HUAKUN – ACTIVE HARMONIC FILTER–AHF

What is Active Harmonic Filter?

Active harmonic filters (AHF)/Active Power filter(APF) are typically stand-alone devices that reduce the high levels of harmonics produced by energy efficient non-linear loads. They work by injecting harmonics into the electrical system in equal and opposite measure to the existing system harmonics.

As previously mentioned, harmonic filters are used to eliminate harmonic distortion caused by excess currents in and out of appliances. It can prevent large quantities of harmonics from causing damage to equipment, downtime of operation, and preventing an increase in operating costs.

Impact of Harmonic

1.Grid side

- Reduction in efficiency of power generation, transmission, and utilization.
- Aging of the installed electrical plant components and shortening of their useful life.
- Reduced ability to transfer power (kW) through existing T&D infrastructure and transformers.
- Overloading, overheating and failure of power factor correction capacitors, distribution transformers and neutral conductors.
- T&D capability in many parts of India has to be de-rated by upto 10% due to increasing level of harmonics generated from consumer side of meter.
- Harmonics result in capacity reduction and higher fuel consumption for DG Sets or Captive Power Plants.

Impact of Harmonic

2.Customer side

- Overheating of transformers, motors and cables.
- Reduction in available capacity of transformers and switchgear.
- Excess neutral currents.
- Power factor capacitor failures.
- Spurious operations of fuses, circuit-breakers and other protective equipment.
- Increased failure of electronic devices.
- Capacity limits on stand-by generators and UPS systems.
- Higher losses in transformers, motors, cables leading to higher power bills.

Impact of Harmonic

3.Power factor

The true power factor is the product of displacement & distortion power factor . If the harmonic distortion in more in the system, then the true power factor cannot be improved with just power factor correction capacitors. This can result in power factor penalties, loss of power factor incentives and higher electricity billing in locations with KVAh billing.

Why Improved Power Factor?

When the power factor is below 1.0 or unity, the electrical efficiency of the system decreases forcing the utility to supply more apparent power than necessary.

Utilities can pass on the resulting costs to the industrial users as power factor penalties and high utility bills.

Issues caused by low power factor may include:

- Poor system performance.
- High energy costs.
- Electric surcharges.
- Harmful environmental impacts.
- The cost of poor Power Quality has a much greater impact than just on the electricity bill.

Why Improved Power Quality?

Power Quality can have a direct impact on overall performance, a fact often overlooked by many companies. The fast and effective response of Active Harmonic Filters to the negative aspects of power quality can improve process reliability, extend equipment life, reduce energy costs by targeting system losses, and increased up-time can improve productivity. So much more than simply complying with legislation, standards and grid codes.

The exponential increase in non-linear and other polluting loads in modern electrical networks presents a varying set of power quality challenges. Operations sensitive to power supply quality, challenging and shock loads, and weak supply connections result in more demanding grid codes and power quality standards to safeguard the reliability of electrical systems for both industrial and commercial processes.

Harmonic distortion, voltage variation, poor power factor and load imbalance are the most commonly observed issues which not only impact on the cost of energy, but can result in equipment mal operational, even failure.

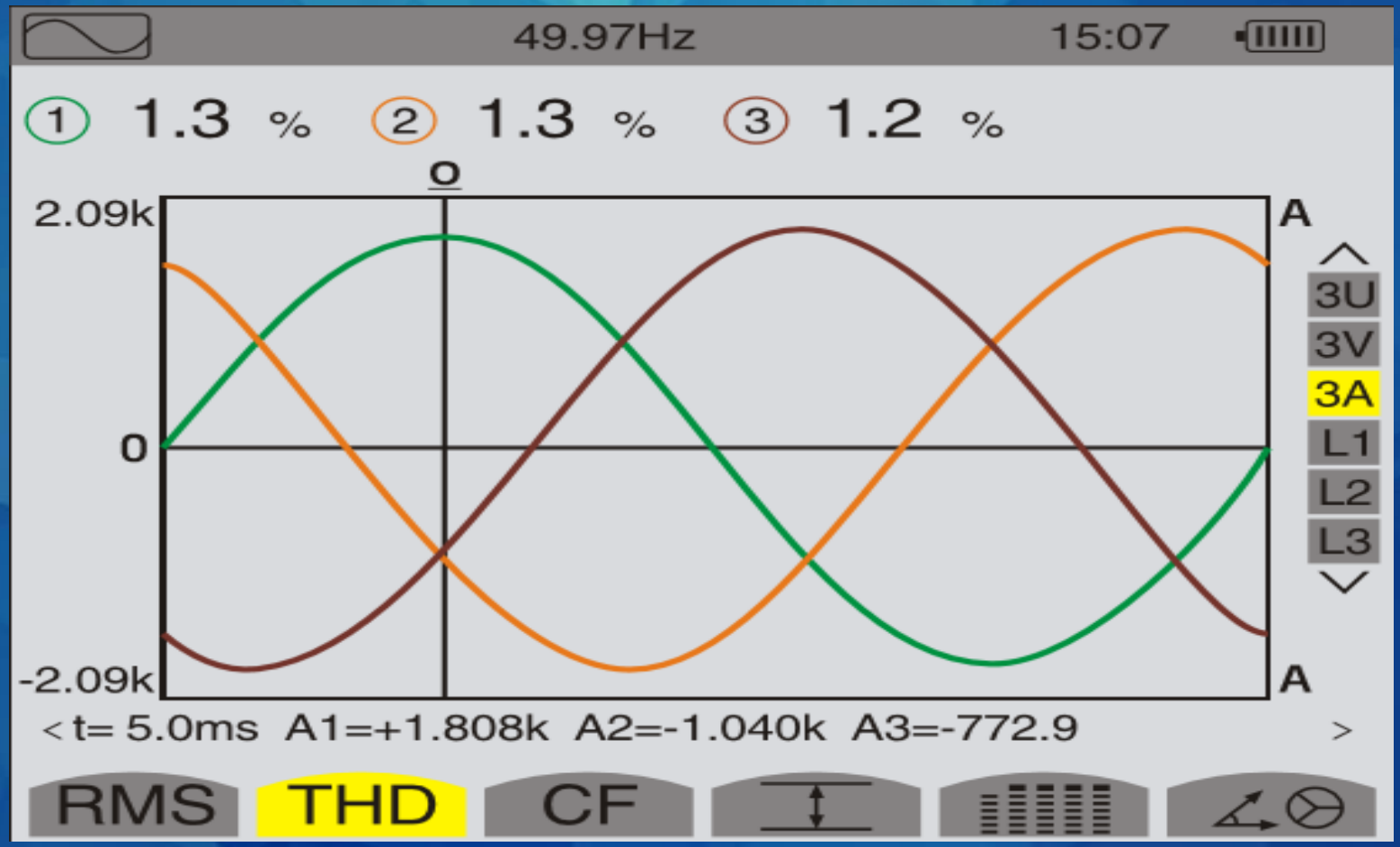
Benefits of installing an Active Harmonic Filter

- Prevention of breakdown and equipment failure
- Maximum utilization of installation capacity
- Improvement of energy efficiency
- Securement of reliability and continuity
- Reduction of service and maintenance costs
- Prevention/reduction of unnecessary energy losses
- Increased safety by reducing fire risk

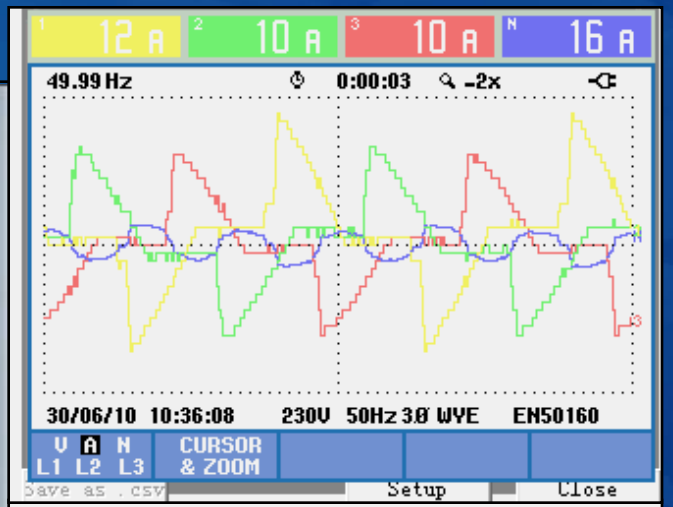
Key Benefits to the User

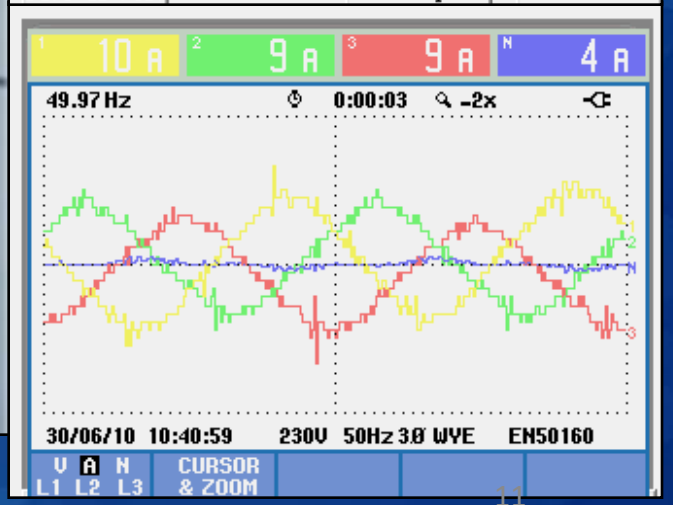
- Close to pure sinusoidal plant current (enhanced power quality).
- Compliance to power quality standards (no harmonics penalty).
- Unity power factor operation (saving in electricity bill as per the state board tariff/schemes).
- Reduced energy losses with improved plant efficiency.
- Reduced plant down times from the nuisance tripping due to harmonics.
- Improved plant equipment life.
- The restored ability of existing electrical infrastructure to operate at full-load capacity.

Meet the requirements of perfect power quality: THDi<5%



During the test period, the voltage distortion rate (THDu) decreased from 1.6% to 1.0%, the current distortion rate (THD1i)decreased from 18% to 3%, and the total harmonic current decreasedfrom 59A to 12A, which effectively suppressed the low voltage distribution. Harmonic pollution in the power system improves the safety and reliability of the power distribution system, and provides a clean and reliable power supply environment for radio, film and television operations

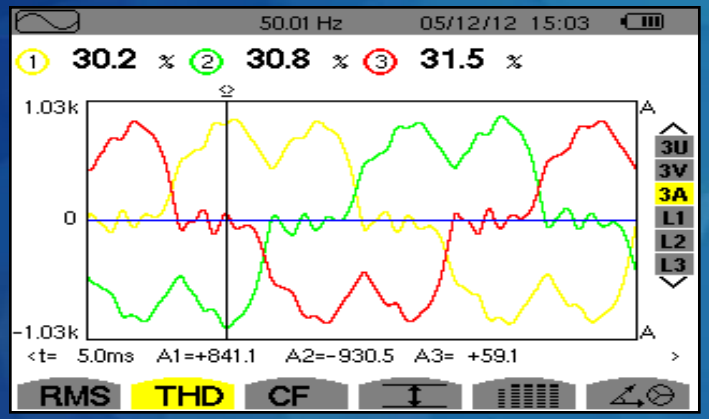


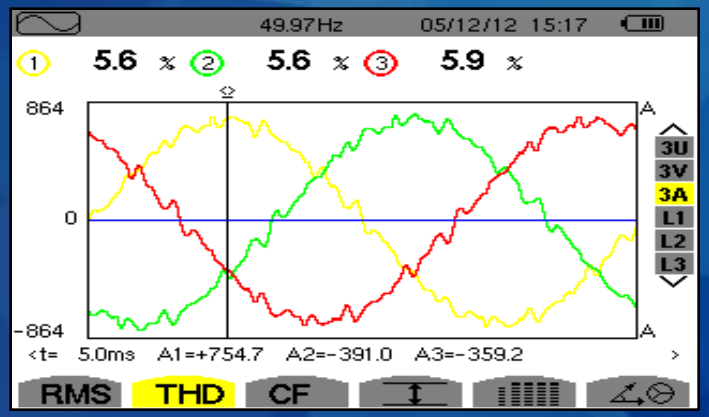


Radio, Film and Television Center harmonic control project

After the Huakun Active Filter (APF) is installed, the power quality of the transformers managed meet the requirements of THDU and THDI in GB/T14549-93. The healthier power quality ensures that the equipment in the Dabancheng wind power plant area in Urumqi is free from the pollution and harm of harmonic voltage.

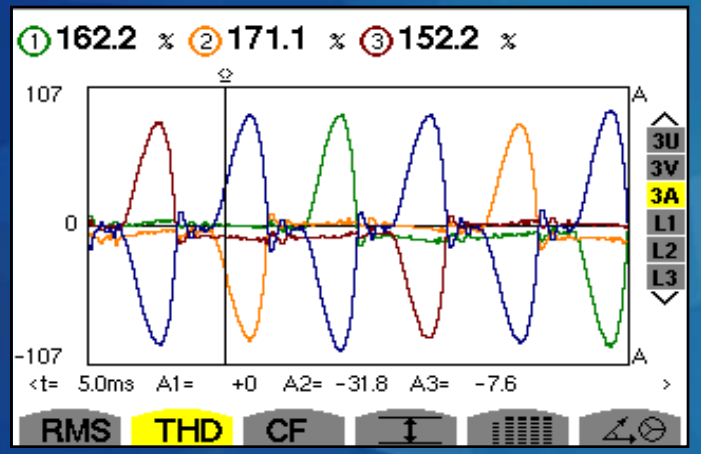
Wind Power Factor Harmonic Control

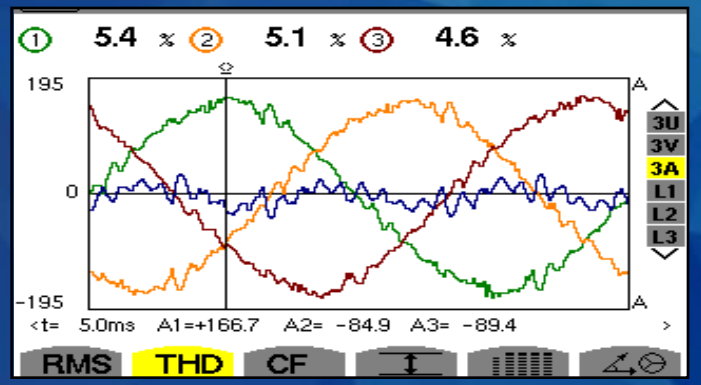




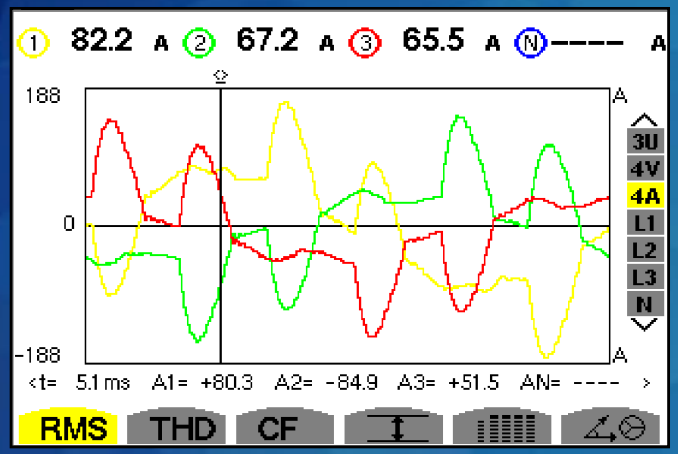
The APF indicates from the figure that the system Di is around 160% when the APF is turned off from the power supply. The APF causes us to drop the THDi to about 5%. When the APF is off, the system line current is about TH of the phase line. After the APF, the system can maintain the line current at After the APF, the system can perfectly control the power quality problems caused by the machine tool factory with the line current APF.

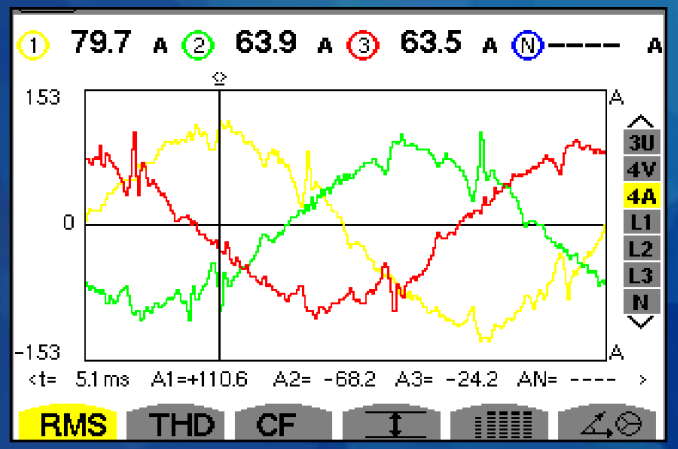
Harmonic Control Project of Beijing First Machine Tool Plar





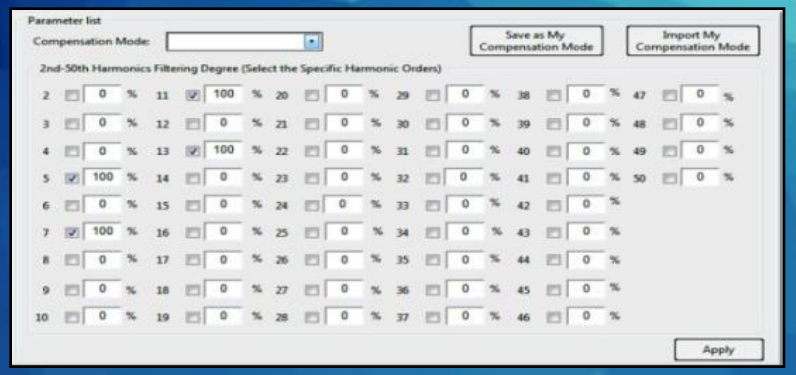
After the source filter is turned on, the waveforms are close to the standard sine wave, especially the current waveform,which is compensated from the very distorted waveform to a relatively regular sine wave. The number oftimes is mainly 5th, 7th, 11th, 13th, 17th, and 19th. After compensation, the harmonic current content is significantly reduced to achieve a perfect compensation effect.



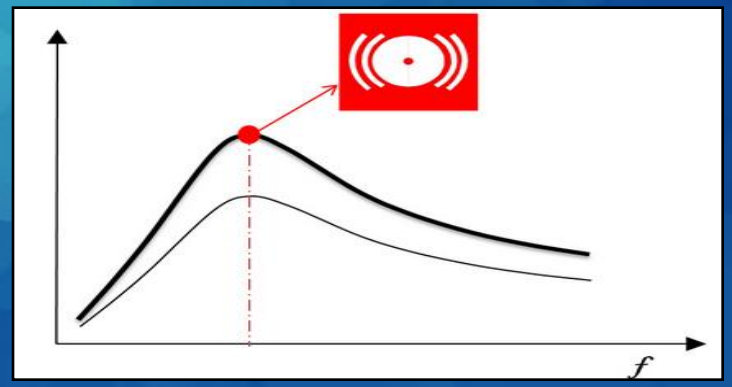


Taiwan AU Optronics Harmonic Control Project

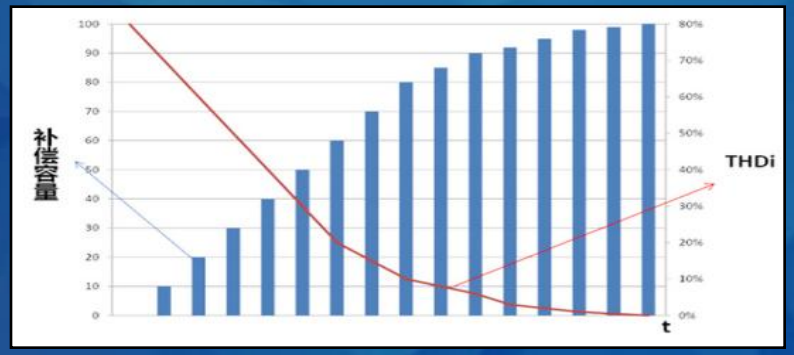
Multi-technology management system resonance



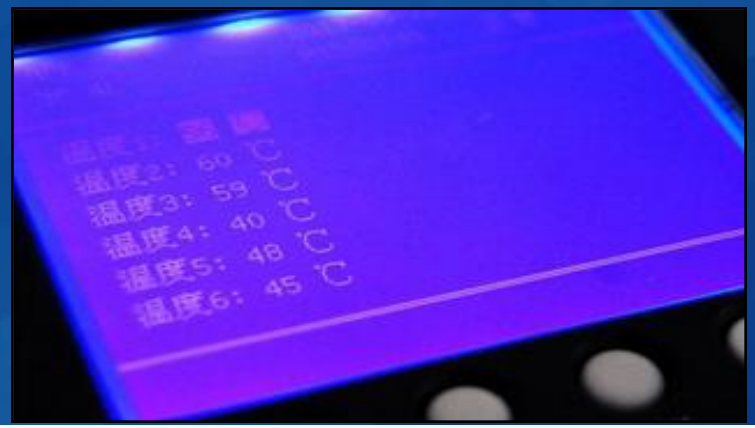
Adjustable compensation times and compensation rates:
Set specific harmonic compensation order/percentage



Smart Fourier Algorithm:
Self-learning and adaptive neural network for system impedance characteristics



Resonance monitoring:
Real-time monitoring of system impedance, once the system resonates, the active filter automatically stops compensation, and automatically re-compensates after the resonance is eliminated .



Temperature monitoring:
Temperature monitoring of IGBT and key components of heat generation

User Comfortable Human-Computer Interaction System

8 inch full-color centralized monitoring touch screen

4.3 inch full-color LCD touch screen

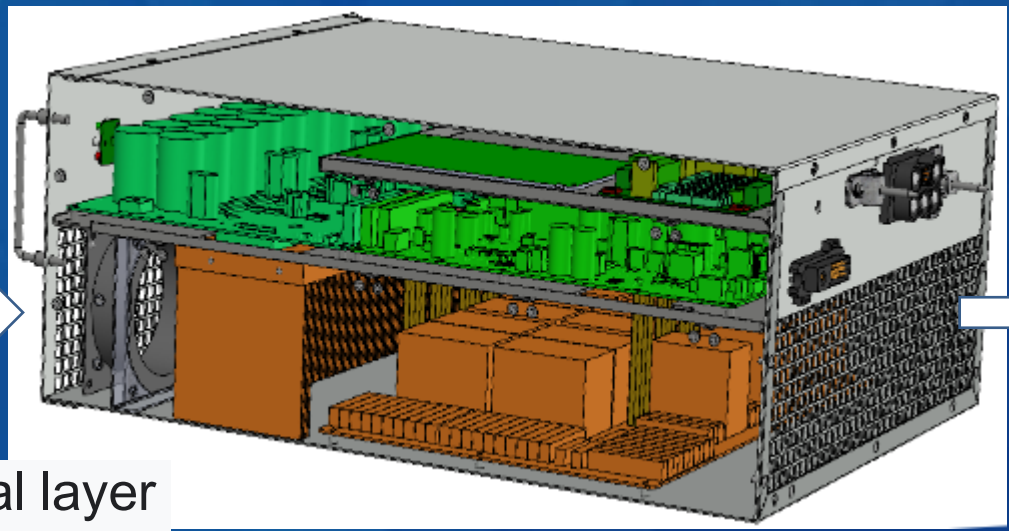
3.8inch LCD full color monitor

PC monitoring system

Independent air duct—maintenance-free design

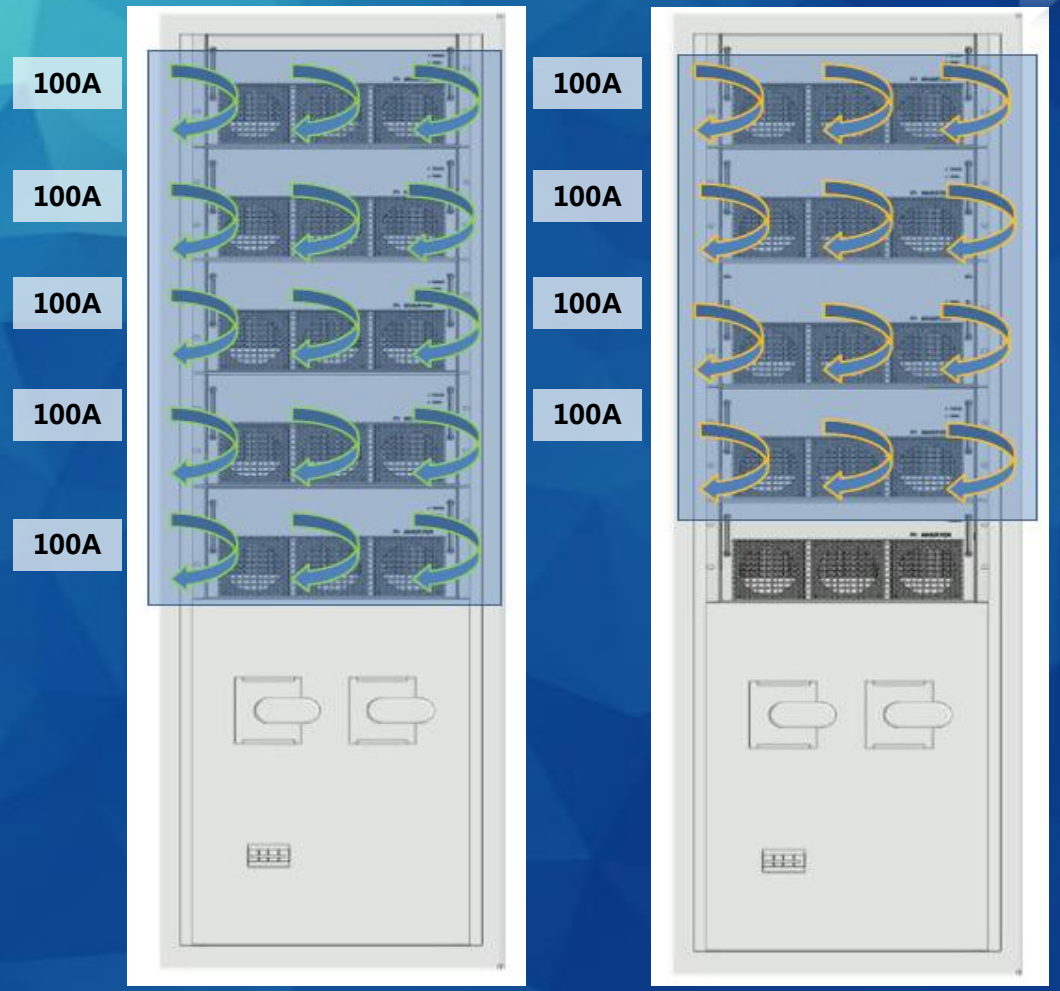
Independent air duct

- Dustproof
- heat dissipation
- waterproof fog



Modularity—ensuring system stability

- Each module has all functions and can run independently;
- Any problem with any module will not affect the work of other modules.



5 *100A modules total compensation for 500A harmonics

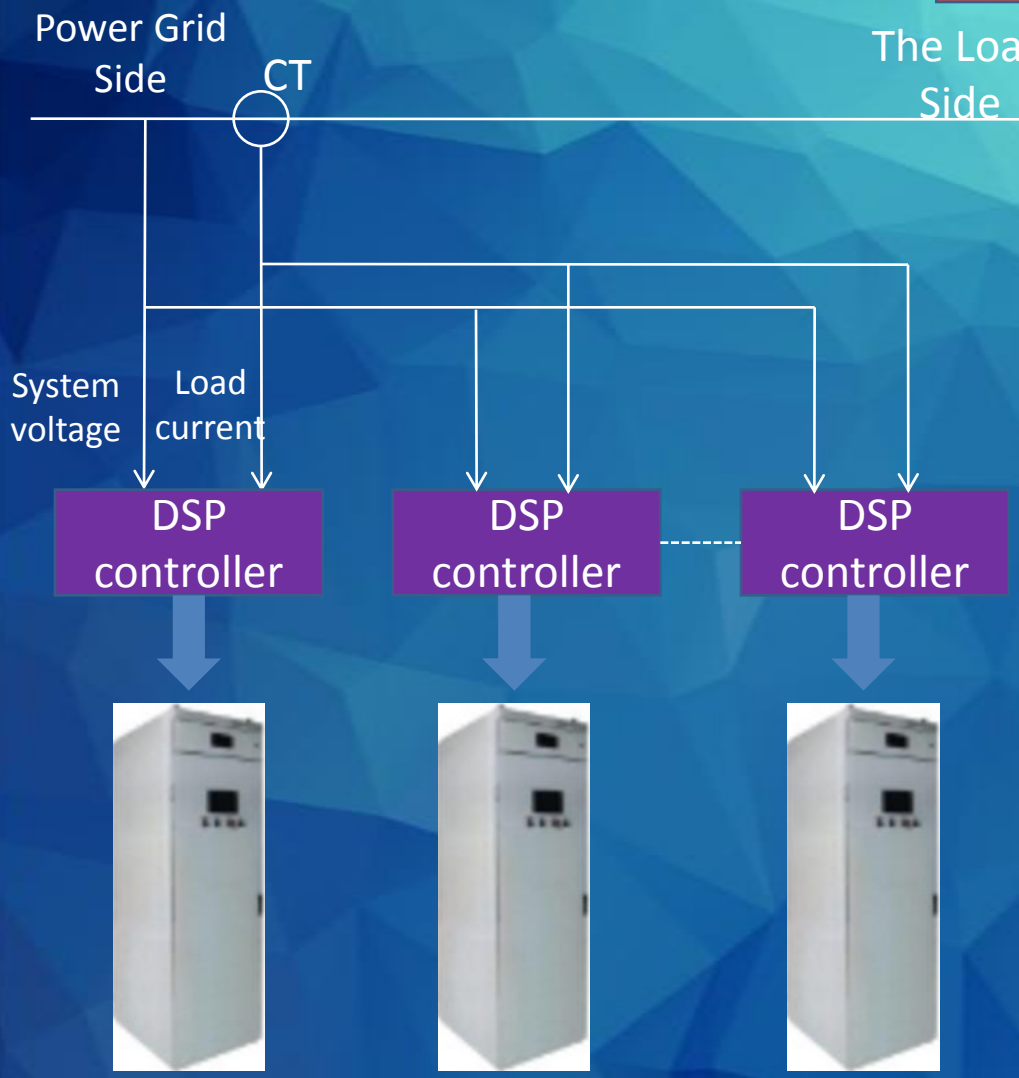
If a module fails, The other four modules still meet the 400A compensation capability

Modular - easy engineering management and product design

Easy to maintain later

Easy to install and transport

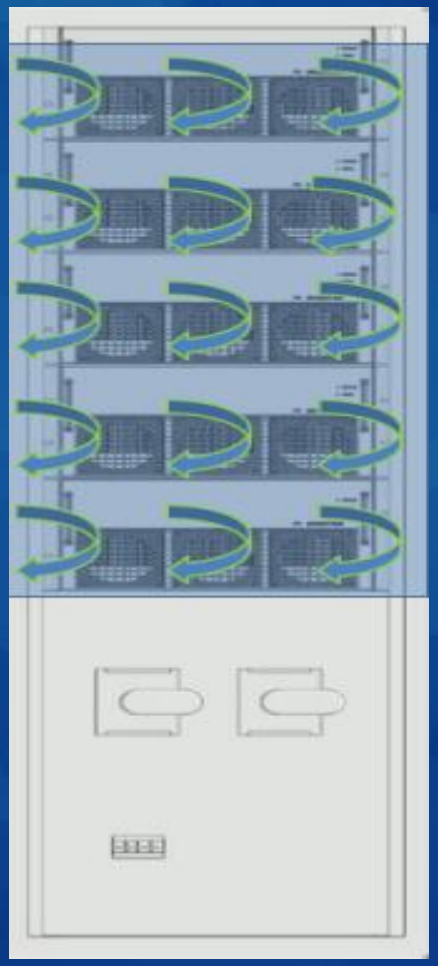
APF Cabinet Scheme



Common parallel methods

High reliability parallel mode:

Centralized control of the same controller, 12 devices can be connected in parallel and only one controller is used for centralized control, each power module has current output, and there is no circulating current between modules .



SHANGHAI HUAKUN METHOD

Parameters

Standard type	400V				480V	600V	690V
	35kvar	50kvar	75kvar	100kvar	90kvar	100kvar	120kvar
System parameters							
Rated input wire voltage	380V (-15%~+20%)				480V (20%~+20%)	600V (-20%~+20%)	690V(-30%~+15%)
Grid frequency	50/ 60Hz (range: 45Hz~63Hz)						
Number of parallel machines	1~10台						
Overall efficiency	≥97%				≥98%		
Grid structure	Three-phase three-wire/ three-phase four-wire				Three-phase three-wire		
Current transformer	150/5~10000/5						
Circuit topology	Tri-level						
Performance index							
Single module compensation capacity	35kvar	50kvar	75kvar	100kvar	90kvar	100kvar	120kvar
Response time	<15ms				<20ms		
Scope of compensation	From -1 to 1, capacitive and inductive continuity is adjustable						
Cooling mode	Intelligent air cooling						
Noise index	<56dB				<65dB		
Communication monitoring ability							
Communication interface	Rs485, internet access						
Communication protocol	Modbus Protocol, General Electric Protocol, TCP/ IP						
Fault alarm	Yes, up to 256 alarm records						
Monitoring mode	Support centralized monitoring and independent monitoring						
Mechanical characteristic							
Fixed mode	Rack type, wall-mounted type				Rack type		
Incoming line mode	Rack-type back-incoming line, wall-mounted up-incoming line				Back-incoming line		
Size (width × height × depth, mm3)	484×180×655.5	484×180×655.5	484×234×655.5	544×234×655.5	Under development		
Net weight per modul	33kg	33kg	40kg	47.5kg	—	—	—
Appearance color	National Standard 7035-Light Grey (Customizable)						
	National Standard 7035-Light Grey (Customizable)						
Altitude	<1500m, used in accordance with rated capacity; 1500-5000m, used according to GB/T 3859.2, reducing rated capacity by 1% for each increase of 100m.						
Operating temperature	-25~40℃						
Relative humidity	5% ~ 95%, no condensation						
Grade of protection	IP20						

Thanks