

01

**Ultra APF
Product Introduction**



1.1 Ultra APF Completes the Last Puzzle Piece of APF



iKonMac breaks through the barrier of the lack of a complete solution to power quality issues in weak grid environments. The independently developed Ultra APF series stable active power filters perfectly achieve the goal of jointly controlling current harmonics and voltage harmonics.

The Ultra APF series stable active power filters feature faster response times and can more accurately avoid resonance. The most prominent advantage is the ability to simultaneously control various unstable harmonics and stabilize the power grid.

Applicable Load Types



Heating Furnace Equipment



Medium Frequency Furnace Equipment



High Frequency Power Supply Equipment

1.2 Ultra APF Advantages

Advantages of Stable APF

- Simultaneously compensates for current distortion rate (THDi) and voltage distortion rate (THDv)
- Capable of mitigating interharmonics, even-order harmonics, transient harmonics, and other unstable harmonics
- Switching frequency can reach up to 80kHz
- Response time $\leq 1\text{ms}$



Challenges with Traditional APF

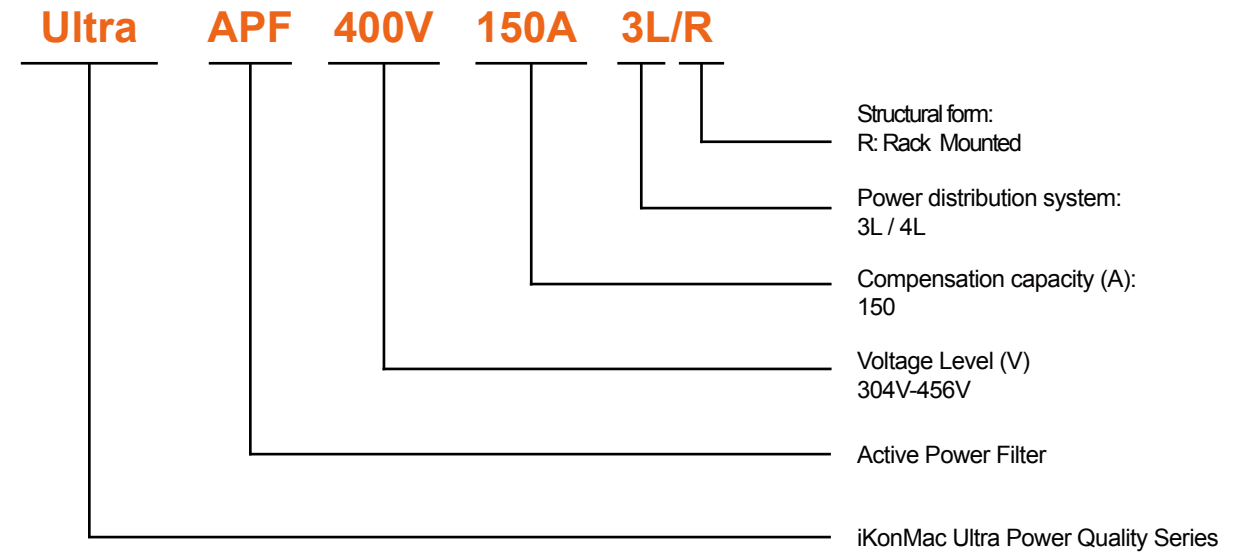


- Can only mitigate current harmonics, not voltage harmonics. In weak grid conditions, where the voltage distortion rate is generally high, traditional APF may fail to operate
- Cannot address complex harmonics such as interharmonics, even-order harmonics, or transient harmonics
- Susceptible to resonance issues

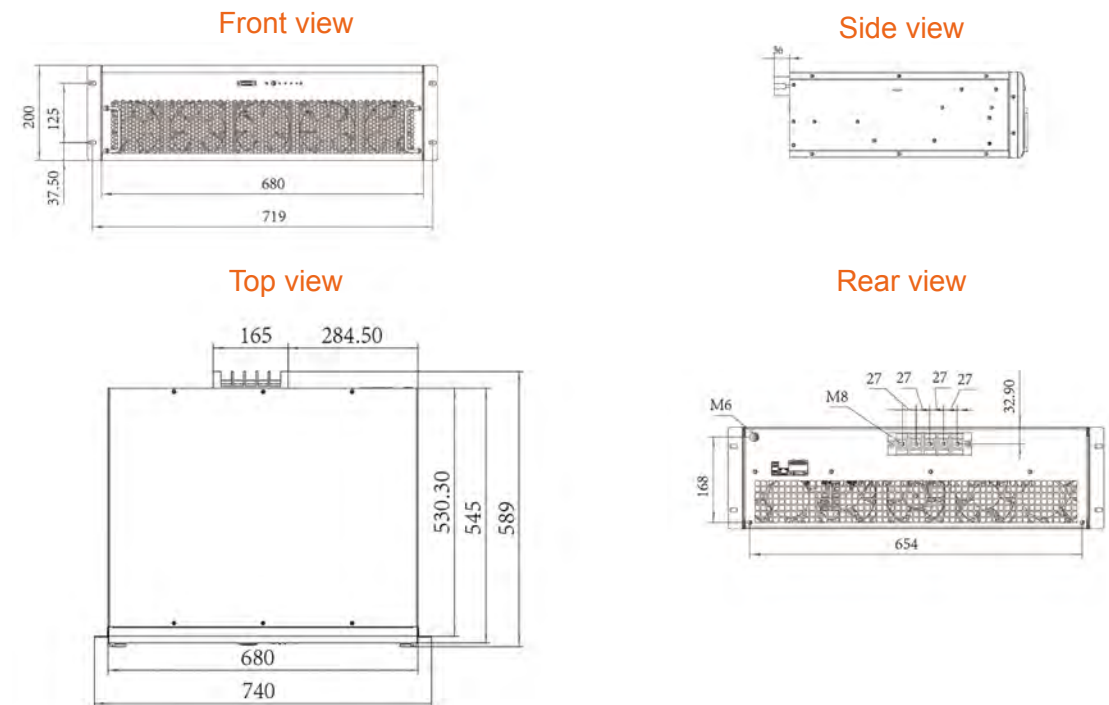
1.3 Ultra APF Technical Specifications

Category	Product	Indicators
Name	Product Series	Ultra Power Quality Series
Dimensions	Module Specifications	100A/150A
	Module Dimensions(W*H*D)	680*200*545
	Number of Parallels	12
	800*800*2200 Max Capacity Per Cabinet	750A
Input	Operating Voltage	(304V-456V)
	Operating Frequency	50Hz(±10%)
	Current Transformer	100 : 5 ~ 10000 : 5
Functions	Controller	100% Full FPGA, 16 CPUs parallel computation
	Harmonic Compensation	Harmonic Current: 2nd to 50th Order, Harmonic Voltage
	Harmonic Elimination Rate	>98% & THDi < 5%
	Switching Frequency	80kHz (5th Generation Infineon IGBT)
Communication Protocol	Communication Method	RS485, Modbus RTU, Wifi (Remote control debugging)
	Upper-Level Software	All parameters can be set via the upper-level software
	Fault Alarm	Up to 500 alarm messages can be recorded
	Monitoring	Supports independent monitoring of each module / centralized monitoring of the entire system
Technical Indicators	Response Time	≤1ms , instant response < 50us
	Active Power Loss	≤2%
	Cooling Method	Intelligent air cooling
	Noise	≤60dB
	Protection Functions	There are more than 20kinds of protection such as overvoltage, undervoltage, overheating, overcurrent, short circuit, etc
	CT Installation Location	Load Side
Mechanical Properties	Module Weight	38.5kg
	Color	7035 Fine orange texture spray painted
Environmental Requirements	Operating Temperature	-20°C~+55°C
	Altitude	<5000meters (More than 1000 meters, For every 100 meters of additional elevation, the power is reduced by 1%.)
	Relative Humidity	<95%, No condensation
	Protection Level	Module IP20 + Electronic Layer IP42 (Customizable IP54 or IP65)
	Pollution Resistance Level	Level 2 (Customizable level 3)

1.4 Ultra APF Model Description



1.5 Ultra APF Product Dimensions



1.6 Application in the Semiconductor Industry



Project Challenge

Dongni Electronics belongs to the semiconductor materials manufacturing industry, with its main load being crystal growth furnaces. During operation, a large amount of harmonics is generated. Multiple crystal growth furnaces cannot be used in parallel, resulting in serious voltage distortion. The load current increases, causing damage to components. Traditional APF cannot effectively solve the resonance issues and voltage harmonic problems in this project.

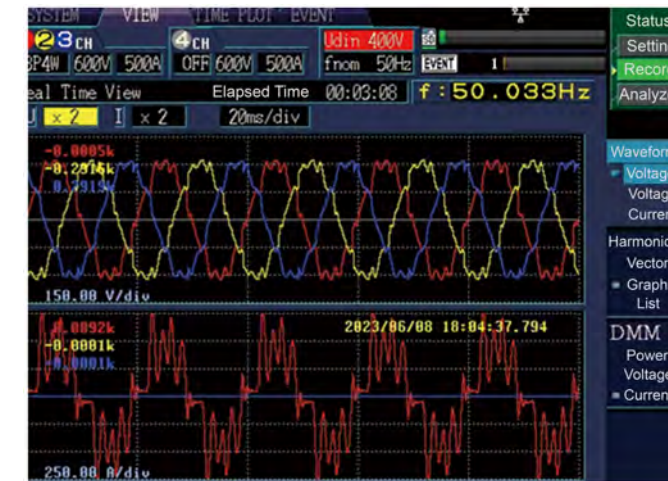
Solution



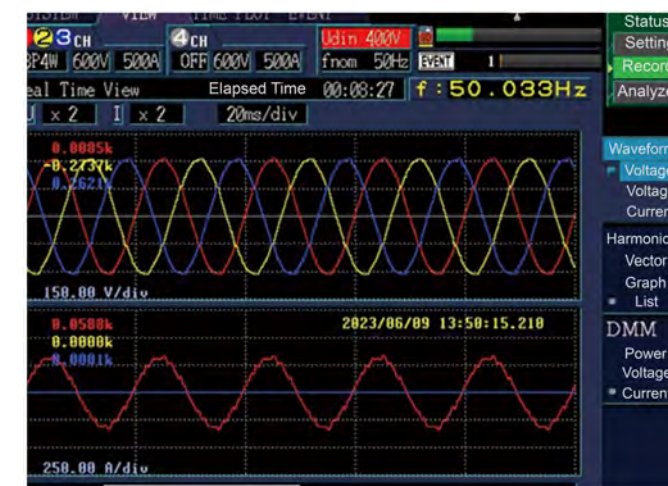
The crystal growth furnace is a high-frequency rectifier power source, which is unstable during operation and easily generates a large amount of voltage and current harmonics. iKonMac Technology solved the persistent voltage harmonic problem and also compensated for current harmonics by using the Ultra APF stable active power filter. The voltage distortion rate remained stable at less than 4%, and the current distortion rate stabilized at around 8%, effectively solving the complex harmonic issues on Dongni's site.

Before and After Treatment Comparison

Voltage Harmonic Distortion Rate
Decreased From **10.7%** to **2.3%**



Voltage waveform before treatment



Voltage waveform after treatment

1.7 Application in Suppressing Odd Harmonics

Project Challenge

In a rectifier power supply project in Qinghai, the power system had significant even-order harmonic current issues, particularly 2nd and 4th harmonic currents as high as 40A. Notably, the system's front-end power supply was an UPS (uninterruptible power supply). In this environment, using traditional Active Power Filters (APF) not only failed to effectively address the even-order harmonic issues, but also caused resonance between the APF and the UPS, further destabilizing the system. Therefore, a more suitable harmonic mitigation solution was needed to ensure the stable operation of the power system.

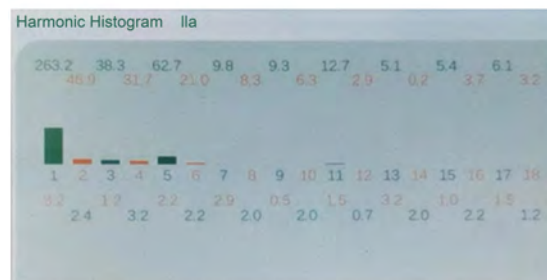
Project Solution

Unlike odd-order harmonics, even-order harmonics primarily arise from specific devices in the power system. These devices are typically non-linear loads, such as rectifiers, thyristors, and electric arc furnaces. When such non-linear loads are widely used in the power system, the even-order harmonic content significantly increases, posing a serious threat to the stability of the power system and the safe operation of equipment.

After installing the Ultra APF stable active power filter on the load side, the even-order harmonics were eliminated. The voltage distortion rate remained stable at around 1%, and the harmonic current distortion rate was significantly reduced from 34% to approximately 6%.

	A	B	C	N
Voltage U:	219.5V	221.4V	221.1V	
Distortion Rate THDu:	2.1%	2.3%	2.1%	
Current I:	286.4A	242.7A	287.4A	24.9A
Distortion Rate THDi:	34.7%	31.7%	27.6%	
Fundamental PF DPF:	0.75	0.85	0.90	
PF:	0.71	0.80	0.86	
Active Power:	44.3kW	43.2kW	54.6kW	
Reactive Power:	39.1kVar	26.8kVar	26.8kVar	
Apparent Power:	62.8kVA	53.6kVA	63.5kVA	

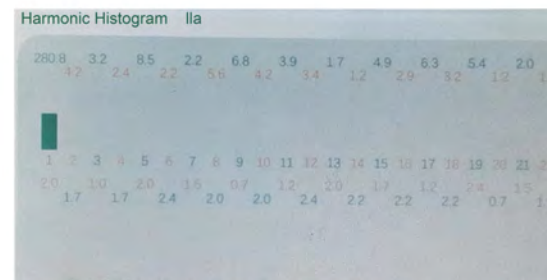
Before mitigation, the grid-side current harmonic distortion rate reached 34%.



Before mitigation, there were even-order harmonics such as the 2nd and 4th harmonics.

	A	B	C	N
Voltage U:	219.4V	221.1V	221.0V	
Distortion Rate THDu:	1.0%	1.2%	1.4%	
Current I:	311.8A	283.4A	280.5A	19.0A
Distortion Rate THDi:	6.0%	6.8%	6.5%	
Fundamental PF DPF:	0.74	0.71	0.82	
PF:	0.74	0.71	0.82	
Active Power:	50.8kW	44.3kW	50.6kW	
Reactive Power:	45.5kVar	44.1kVar	35.5kVar	
Apparent Power:	68.4kVA	62.6kVA	61.9kVA	

After mitigation, the grid-side current harmonic distortion rate was reduced to 6%.



After mitigation, even-order harmonics were successfully eliminated.

1.8 Application in Rectifier Power Supply Loads

Project Challenge

At the Tianma Power Supply project site, the load used is a rectifier power supply. When traditional APF is used for compensation, the harmonics compensated for create resonance with high order harmonics, resulting in poor compensation and a discrepancy with the customer's target requirements.



Project Application Site

Project Solution

Rectifier power supply loads generate a series of harmonic components during the rectification process due to their non-linear nature. These harmonic components not only affect the efficiency of the rectifier power supply itself but also pollute the power grid, interfering with the normal operation of other electrical equipment.

By installing the Ultra APF stable-type active power filter on the load side and simultaneously compensating for both current and voltage harmonics, the harmonic current distortion rate was reduced from 46.5% to 1.9% after compensation.

	A	B	C	N
Current I:	273.6A	273.6A	268.6A	41.6A
Distortion Rate THDi:	46.5%	49.4%	48.3%	
Fundamental Power DPF:	0.94	0.94	0.94	
Power Factor PF:	0.88	0.87	0.87	
Active Power P:	51.5kW	51.8kW	51.3kW	
Reactive Power Q:	18.0kVar	18.4kVar	18.2kVar	
Apparent Power:	58.6kVA	59.4kVA	58.8kVA	

Before mitigation, the current harmonic distortion rate was 46%.



After mitigation, the current harmonic distortion rate was 1.9%.

A technician in a white lab coat and safety glasses is working on a circuit board in a factory setting. The technician is wearing white gloves and is focused on the task. In the background, another technician is visible, also working. The scene is lit with blue and white lights, creating a professional and technical atmosphere.

02

**iKonMac Tech
Core Advantages**

2.1 Research and Development Strength

1 Master the Core Technology of APF/SVG

- iKonMac specializes in R&D, with all products independently developed using core APF and SVG technologies, including 5th-generation IGBT and full FPGA control chips.
- The Product Features a unique layered design, with industry-leading technical parameters and over 30 patents, including 5 inventions and 8 software copyrights.
- iKonMac continuously innovates to advance power quality products and drive industry progress.

Quality Comes From Professionalism



2 R&D Team Composition

- The R&D team of iKonMac is composed of high-tech professionals such as postdoctoral, doctoral, and master's degrees, with a R&D workforce accounting for 35%.
- The R&D team consists of positions such as Chief Engineer, Software, Control, Electronics, Electrical, Layout, Structure, Heat Flow, Testing, Process, etc. The R&D team is fully equipped.
- The R&D personnel mainly come from well-known universities such as Shanghai Jiaotong University, Zhejiang University, Xi'an Jiaotong University, Huazhong University of Science and Technology, and China University of Mining and Technology.

Focus On Creating Excellence



5 Proportion of R&D Investment

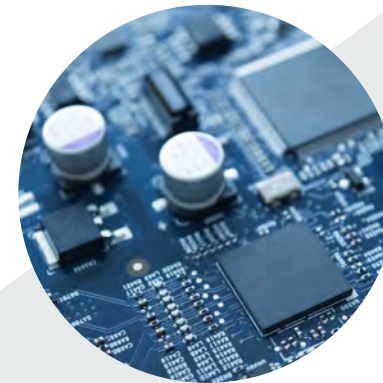
- The proportion of R&D investment is greater than 12% of annual sales revenue and continues to increase year by year.

4 R&D Management and Development Equipment

- iKonMac follows the IPD product development process and has partnered with Shanghai JiaoTong University to establish a joint laboratory. This collaboration enhances R&D management, accelerates the transformation of high-tech achievements, and boosts product innovation.
- We have advanced development and testing equipment, including vibration tables, programmable power supplies, IGBT testers, power quality analyzers, temperature change test boxes, and performance testing platforms for active filters and static reactive power generators.
- A dedicated project customization team provides R&D support for product adjustments in special projects.

3 Experienced R&D Team

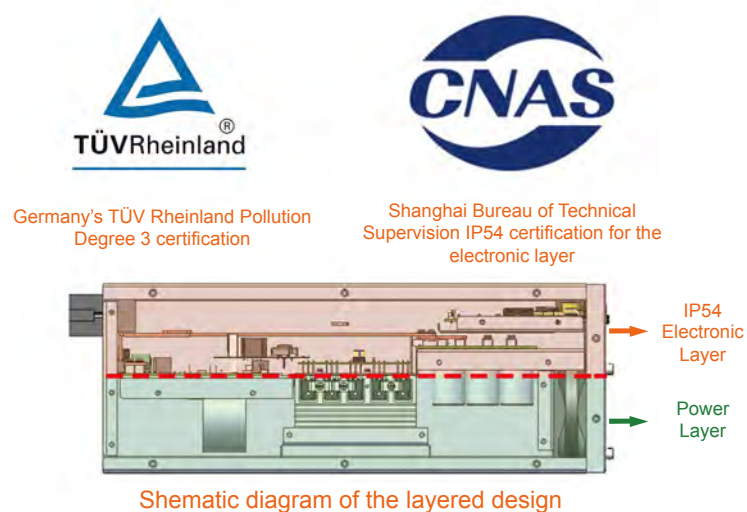
- Core R&D personnel with 30 years of experience in power electronics development and over 15 years of experience in APF/SVG development.
- The R&D team previously developed the medium voltage SVG in 2007 and put it into use in 2008. In 2009, a full cabinet APF was developed and put into use the same year. Modular APF was developed from 2010 to 2011 and put into use in 2011. In 2015, APF/SVG was developed based on the core technology of the 5th generation IGBT and full FPGA, and was put into use in 2016. Industrial specific models were developed in 2019 and officially put into use in 2020.



2.2 Product Core Advantages

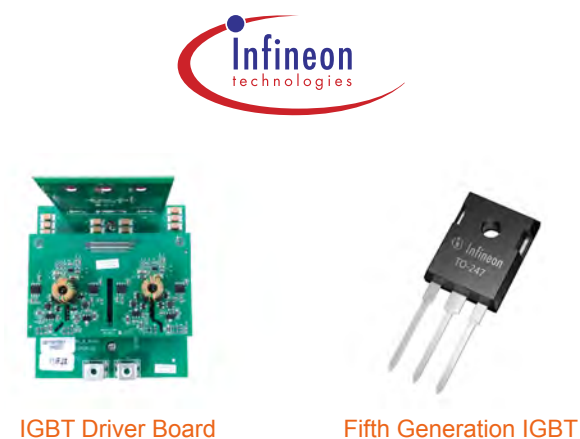
1 Extremely High Anti Pollution Ability

The design adopts a layered structure, with the electronic layer and power components separated. The electronic layer provides effective insulation, moisture-proofing, and dust-proofing, while the power layer is cooled by fans. The electronic layer has an IP54 protection rating, and the module has a pollution resistance level of Class 3, making it suitable for harsh environments such as saline, humid, dusty, and corrosive gas conditions.



2 Adopting the 5th Generation IGBT from German Infineon

iKonMac's APF/SVG uses the fifth generation IGBT, while most domestic APF/SVG manufacturers still use the third generation. At the same time reducing switching loss by one-third and increasing the switching frequency by 2x40kHz, with parallel interleaving technology achieving an effective switching frequency of 80kHz. This challenges the control algorithm, as the main control chip needs to complete a PWM calculation within $1/80k=12.5\mu s$. iKonMac uses FPGA as the main control chip with parallel processing and multi-core CPU computing, allowing faster completion of control algorithms.



3 Adopting a Full FPGA Main Control Chip

Using the fifth-generation IGBT, doubling the switching frequency halves the control calculation time. Most manufacturers use DSP combined with CPLD or FPGA, but DSP's single-core serial processing can't meet the high switching frequency of the fifth generation IGBT. iKonMac's APF/SVG uses an all FPGA control chip, with 8 million logic gates in the calculation program, equivalent to 16 parallel-running hardware CPU units.



FPGA Main Control Chip

4 Extremely Low Noise 60dB

Noise is crucial for user experience and comes from two main sources: first, heat dissipation, including airflow and fan noise. With the fifth generation IGBT, iKonMac reduces losses, adds temperature monitoring, and adjusts fan speed based on temperature, significantly lowering fan noise. Second, noise from the reactor is caused by high-frequency switching currents, with higher switching frequencies resulting in lower noise. iKonMac's fifth-generation IGBT achieves an effective switching frequency of 80kHz, compared to the common 20kHz, reducing module noise to under 60dB, while the industry standard is below 70dB.



Extremely Low Noise 60dB

5 Extremely Low Power Consumption 2.5%

The higher the active power loss, the more severe the heat generated by the device, and many failures in power electronics are due to internal heat damaging electronic components. Reducing active power loss is crucial, especially for large-scale applications like state grid industries. For APF/SVG, power loss is a critical technical parameter. For instance, a 100A APF module has a loss of 2.5%, which affects touch screen power, reactor heating, IGBT heating, etc., and reducing loss by even 0.1% is challenging.

iKonMac uses the fifth-generation IGBT, which reduces loss by 1/3 compared to the previous generation. By increasing the switching frequency to 40kHz, the inductance is halved, and with interleaved parallel technology, it is reduced even further. This results in an inductance value only 1/4 of similar products, leading to proportionally lower losses. As a result, iKonMac's APF/SVG has a loss of less than 2.5%, while domestic products typically measure 3.5%.



Power Consumption \leq 2.5%

6 Extremely High Temperature Resistance of 55°C

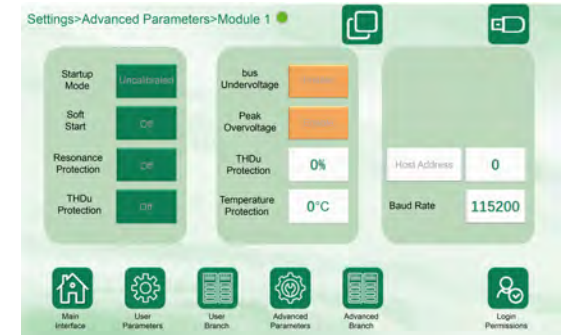
For APF/SVG, reliability comes from voltage and temperature resistance. iKonMac's APF/SVG can run at full load in 55°C environments, thanks to the fifth-generation IGBT, which reduces loss and temperature rise, and the layered design that ensures effective heat dissipation and protection for the electronic layer.



Full-load operation at an ambient temperature of 55°C.

7 Intelligent Compensation Efficient Prevention of Resonance

iKonMac's APF/SVG adds a smart startup mode in the software to effectively avoid resonance points and protect the device's normal operation, enhancing product reliability. This allows the product to be used in more challenging electrical environments.



Smart Startup Mode

8 Extremely High Power Density 800A/675kvar

iKonMac's APF/SVG adopts a standard modular design with an efficient layout and high power density. For a 800x800 standard cabinet, its capacity can reach 800A or 675kvar.



Specification	Max Power
Single Module/ Wall Mounted	200A/150kvar
600(W) * 600(D) Cabinet	300A/200kvar
800(W) * 600(D) Cabinet	400A/300kvar
600(W) * 800(D) Cabinet	600A/300kvar
800(W) * 800(D) Cabinet (Recommend Dimensions: 800(W) * 1000(D) Cabinet)	800A/675kvar

Maximum 800A/675kvar per cabinet

2.3 Quality Control

Incoming Inspection:

- All components are sourced from well-known international and domestic manufacturers.
- All materials undergo incoming inspection, with random checks for standard materials and full checks for critical ones.
- Key inspection equipment includes:
 - Bridge — for measuring inductance
 - Heat sink jig — for measuring hole positions on heat sinks
 - Inductor jig — for measuring inductor dimensions
 - Oven — for testing FPC terminal temperature resistance
 - Microscope — for inspecting PCBA soldering quality
 - High-precision multimeter — for measuring precision resistors (0.001)
- After all components are inspected, they are sent to the SMT factory for assembly.

ICT Testing

- The SMT factory conducts ICT testing on all completed PCBs to prevent soldering defects such as cold or missed solder joints.

FCT Testing

- Once the PCBs arrive at the company, full inspection is carried out with dedicated testing fixtures for each board

Assembly

- All assembly is done in an ESD-protected environment (ESD clothing, shoes, flooring, constant temperature and humidity chamber, ESD wristbands, ESD transit boxes, and all equipment grounded). Process inspections are conducted according to SOP.

Low-voltage Testing

- After assembly, products undergo 30V low-voltage communication testing on a custom automated test platform.

High-voltage Testing

- Next, products undergo 400V high-voltage on/off testing on a custom automated test platform.

Aging Test

- Full-load aging test of all modules for 24 hours.

Final Inspection

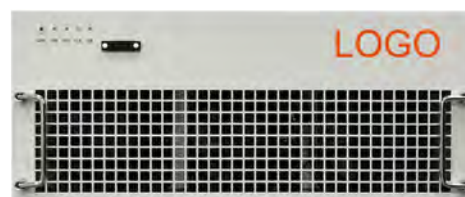
- Before shipment, the product undergoes a final inspection to check its operational status.



2.4 Service Competitiveness

Product Customization

- Custom brand silk printing
- Customized design for human-machine interface startup screen
- Customized shipping documentation
- Special projects with dedicated R&D technical support.



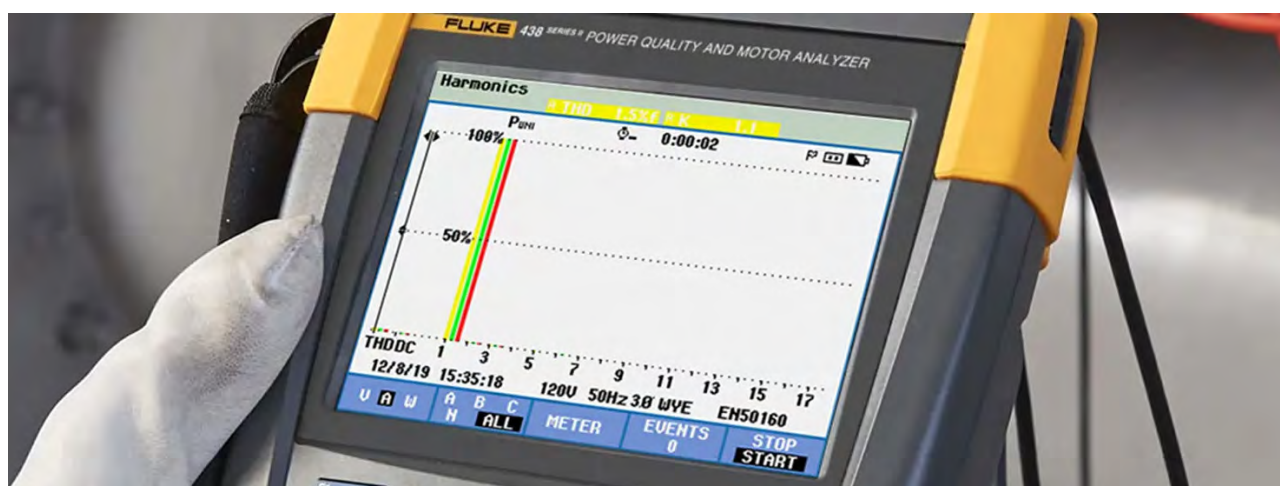
Power Quality Testing Services and Professional Solutions

- Provide power quality testing services
- Develop professional power quality management solutions
- Create reasonable corrective action plans
- Full-line technical support for solution implementation
- Provide project effectiveness reports and equipment operation reports.



Power Quality Issues:

Technical Consultation, Installation Guidance, Debugging, and Training Services



After-Sales Service Commitment

Supporting Documentation

We ensure product traceability with full documentation, including user manuals, product drawings, and technical info for each project.

Online-Remote Service

We offer remote technical support with a response time under 2 hours, and resolve issues within 24 hours. For unresolved issues, on-site technicians will be dispatched.

Post-Warranty Service

Lifetime maintenance after warranty, charging only for costs. A full maintenance plan is provided beyond warranty.

Service Records

We keep detailed records of every customer interaction, service, and feedback for quality analysis.

Preventive Inspections

Regular follow-ups and site inspections to ensure customer satisfaction.



iKonMac *Reliability at Our Core*