

有源电力滤波器 Active power filters



产品概述 Product Introduction

HPQ有源电力滤波器是HOWCORE经过多年研发，已成功应用于众多工业现场，是当今用于电能优化技术中质量优良，性能稳定的高科技产品。HPQ active power filter is a high-tech product with excellent quality and stable performance in HOWCORE's power optimization technology after years of research and development, which has been successfully applied to many industrial sites.

HPQ有源滤波器拥有闭环控制系统和对每次谐波独立选择的两大功能。

The HPQ active filter has two functions: a closed-loop control system and independent selection of each harmonic

● 闭环控制系统可以检测到电流中每一次谐波的大小和无功功率，通过与用户设定的目标对比从而实现自动修正。

The closed-loop control system detects the magnitude and reactive power of each harmonic in the current and automatically corrects it by comparing it with the target set by the user.

● 对每次谐波进行独立选择的功能来自于先进的算法。滤波器所释放的补偿电流将完美地注入到所选定的目标谐波中，这保证了用户锁定的目标谐波将会完美滤除。

The ability to independently select each harmonic comes from advanced algorithms. The compensation current released by the filter is perfectly injected into the selected target harmonic, which guarantees the user-locked target harmonic the waves will be filtered out perfectly.

HPQ有源电力滤波器闭环控制系统同样帮助滤波器实现卓越的无功补偿功能和三相平衡功能。

The closed-loop control system of the HPQ active power filter also helps the filter achieve excellent reactive power compensation and three-phase balancing functions.

电能质量差带来的损失 Losses due to poor power quality

存在电能质量问题的电气系统将导致成本上升、环境污染和安全隐患在用户的供电系统中，种类繁多的负载会带来以下三个明显的电能质量问题 Electrical systems with power quality problems will lead to rising costs, environmental pollution and safety hazards in the user's power supply system, a wide variety of loads will bring the following three obvious power quality problems

- 谐波污染 Harmonic pollution
- 负载不平衡而导致的电压不平衡和相对零电压 Voltage imbalance and relative zero voltage due to load imbalance
- 无功功率 Reactive power

电能质量问题带来的不仅仅是金钱上的损失。它还会带来更多其它问题：Power quality issues bring more than just monetary losses. It raises many other problems:

- 设备故障率上升 The equipment failure rate is rising
- 设备寿命下降 Reduced equipment life
- 产量下降 Production declined
- 配电系统的安全性下降 The safety of the power distribution system is reduced
- 增加碳排放 Increase carbon emissions
- 无法满足供电局相关规范要求 Unable to meet the relevant specifications of the power supply bureau

此外，谐波污染还会导致电网中诸如变压器、电缆和马达等设备的有功损耗上升，这些损耗又将占用发电站的输出能量并导致更多的二氧化碳排放。排放量的大小将取决于整个生产过程和发电所用的燃料类型。

In addition, harmonic pollution can lead to higher active losses in equipment such as transformers, cables, and motors in the grid, which in turn will take up the output energy of the power station and lead to more CO₂ emissions. The magnitude of the emissions will depend on the entire production process and the type of fuel used to generate electricity.

负载平衡式例 Example of load balancing

不带滤波器 Without filter

线电流 Line current 1	49.1Arms
线电流 Line current 2	5.3Arms
线电流 Line current 3	5.1Arms

带滤波器 With filter

线电流 Line current 1	19.6Arms
线电流 Line current 2	19.4Arms
线电流 Line current 3	19.5Arms

中性线电流 Neutral current	44.1Arms
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中性线电流 Neutral current	3.5Arms
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解决方案 Solution

HOWCORE有源电力滤波器 HPQ 能解决谐波污染、三相不平衡和无功补偿等电能质量问题。

The HOWCORE active power filter HPQ solves power quality problems such as harmonic pollution, three-phase unbalance and reactive power compensation.

● 可应用于不同类型的场合，并同时适用于商业和工业环境。

It can be used in different types of applications and is suitable for both commercial and industrial environments.

● 为客户提供谐波滤除、三相平衡和容性或感性无功补偿。

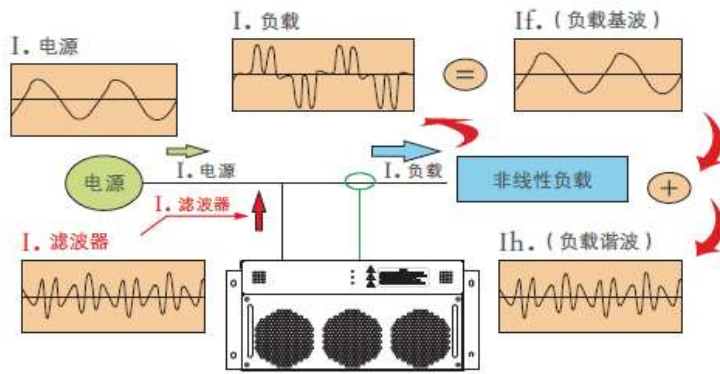
Provide customers with harmonic filtering, three-phase balancing and capacitive or inductive reactive power compensation.

● 通过主从模块的并联扩展，从几十安培到几千安培的丰富的滤波方案可以为每个系统提供最优化的解决方案。

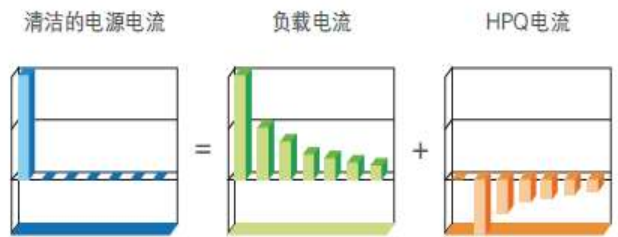
Through the parallel expansion of the master-slave modules, the rich filtering scheme from tens of amperes to thousands of amperes can provide the most optimized solution for each system.

● HPQ有源动态滤波器可安装在低压电网中，并可通过合适的升压变压器接入中压系统使用。

HPQ active dynamic filters can be installed in low-voltage power grids and can be connected to medium-voltage systems via suitable step-up transformers.



工作原理 How it works



谐波 Harmonic wave

HPQ有源电力滤波器为供电系统带来以下好处。

HPQ Active power filters bring the following benefits to power delivery systems.

- 减少停机时间
Reduce downtime
- 提高系统运行效率，减少二氧化碳排放
Improve the efficiency of system operation and reduce CO2 emissions
- 满足严格的供电局要求，避免罚款或断电
Meet stringent power bureau requirements and avoid fines or power outages
- 无需对电网的特殊分析，方案实施快而简单
No special analysis of the grid is required, and the implementation of the solution is quick and simple
- 不会过载，特别适用于负载变化快的低压系统
It will not be overloaded, and is especially suitable for low-voltage systems with fast load changes

应用范围

Scope of application

HPQ有源电力滤波器可提供不同结构、不同尺寸和不同电流容量的产品，完全满足不同场合的不同要求。The HPQM modular product is a compact product developed for commercial and residential as well as light industrial applications, and is suitable for both three-phase three-wire and three-phase four-line. The wall-mounted mode makes the product suitable for applications where space is limited. It can also be installed in enclosures.

典型应用行业

Typical application industries

- 石油和天然气行业（陆地和海上） Oil & Gas Industry (Onshore & Offshore)
- 钢铁行业 Iron and steel industry
- 水处理行业 Water treatment industry
- 水泥行业 Cement industry
- 汽车行业 Automotive industry
- 过程控制行业 Process control industry
- 造纸行业 Paper industry
- 太阳能行业 Solar energy industry
- 印刷行业…… Printing Industry

HPQM模块化产品为商业和民用以及轻工业场合开发的一款紧凑型产品，同时适用于三相三线和三相四线。墙上安装的模式使得产品适用于空间有限的场合。同样它也能安装在盘柜中。The HPQM modular product is a compact product developed for commercial and residential as well as light industrial applications, and is suitable for both three-phase three-wire and three-phase four-line. The wall-mounted mode makes the product suitable for applications where space is limited. It can also be installed in enclosures.

典型应用行业

Typical application industries

- 办公室和商业大厦 Office and commercial buildings
- 计算机和数据中心 Computers and Data Centers
- 住宅 Residence
- UPS系统，电梯和照明系统 UPS systems, elevators and lighting systems
- 轻工业（例：远程泵站） Light industry (e.g. remote pumping stations)
- 轨道交通…… Rail transit

有源滤波控制器

Active filter controller

简单的调试工作在整个应用过程中尤为重要，同时用户需要实时监视整个网络的电能质量情况。HK-070HE是应用于所有HPQ型号的一款标准化用户图形操作界面。它能为用户提供滤波器控制、编程和电网参数监视等功能，还具备通讯、故障和实时事件记录等功能。Simple commissioning is especially important during the application process, where users need to monitor the power quality of the entire network in real time. The HK-070HE is a standardized graphical user interface for all HPQ models. It can be directly used for functions such as filter control, programming, and grid parameter monitoring, as well as communication, faults, and real-time events recording and other functions.

全图形化显示

Full graphical display

HK-070HE通过64×132像素的液晶面板，清晰地为用户提供了各类滤波器信息。The HK-070HE provides users with a wide range of filter information through a 64×132 pixel LCD panel.

主要功能如下：

The main features are as follows:

启动、停止和重启滤波器测量、分析和记录各个参数对滤波器进行设定监视滤波器状态和故障记录满足不同场合的不同要求。Start, stop, and restart filters measure, analyze, and record individual parameters, set the filter, and monitor the filter status and fault records meet the different requirements of different occasions.

操作键

Action keys

简单而又友好的操作键让整个操作简单而又直观。Simple and user-friendly keys make the whole operation simple and intuitive.

通讯

Communication

HK-070HE提供了Modbus RTU模式的通讯接口。通过Modbus RS-485转换器（可选），PQF能够联入上位机。所有参数、设定和测量值均能够进行传输。The HK-070HE provides a communication interface in Modbus RTU mode. Pass Modbus RS-485 converter (optional), PQF can be connected to the host computer. All parameters, settings and measured values can be transmitted.

帮助键

Help key

帮助键能够让用户便捷地获得各个功能特性的详细描述。The help button allows the user to easily obtain a detailed description of each function.

调试简单

Commissioning is simple

自动检测和对误接CT进行校正的功能使得调试工作更加简单。Automatic detection and correction of misconnected CT images makes commissioning easier.

用户收益

User Benefits

保护功能降低了停机时间 Protection features reduce downtime
直接获取电网关键参数 Direct access to key grid parameters
适用于不同工况下 It is suitable for different working conditions

尺寸安装

Dimensional mounting

外观尺寸 Exterior dimensions : 203*145*38 mm
开孔尺寸 Cut-out size : 192*138 mm



HOWCORE可为电能质量提供整体解决方案，公司拥有全电压等级的一系列电能质量解决方案。

HOWCORE can provide a total solution for power quality, and the company has a range of power quality solutions at all voltage levels.

通过在不同行业中收集的各种电能质量问题，HOWCORE研发部门为客户各种应用需求提供更加优化的解决方案，同时作为一项重要的附加值，HOWCORE 还为用户提供最优质的服务以满足客户的不同需求。

Through the collection of various power quality problems in different industries, HOWCORE's R&D department provides customers with more optimized solutions for various application needs, and at the same time, as an important added value, HOWCORE also provides users with the best quality service to meet the different needs of customers.

HPQ有源电力滤波器是数十年研发不断的积累和大量现场应用经验结合的成果。这让 HPQ 产品成为了为工业或商业环境用电环境提供强有力保证的首选，同时也能让用户的供电系统能满足任何严苛的电能质量规范。HPQ有源电力滤波器让用户无任何的后顾之忧。

The HPQ active power filter is the result of decades of research and development combined with a large amount of field application experience. This makes HPQ products the first choice for providing strong assurance for the power supply environment in an industrial or commercial environment, while also enabling the user's power supply system to meet any stringent power quality specifications. HPQ active power filters allow users to have no worries.



通过独特的闭环控制系统和谐波独立选择功能实现了卓越的滤波效果

Superior filtering is achieved through a unique closed-loop control system and harmonic-independent selection

- 能够同时滤除 20 种谐波 (PQFS 四线模式下可滤除 15 种) 2 到 51 次谐波可随意选择
It can filter out 20 harmonics at the same time (15 harmonics in PQFS four-wire mode) and 2 to 51 harmonics can be selected at will
- 滤波效率超过 97%
Filtering efficiency over 97%
- 每次被选择的谐波均能设定滤波范围
The filtering range can be set for each selected harmonic
- 满足谐波规范中的任何参数要求包括对每次谐波的限值
Meets any parameter requirements in the harmonic specification, including limits for each harmonic
- 同时解决高频次和低频次谐波带来的问题
Solve the problems caused by both high-frequency and low-frequency harmonics
- 增强系统稳定性
Enhance system stability

为感性负载和容性负载提供无级无功补偿

Stepless reactive power compensation for inductive and capacitive loads

- 为感性负载和容性负载提供无级无功补偿
Stepless reactive power compensation for inductive and capacitive loads
- 降低系统元件的负载率并降低系统损耗
Reduce the load factor of the system components and reduce the system losses
- 避免供电局罚款
Avoid electricity supply bureau fines
- 为发电机提供补偿而不会有过补偿的风险
Compensate generators without the risk of overcompensation
- 为刀片服务器等容性负载提供补偿以保证 UPS 系统正常运行
Compensates for capacitive loads such as blade servers to keep UPS systems up and running

为三线和四线系统提供三相平衡功能

Three-phase balancing is available for three- and four-wire systems

- 降低电压不平衡给负载带来的影响
Reduce the impact of voltage imbalance on loads
- 减少供电电缆和零线电缆上的电流
Reduce the current on the power supply cable and neutral cable
- 降低零对地电压。这将提高系统的安全性并允许感性负载稳定运行
Reduce the voltage to ground from zero. This will increase the safety of the system and allow the stable operation of sensitive loads

将系统稳定性提高到前所未有的水平

Increase system stability to an unprecedented level

HPQ有源电力滤波器整合了冗余功能，这将允许多台滤波器同时协调高效运行并满足任何对冗余功能有严格要求的数据中心、通讯、敏感性工业生产过程等各种应用场合。HPQ 有源电力滤波器整合了冗余功能，这将允许多台滤波器同时协调高效运行并满足任何对冗余功能有严格要求的数据中心、通讯、敏感性工业生产过程等各种应用场合。HPQ active power filters incorporate redundancy, which will allow multiple filters to operate efficiently and meet any pair of redundancy at the same time. Functional requirements for a variety of applications such as data centers, communications, sensitive industrial processes, etc.

根据应用环境的要求，客户还可以选择全冗余还是部分冗余。Depending on the requirements of the application environment, customers can also choose between full or partial redundancy.

- 在全冗余系统中，滤波系统中的任何一个单元都可以被其他单元控制，如果其中一台出现故障，其他滤波器还能正常工作并继续滤波
In a fully redundant system, any unit in the filtering system can be controlled by the others, and if one of them fails, the other filters can still function and continue to filter
- 在部分冗余系统中，滤波系统中的从单元都可以被其他主单元控制，如果某台从模块出现故障，其他滤波器还能正常工作并继续滤波。为了得到全冗余功能，在选择时需要选取主模块来组成整个滤波系统。如果部分冗余可以接受，主模块和从模块可根据所需要的数量进行组合。冗余的程度取决于滤波系统中主模块数量的多少。
In a partially redundant system, the slave units in the filter system can be controlled by other master units, and if one slave module fails, the other filters can still work normally and continue to filter. In order to obtain full redundancy, it is necessary to select the main module to form the entire filtering system during the selection. If partial redundancy is acceptable, master and slave modules can be combined in the required quantity. The degree of redundancy depends on the number of main modules in the filtering system.

从用户角度出发的研发设计

R&D and design from the user's point of view

- 丰富的电压等级和多规格的电流容量为每个用户提供最优选择
Abundant voltage levels and multi-specification current capacity provide the best choice for each user
- 常规 CT 即可
Conventional CT is sufficient
- 不过载的模块化技术可以为以后扩展提供便利
The modular technology that does not overload allows for easy expansion at a later date
- 简单的用户界面，丰富的电网监控能力和外部输入输出信号
Simple user interface, abundant grid monitoring capabilities and external input and output signals
- 自动降容功能允许滤波器在温度较高的配电间以降容的模式运行
The auto-descaling feature allows the filter to operate in decapitation mode in hotter distribution rooms
- 紧凑型方案可同时适用于新项目或改造项目
The compact concept can be used for both new and retrofit projects

技术参数

Technical parameters

● 电气参数

Electrical parameters

联接方式 Connection mode	三相三线 / 三相四线 Three-phase three-wire / three-phase four-wire
电压等级 Voltage level	400V/690V (± 20%)
电网频率 Grid frequency	50Hz/60Hz (± 5%)
滤波电流能力 Filtering current capability	50A/75A/100A/125A/150A
零线谐波滤除能力 Neutral harmonic filtering capability	三倍于相线 Three times as much as the phase
模块数量 Number of modules	≤ 8 PCS
冗余功能 Redundancy	主主 / 主从 Master Master / Master Slave
设备损耗 Wear and tear of equipment	≤ 3%
内部保护装置 Internal protection	短路, 过流, 过压, 过热等 Short circuit, overcurrent, overvoltage, overheating, etc

● 滤波器参数

Filter parameters

滤波范围 Filter range	2nd to 51st
谐波选择范围 Harmonic selection range	20次
滤波设定 Filter settings	可对每次谐波电流进行单独设定 Each harmonic current can be set individually
滤波能力 Filtering capabilities	≤ 5% THDi
整机效率 Overall machine efficiency	97.50%
谐波滤除率 Harmonic filtering rate	≥ 98%
涌入电流 Inrush current	少于额定电流值 Less than the rated current value
限流运转 Current-limited operation	限制在额定电流补偿 Limited to rated current compensation
瞬时响应时间 Instantaneous response time	≤ 0.1ms
全响应时间 Full response time	≤ 8ms
噪音 (距离1米) Noise (distance of 1 meter)	≤ 60dB

● 无功补偿参数

Reactive power compensation parameters

目标功率因数 Target power factor	可设定0.6 (感性)-0.6 (容性) Configurable 0.6 (sensitivity) - 0.6 (capacitance)
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● 负载平衡参数

Load balancing parameters

模式 Mode	相相间 Interphased :ON/OFF
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● 编程 / 通讯

Programming / Communication

数字输入输出 Digital inputs and outputs	2 digital inputs/6 digital outputs
报警点 Alarm point	1 NO point, 1 NC point

● 安装

Installation

海拔 Elevation	≤ 1500m, Indoor installation (1% reduction per 100 meters)
环境温度 Ambient temperature	-10° C 至 40° C
湿度 Humidity	95%, 无凝露 No condensation

订货资料 - 选型表

Ordering Information - Selection Table

模块组合示例400V

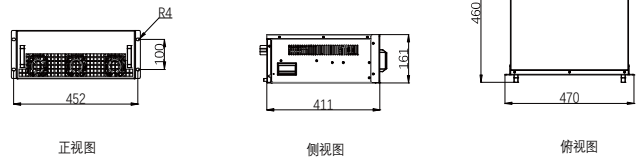
Module combination example 400V

滤波电流 Filtering current	APF 模块组合
50A	HPQ-APF-400V-50A-XL
75A	HPQ-APF-400V-75A-XL
100A	HPQ-APF-400V-100A-XL
125A	HPQ-APF-400V-125A-XL
150A	HPQ-APF-400V-150A-XL
200A	HPQ-APF-400V-100A-XL*2
250A	HPQ-APF-400V-125A-XL*2
300A	HPQ-APF-400V-150A-XL*2
350A	HPQ-APF-400V-100A-XL*2+HPQ-APF-400V-150A-XL
400A	HPQ-APF-400V-100A-XL+HPQ-APF-400V-150A-XL*2
450A	HPQ-APF-400V-150A-XL*3
500A	HPQ-APF-400V-50A-XL+HPQ-APF-400V-150A-XL*3
550A	HPQ-APF-400V-100A-XL+HPQ-APF-400V-150A-XL*3
600A	HPQ-APF-400V-150A-XL*4

产品尺寸

Product dimensions

抽屉式 APF-30A 50A

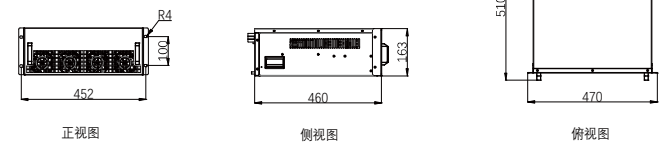


正视图

侧视图

俯视图

抽屉式 APF-75A

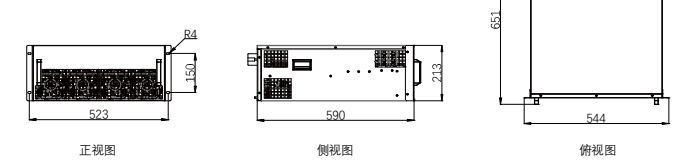


正视图

侧视图

俯视图

抽屉式 APF-100A 150A

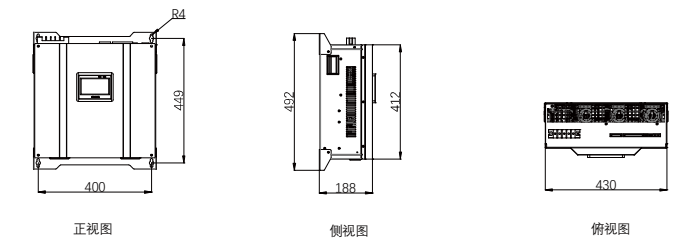


正视图

侧视图

俯视图

壁挂式 APF-30A 50A

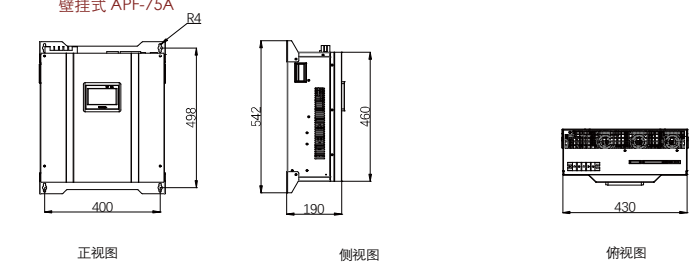


正视图

侧视图

俯视图

壁挂式 APF-75A

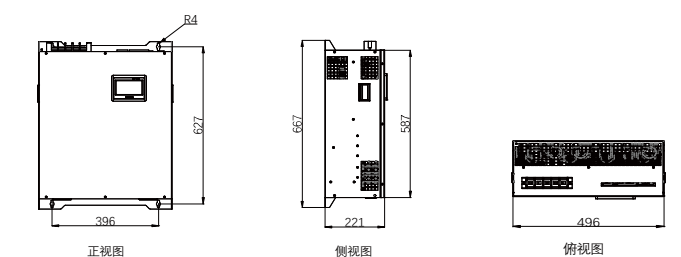


正视图

侧视图

俯视图

壁挂式 APF-100A 150A



正视图

侧视图

俯视图