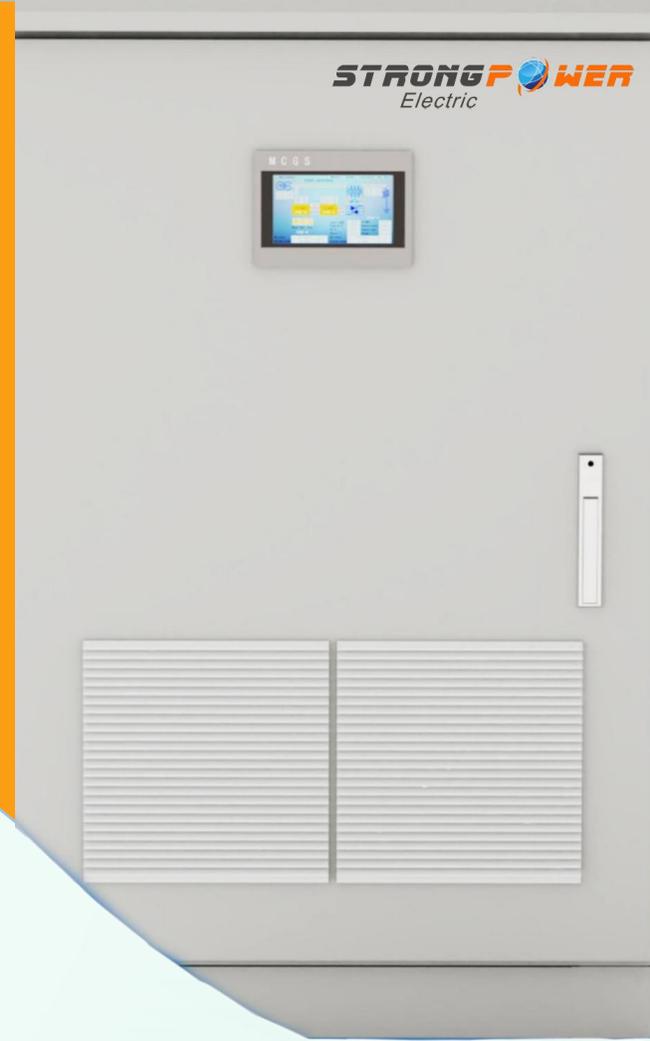


UPQC product presentation

Strong Power Electrical Co., Ltd.



Optimizing electricity quality and improving the electricity environment

Product introduction background

Electric power quality refers to a measure of whether the electricity provided by the power system to users meets the relevant national and international standards and the normal operation requirements of equipment, covering a number of performance indicators such as voltage, current, frequency and waveform of electric power.

Specific metrics for the measurement of power quality include but are not limited to:



Voltage deviation:

The difference between the actual voltage and the rated voltage.



Waveform quality:

Including harmonic content, interharmonic, three-phase unbalance, voltage fluctuation and flicker, etc.



Frequency deviation:

Ideally, the frequency of the alternating current should be maintained within a strict range, for example, the standard frequency for most countries is 50Hz or 60Hz.



Transient event:

Including voltage surges, dips, momentary interruptions, etc.;

The R&D background of comprehensive treatment products for power quality mainly including the following aspects.

1. The exacerbation of power quality issues

The acceleration of industrialization and widespread use of non-linear and impact loads (e.g., frequency converters, switching power supplies, electric arc furnaces) generate significant harmonic currents. Concurrently, power system transient events like short circuits cause voltage fluctuations, flicker, and sags. These power quality issues jeopardize grid stability, impair equipment performance, shorten device lifespans, increase energy consumption, and may trigger safety accidents.

3 .Improve the standard requirements of power quality

With the international and national strict standards of power quality, the supervision of power quality is also strengthened, and the requirements of users for power quality are constantly improving.

UPQC, as an advanced power quality management tool, can help enterprises to comply with strict power quality regulations and avoid the risk of fines or forced shutdown due to non-iance.

5. Promote clean energy access

With the large-scale access of distributed energy, especially renewable energy (such as wind energy, solar energy), the power quality problem of power system is more and changeable. UPqC can effectively support the access of these unstable energy, help it achieve harmonious interaction with the main grid, and improve the ability of the grid to renewable energy.

2. Limitations of traditional solutions

Traditional power quality solutions like passive or active filters address only specific, limited issues and cannot simultaneously tackle multiple complex problems. In contrast, the UPQC integrates series and shunt active filters, enabling bidirectional dynamic compensation to resolve both grid-side voltage issues (e.g., fluctuations, sags) and load-side current problems (e.g., harmonics), enhancing overall power quality comprehensively.

4. Ensure the continuous operation of critical loads

In some industries that are extremely sensitive to power quality (such as data centers, semiconductor manufacturing, medical facilities, etc.), the quality of power directly affects normal operation and economic benefits of core businesses. UPQC can effectively protect these critical loads from the impact of power quality issues, ensuring their stable operation.

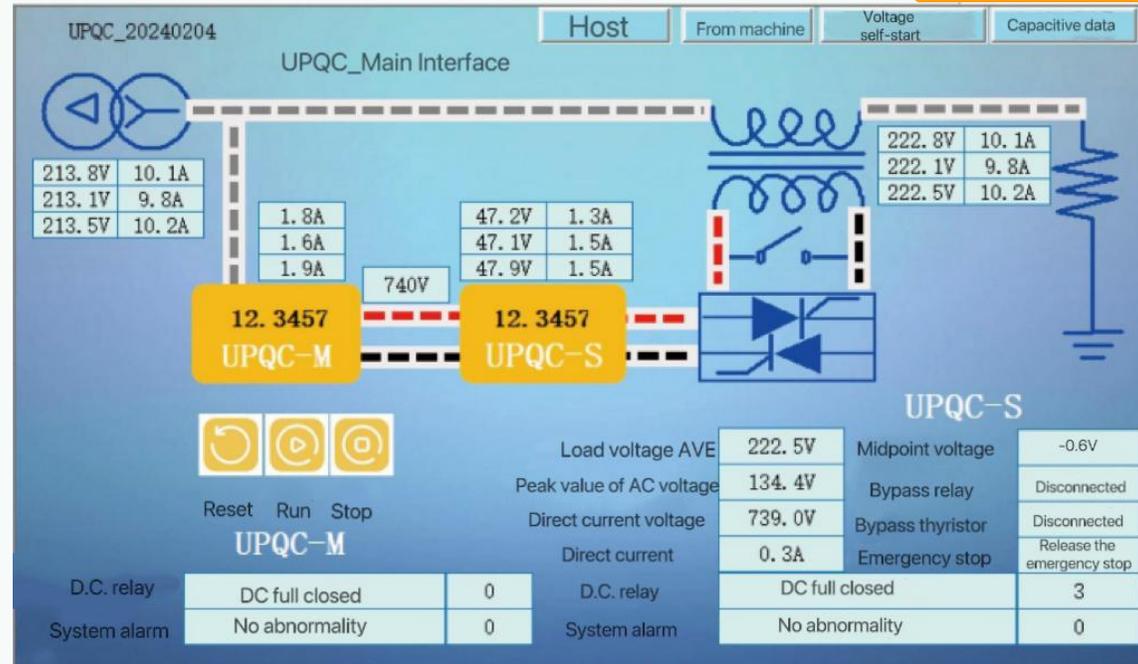
In summary, the research and development of UPQC is to solve complex power quality problems more comprehensively and efficiently, to ensure the safe, stable and efficient operation power systems, to improve the reliability, stability and compatibility of power systems, and to meet the high standards of power quality in modern society.

Product display and on-site application

Product display



Part of the on-site application



Part of the on-site application

This site is in a certain industrial park, and due to the phenomenon of low load voltage, our company's UPQC unified power quality regulator is used for.

As can be seen from the figure, the three-phase load voltages before compensation are: 213.8V, 213.1V, 13.5V, and the three-phase load voltages after compensation are: 222.8V, 222.1V, 22.5V.

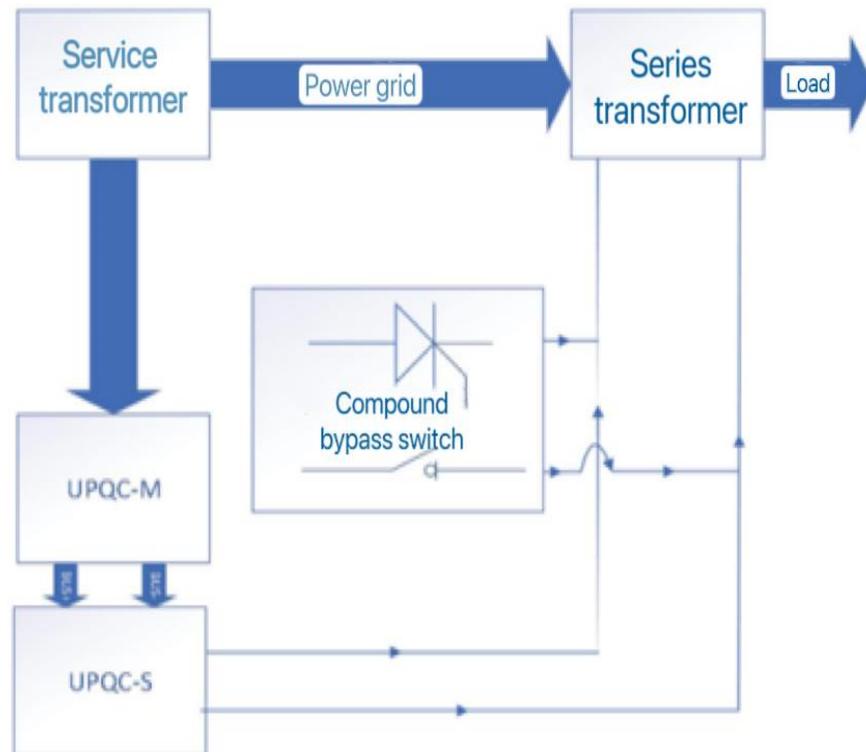
The equipment works normally and the compensation effect is good.

Introduction to the principle

Our company's UPQC power quality regulator addresses comprehensive issues like voltage instability and harmonics.

The system comprises four components: a host unit (parallel-connected to the grid for reactive/harmonic compensation), a slave unit (converts DC to AC via inverter and transformer for voltage regulation), a series transformer, and a hybrid bypass switch (thyristor + contactor).

The host's DC bus powers the slave unit, enabling bidirectional compensation to stabilize grid voltage and correct load-side current issues simultaneously.



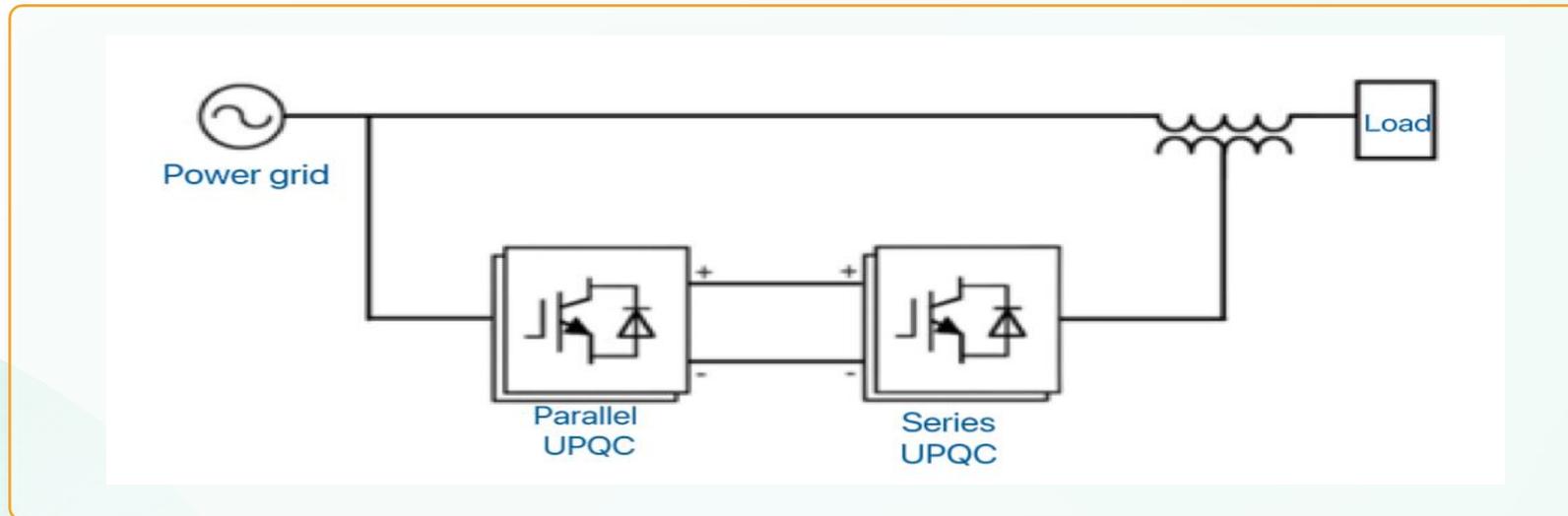
The unified power quality conditioner (UPQC) utilizes advanced control algorithms and power electronic technology to monitor the power grid in real-time, dynamically compensating for such as voltage fluctuations, sags, harmonics, and current peaks, thereby enhancing the stability and reliability of the power grid.

Its rapid response, low energy consumption, and adapt to different power systems and loads effectively improve power supply quality.

As power systems and quality standards continue to improve, the role of UPQC in ensuring reliable power supply will become increasingly important.

Working principle

The Unified Power Quality Conditioner (Unified Power Quality Conditioner, UPQC) is an advanced system addressing both voltage and current quality issues in power grids. Integrating series and parallel active filters, it monitors grid voltage and load current in real time, dynamically generating compensation signals to eliminate voltage fluctuations, harmonics, reactive power, and phase imbalances, while enhancing power factor.



The UPQC comprises two components: series voltage-type (UPQC-S) and parallel current-type (UPQC-M), handling grid voltage and current issues separately. The UPQC-S dynamically compensates grid voltage to stabilize it, addressing fluctuations and sags. Meanwhile, the UPQC-M suppresses harmonics and current peaks via dynamic current compensation, improving grid current quality.

The working principle of the voltage type UPQC (UPQC-S)

The device monitors the grid voltage in real time through a voltage sensor, obtaining real-time information about the voltage. Then, the voltage signal is sampled, and processed by the core controller inside the UPQC, generating corresponding compensation information.

The device's compensation output is inversely transformed to the grid by series UPQC, and compensation signal is injected into the grid through operation, achieving compensation for the grid voltage. The series UPQC improves the stability of the voltage by adjusting the grid voltage to maintain consistency with rated voltage.

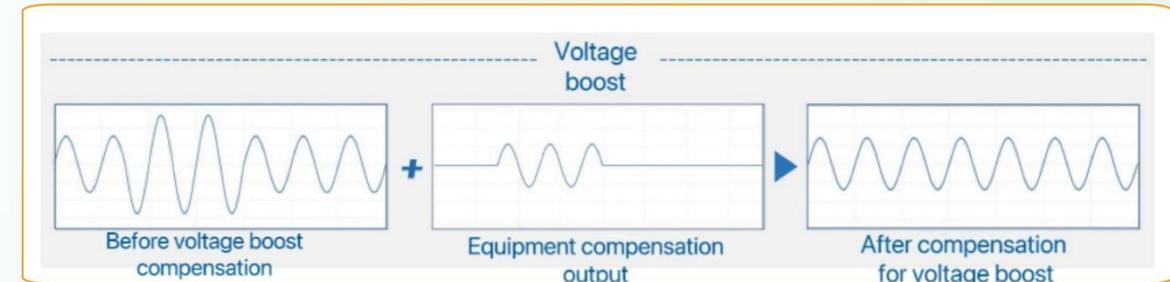
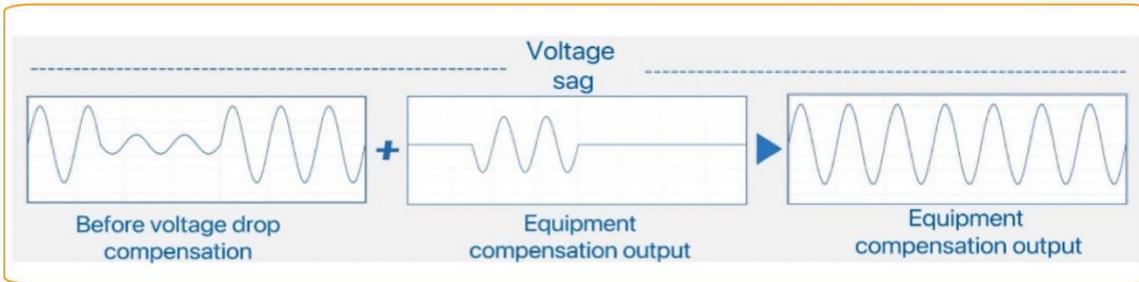
The working principle of current-type UPQC (UPQC-M)

The UPQC uses current sensors to monitor grid current in real time. Its controller processes the signal to generate compensation data, which is injected into the grid. The parallel UPQC adjusts the current waveform to suppress harmonics, manage reactive power, and correct imbalances, enhancing grid current quality.

The parallel UPQC and the series UPQC are combined to work, which can achieve comprehensive control and compensation for voltage and current of the power grid. The voltage-type UPQC (UPQC-S) is mainly responsible for dealing with voltage problems, and the current-type UPQC (UPQC-M) is mainly responsible for dealing with current problems. The two work together to achieve comprehensive compensation and management of power quality.

Introduction to some features

1. Voltage compensation function



The UPQC-S (series unit) stabilizes load voltage in three steps:

Monitor: Tracks grid voltage (amplitude, frequency, harmonics) via sensors.

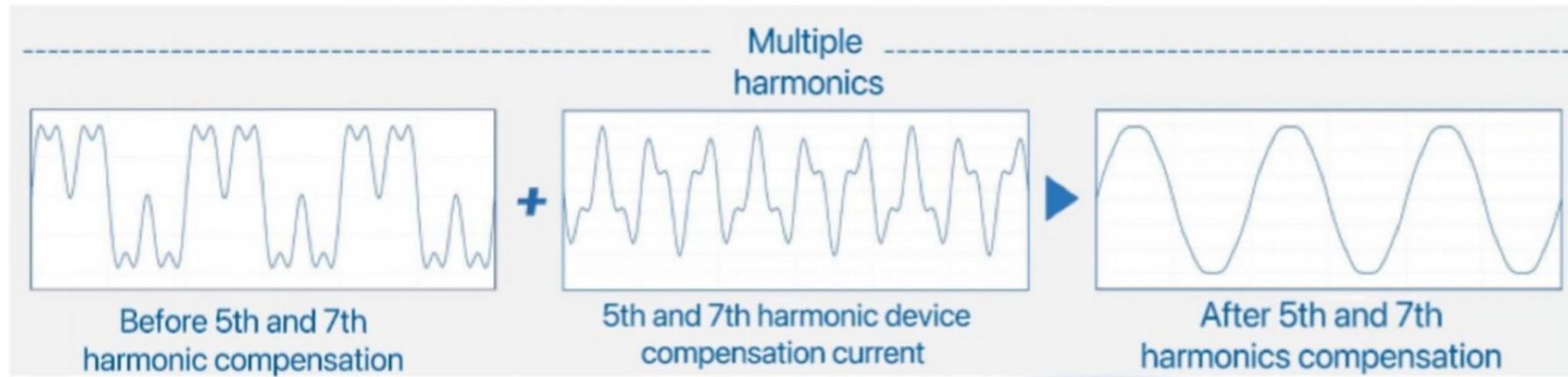
Calculate: Compares real-time voltage to ideal → generates reverse-phase compensation voltage commands.

Correct: Injects compensating voltage (via IGBTs) into the grid-load circuit, neutralizing deviations.

A closed-loop PID algorithm adjusts compensation dynamically for real-time precision.

Result: Stable, sinusoidal load voltage.

Introduction to some features



2. Harmonic management function

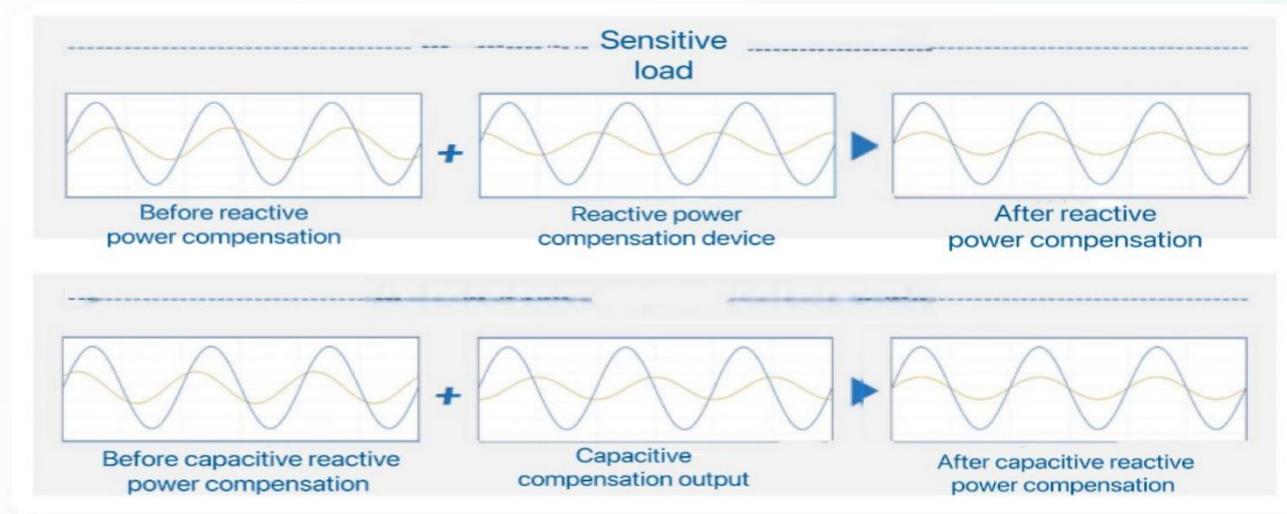
UPQC Harmonic Current Management Process :

The harmonic current management function of the UPQC (Unified Power Quality Conditioner) is primarily implemented through its parallel unit (UPQC-M). The workflow is as follows:

1. Harmonic Monitoring →
2. Harmonic Analysis →
3. Compensation Command Generation →
4. Compensation Current Generation →
5. Harmonic Cancellation →
6. Dynamic Adjustment

Core Function: By injecting "reverse harmonic current," the UPQC-M eliminates harmonic pollution from the load to the grid, significantly improving power quality.

Introduction to some features



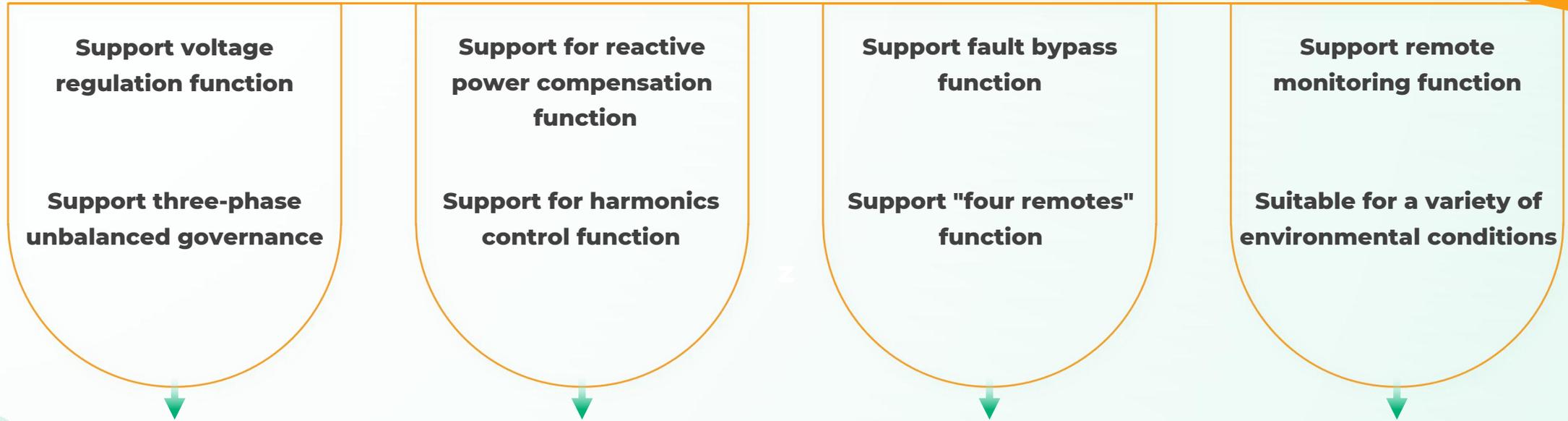
3. Reactive power compensation function

The UPQC-M (parallel unit) compensates reactive power in three steps:

1. Monitor: Tracks grid voltage and load current (active + reactive components) via sensors.
2. Calculate: Detects reactive power → generates reverse-polarity compensation current commands.
3. Compensate: IGBTs inject compensating current into the grid, neutralizing reactive components. A closed-loop PID algorithm dynamically adjusts compensation for real-time precision.

Result: Improved grid power factor and reduced line losses.

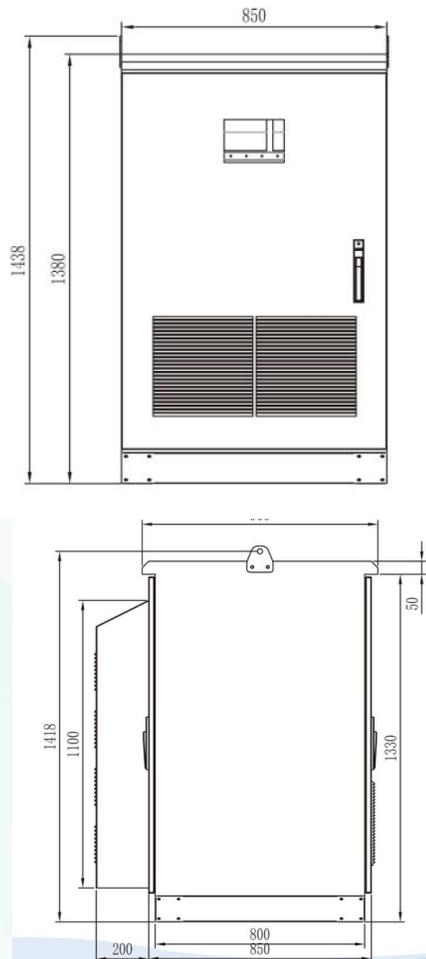
Technical features



UPQC unified power quality regulator device is mainly used to treat various power quality problems such as excessive or insufficient supply voltage, unbalanced three-phase voltage and current, low power factor, and high current harmonic content at the end of distribution transformer or line in the distribution area, and it is a powerful, comprehensive performance, and cost-effective power distribution integrated power quality management product.

Product model and size

Product exterior structure size chart



Basic parameters	
Size (Depth × Width × Height)	1050×850×1438mm (specific dimensions are related to product capacity)
Protection level	IP44
Working altitude	≤2000m(greater than the down-rating)
Method of installation	Full cabinet installation
Cooling method	Forced air cooling
Loss	≤2.5%
Single-phase system	three-phase four-wire
Working frequency	50Hz±5%
Response time	≤20ms
Protection function	Overvoltage of power grid; undervoltage of power grid; phase loss of voltage; instantaneous overcurrent; time-delayed overcurrent; busbar over; busbar undervoltage; equipment overheating; fan fault; power supply fault; current limiting protection; frequency protection; fuse fault.
Power supply method	Downline
Sampling method	Current transformer
Communication protocol	MODBUSTCP/MODBUSRTU; other protocols can be customized
Communication interface	Ethernet/RS485
Remote monitoring	4G/WIFI/Ethernet
Four remote capabilities	Capable of achieving "remote signaling," "remote control," "remote measurement," and "remote regulation."

UPQC unified power quality conditioner

Product parameters			
Product name	UPQC unified power quality conditioner		
Product model	UPQC/50-50-0.4-Z	UPQC/200-200-0.4-Z	UPQC/400-400-0.4-Z
Rated capacity	50kVA	200KVA	400KVA
Voltage regulation capability			
Input voltage range	290V~460V line voltage		
Output voltage range	Voltage regulation capability of $\pm 20\%$, other regulation ranges can be customized.		
Output voltage accuracy	$\leq 1\%$		
Product parameters			
Three-phase unbalanced governance capability			
Three-phase voltage unbalance	The system output voltage imbalance $\leq 2\%$ when the negative sequence voltage unbalance degree of the power grid $\leq 15\%$.		
Three-phase current unbalance	$\leq 30\% \times I_n$ (module rated current)		
Reactive power compensation capability			
Compensation capacity	$\leq 30\% \times S_n$ (system capacity)	Power factor shall be maintained above 0.95	
Compensation accuracy	$\leq 1\% \times S_n$ (system capacity)		
Product parameters			
Harmonic management capability (optional)			
Compensation count	3,5,7,9,11,13	Compensation capacity System output harmonics $\leq 3\%$ when the grid-side harmonics do not exceed 8%	
Compensation capacity	$\leq 30\% \times I_n$ (module rated current)		
Fault bypass capability			
Dual auto bypass	Electronic bypass <1ms, mechanical bypass <30ms		
Bypass conversion characteristics	Switch time blocks, seamless switching, ensure no power outage, support manual bypass.		

Selection details

Characteristics

Low voltage regulation-installed system single phase

30kVA 1-phase

UPQC/30-0.22

15kVA 1-phase

UPQC/15-0.22

5kVA 1-phase

UPQC/5-0.22

Low voltage regulation - 3 phase installation system

100kVA 3-phase

UPQC/100-0.4

200kVA 3-phase

UPQC/200-0.4

400kVA 3-phase

UPQC/400-0.4

Voltage compensation range

±12.5% ±25% ±30%

Full container load

Indoor Outdoor