, including motor control centres. Application engineered designs and higher ampere ratings can be easily accommodated. Where the neutral connection presents a harmonic concern, a 4 wire product be used, eliminating the need for another installed device.

Harmonic mitigation increases electrical capacity and stabilizes the electrical system, while power factor correction increases power efficiency and reduces electric utility costs.

### Active Filtering and Power Generation

Installing an active harmonic filter can benefit on-site power, emergency power, and distributed generation/energy. Technologies such as reciprocating (diesel and natural gas) engine-generators, microturbines, fuel cells, solar/photovoltaics, and wind turbines can have improved system performance and reliability, especially during start up and load transfers. In addition, BPC Active Harmonic Filters will alleviate problematic, disruptive and potentially damaging harmonics from the total load or distribution system. This product performs the same, regardless of impedance, and regardless of using the AC line, on-site power, or even the output of a UPS or flywheel. When power factor correction capacitors are incorporated, size requirements may be reduced, saving up front costs.

Newer technologies use power electronics for system operation and control. Though efficient in and of themselves, these devices are the primary cause of harmonics produced in an electrical system. This Active Harmonic Filter helps assure continuous power, especially where energy and efficient power delivery is critical.

BPC products can further enhance your power quality solutions with bundled packages including voltage regulation, surge/sag, ride-through, uninterruptible power (UPS) and power factor / harmonic correction.

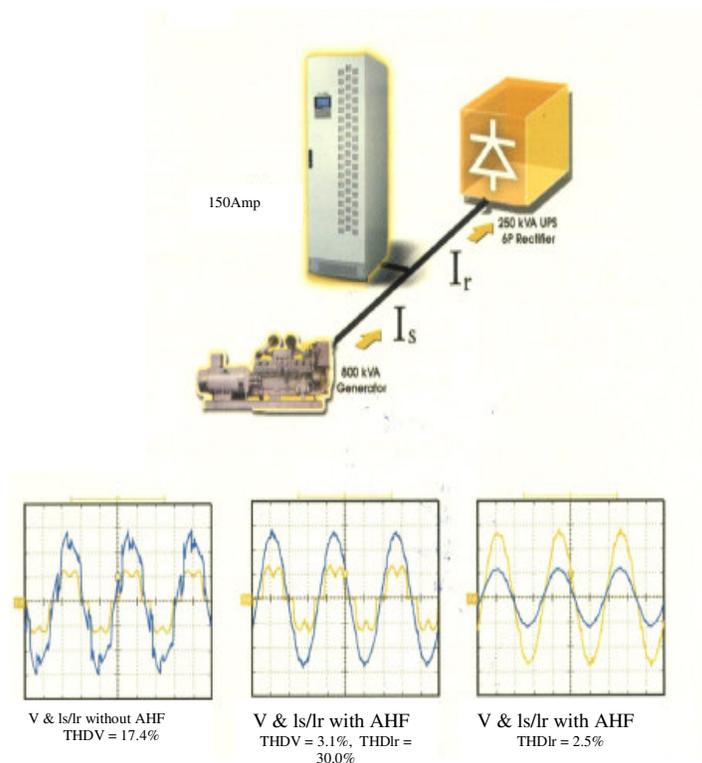
### A Real Solution

This Active Harmonic Filter behaves like a harmonics current generator. It measures the harmonics generated from a nonlinear load and cancels the harmonics with a newly generated, opposite phase shifted harmonic current of the same amplitude (AC/DC/AC). This allows it to:

- Eliminate all harmonic currents from nonlinear loads
- Compensate reactive power factor of lagging loads
- Act as a damping resistor to prevent harmonic resonance

### Example of Active Harmonic Filtering

A large 3 phase UPS with a 6 pulse rectifier creates heavy harmonic feedback of 30 – 40% THD into Mains or an emergency generator. It can cause voltage distortion or generator malfunction. The BPC Active Harmonic Filter is designed to work with the UPS and mitigates harmonics to less than 5%.

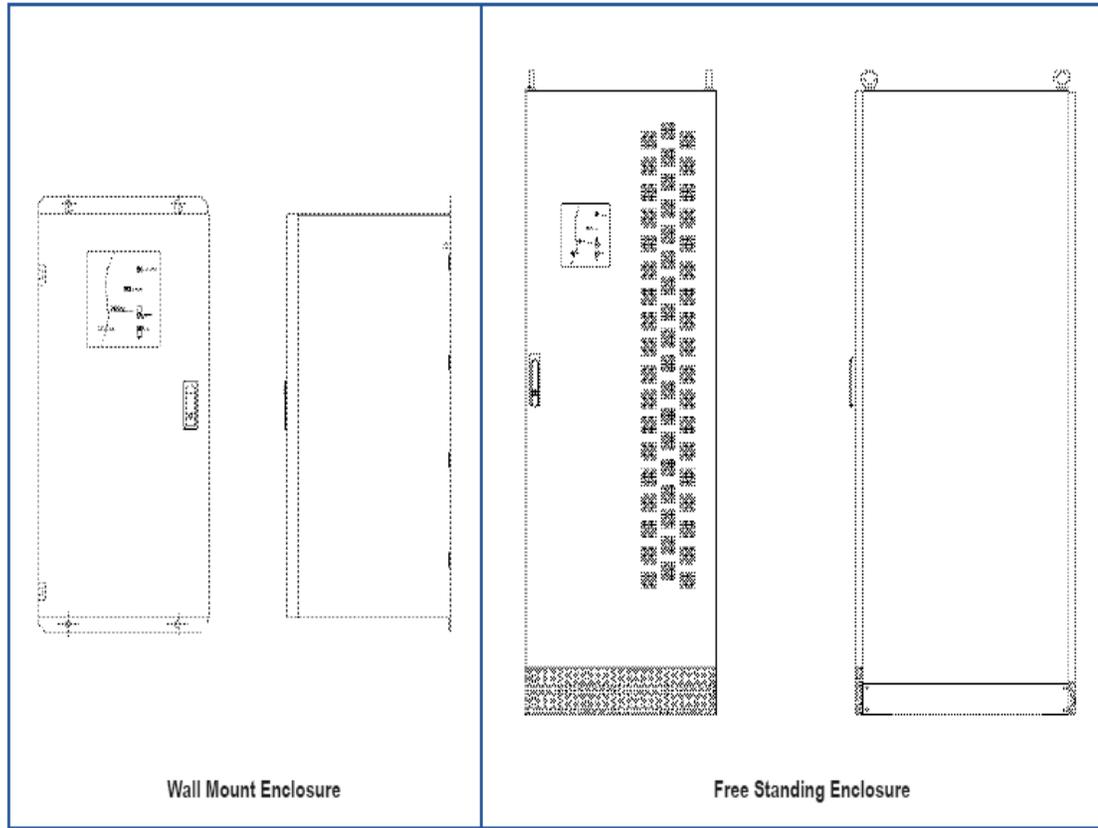


## Reactive Power (KVAR)

Voltage	AF-0025	AF-0050	AF-0100	AF-0150	AF-0200
208V	2.9	5.8	11.6	17.3	23.1
220V	3.2	6.5	13.0	19.4	25.9
380V	9.9	19.7	39.5	59.2	79.0
480V	15.6	31.3	62.5	93.8	124.8

## Nominal Reactive Current (Amperes) at 60 Hz

Voltage	AF-0025	AF-0050	AF-0100	AF-0150	AF-0200
208V	8	16	32	48	64
220V	8.5	17	34	51	68
380V	15	30	60	90	120
480V	18.8	37.4	75	113	150



Mechanical Specifications	Ampere Rating				
	25 Amp AF-0025	50 Amp AF-0050	100 Amp AF-0100	150 Amp AF-0150	200 Amp AF-0200
Operating Temperature (Fahrenheit)	+32° F to +104° F				
Equipment Storage Temperature	-4° F to 158° F				
Operating Altitude	< 3281 Ft.				
Operating Relative Humidity	< 95% non-condensing				
Weight (lbs) Wall Mount	121	154	NA	NA	NA
Weight (lbs) FreeStanding	NA	NA	595	661	1,190

Enclosure Dimensions (Inches)			
<b>Wall Mount Enclosures</b>			
NEMA 1	H	W	D
25/50 Amp (3 Wire)	34.65	16.14	15.35
25/50 Amp (4 Wire)	36.22	19.29	15.75
<b>Free Standing Enclosures</b>			
NEMA 1	H	W	D
100/150 Amp (3 Wire)	75.98	23.62	31.89
100/150 Amp (4 Wire)	75.98	27.56	31.89
200 Amp (3 Wire)	75.98	47.24	31.89
200 Amp (4 Wire)	75.98	55.12	31.89

Specifications	Ampere Rating				
	25 A	50A	100A	150A	200A
<b>General Specifications</b>					
Controller	Digital DSP Design (Global, Selectable)				
Switching Speed	20 kHz				
Loss of Power	Configurable Restart				
Overload	Units Cannot Be Overloaded				
Cooling	Fan Cooled				
Units used in Parallel	Up to 6 units can be used in Parallel				
Communications	RS232 (standard), RS422, RS485, RJ45, USB, TCP/IP (optional)				
Soft Start	10 sec				
Heat-losses	550W	950W	2000W	3000W	4100W
Audible Noise from 1 meter	60 dBA	60 dBA	63 dBA	63 dBA	65 dBA
Filter Performance	3rd to 51st Order				
<b>Electrical Specifications</b>					
Line Voltage	208 - 480 V +/- 15% (step-up transformer for higher voltages)				
System Frequency	50/60 Hz, +/- 3 Hz				
Phase/Wires	3 Phase 3 wires or 3 phase 4 wires				
Compensating Current in Phase	25 Arms	50 Arms	100 Arms	150 Arms	200 Arms
Compensating Current in Neutral (4 wire)	75 Arms	150 Arms	300 Arms	450 Arms	600 Arms
Steady State Response	<40 ms detection time at 100% step load				
Control Topology	Fully digital with DFT ( <i>discrete fourier transform</i> ) algorithm 3-wire (Response Time <20 ms)				
Inrush Current	Less than rated current				
Current Limitation	At full correcting				
Input Fuses	200 kaic protection, class J				
Disconnect Switch	Use of external device, review local NEC				
Current Transformers (Standard)	2,000 : 1, 20 va, 400 hz				
<b>Standards</b>					
Safety	UL508 / EN50178				
EMI	FCC Part 15 / EN55011				
Surge Immunity	ANSI C62.41, IEEE587 / EN61000-4-5				
Harmonic Guidelines	IEEE519-1992 / EN61000-3-4				
Enclosure	NEMA 1 (IP20) 14 gauge steel with textured gray finish (NEMA 12 / 3R optional)				

