

# 低压有源电力滤波器 Power<sup>IT</sup> LV Active Filters

PQFI-PQFM-PQFK

1SXF070001C2901 12-2004

电网质量产品



# 低压有源滤波器

## PQFI-PQFM-PQFK

### ABB 应用于谐波动态治理的综合性方案

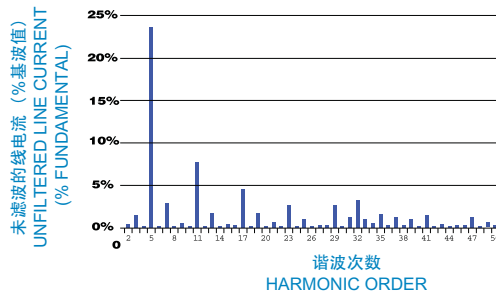
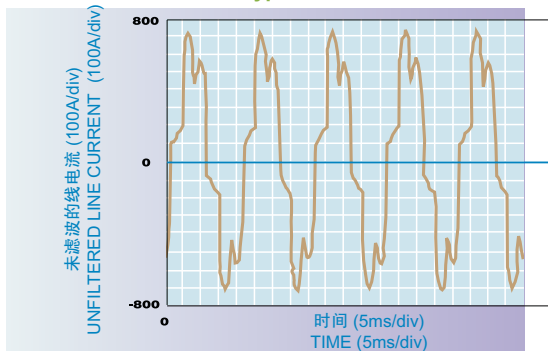
#### 谐波与电网质量

电网质量与供电的波幅、频率和波形畸变等因素相关。供电的波幅、频率很大程度上由发电厂控制，而电流或电压波形的畸变则归因于用电的设备或负载。线性负载，如磁感应电动机、白炽灯泡、电阻发热丝或电容器组，它们的电流波形是和正常电网电压波形一致的正弦波。但如今大部分使用的负载是非线性的，如变频调速设备、整流器、不间断电源、电脑、电视机、节能灯（荧光灯）和复印机等等。这些负载的电流波形不再和电网的正弦电压波形一致，因而产生畸变现象。波形畸变是由于非线性设备产生的谐波而引起的，这些谐波为供电电网和用户带来越来越多的影响和干扰。

#### 谐波可能导致以下严重的问题：

- 造成电缆、电动机和变压器过热
- 损坏敏感的设备
- 引发断路器误动作
- 熔丝提前熔断
- 导致电力设备的过早老化，使用寿命下降
- 造成电容器过载或因故障而损毁
- 导致中性线上出现大电流而引发系统故障
- 诱发电网谐振现象

典型的变频器电流  
Typical VSD current



### ABB 的解决方案：PQF 有源滤波器

ABB 的有源滤波器具有前所未有的能力去滤除电网中的谐波。PQF 是以一种可控的动态方式滤除出现在供电系统中的谐波。它不受电网运行结构改变的影响，如并联电源供电、电网供电和备用发电机之间切换供电等不同供电状况下所引起的系统阻抗变化的影响。

PQF 实时监测线路电流，并把被监测到的谐波转化为数字信号处理器（DSP）中的数字信号。同时；DSP 数字信号处理器产生一系列宽脉冲调制信号（PWM），驱使 IGBT 功率模块通过线路电抗器向电网输出相位正好与电网谐波电流相反而大小相同的电流，两种谐波电流正好相互抵消，从而达到滤除谐波，净化电网电流的目的。

PQF 具备通讯功能，可与用户现有的控制系统通讯。PQF 采用 Modbus RTU 技术，让用户通过 RS232 - RS485 的转换器(可选配件) 轻松实现 Modbus 通讯，远距离监测和控制 PQF。

### The ABB comprehensive solution for active filtering of harmonics

#### Harmonics and Power Quality

Power Quality relates to the amplitude, frequency and distortion of the supply system. While the amplitude and frequency of the supply is largely controlled by the utility, the distortion of the wave (voltage or current) is attributed to the user (of the power) or the loads. Linear loads like an induction motor, an incandescent bulb, resistive heating or a capacitor bank draw a current which follows the wave shape of the supplied voltage (sinusoidal). On the other hand, most of the common loads nowadays are non-linear, like VSDs (Variable Speed Drives), rectifiers, UPS-systems, computers, TV sets, energy efficient (fluorescent) lamps, photocopiers etc. These loads draw a current from the source which does not follow the voltage wave shape and hence introduce distortion.

The distortion is introduced by harmonics generated by the non-linear devices. These harmonics are a growing problem for both electricity suppliers and users.

#### Harmonics can lead to serious problems:

- overheating of cables, motors and transformers
- damage to sensitive equipment
- tripping of circuit breakers
- blowing of fuses
- premature ageing of the installation
- capacitor overloading and failures
- high current in neutral conductors
- excitation of network resonance

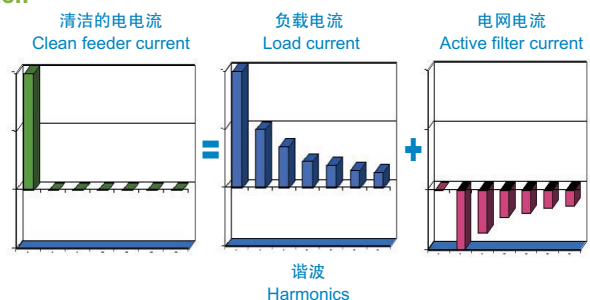
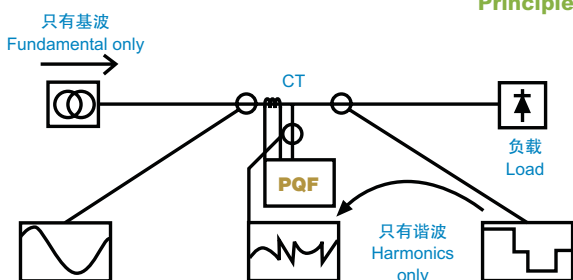
### The ABB Solution: PQF Power Quality Filter

The ABB Power Quality Filter offers unprecedented ability to clean the network from harmonics. The PQF actively eliminates the harmonics present in the supply system in a controlled way. It is insensitive to large network impedance changes due to change in network topology like paralleling of sources, or switching between mains supply and generator operation.

The PQF monitors the line current in real time and processes the measured harmonics as digital signals in a high-power multi-DSP (Digital Signal Processor) based system. The digital controller generates Pulse Width Modulated (PWM) signals that drive IGBT power modules which through line reactors inject harmonic currents in the network with exactly the opposite phase to the components that are to be filtered.

The PQF also offers communication facilities with the customer's existing communication network. This feature which uses Modbus RTU, allows the PQF to be easily monitored and controlled from a remote location. The Modbus communication feature can be used by means of an RS-232 to RS-485 converter (optional).

#### 工作原理 Principle of operation



# 低压有源滤波器

## PQFI-PQFM-PQFK

### PQF：高滤波效能的有源滤波器

PQF为滤除谐波提供了完美的解决方案。使用PQF的效果是滤除畸变的电流波形中的谐波部分而得到干净的正弦电流波形。滤波之后，流过馈电变压器的电流是无谐波电流，因而这些谐波源负载产生的谐波不会给电网带来污染。

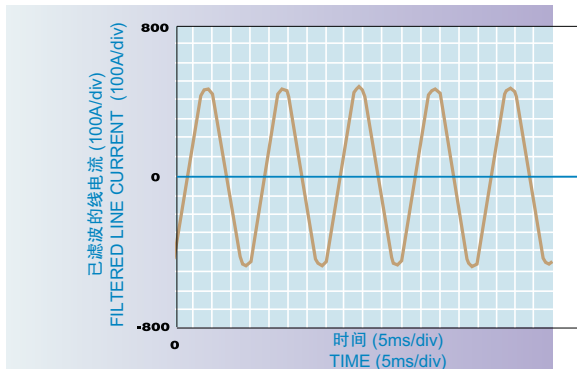
PQF使用闭环反馈控制，这给用户带来的好处是它无需特别的测量设备就可以实现精确的滤波功能。PQF采用数字式控制器，更增强了它在滤波方面的适应性和准确性。

PQF使用的是基于IGBT技术的功率模块，这些功率模块为不同型号的PQF产品量身定制，功能设计上符合不同类型的PQF需要。

ABB具备各种工程领域的经验，具备和不同类型负载打交道的丰富经验，因此能够根据不同的工程需要设计最优化的PQF滤波方案。合理的整体设计确保PQF的控制电路和主回路在电气上完全绝缘。PQF-Manager能够为用户测量各种电网参数，并对PQF进行参数设定和编程控制。

PQF有源滤波器是参照G5/4和IEEE519等各种国际标准中有关谐波的要求而设计。PQF系列有源滤波器符合UL认可和CSA认可，并获得CE认证标志。整个生产制造流程通过ISO9001和ISO14001认证。

线电流—有滤波器工作  
Line current - Filter running



### PQF的优点

- 同时滤除多达20种谐波
- 最高可以滤除到第50次谐波
- 对目标谐波，有效滤波能力可达97%
- 符合国际标准如G5/4、IEEE519的要求
- 使用闭环反馈控制方式保证了更高的滤波精度
- 滤波器不会过载
- 可以设定滤波模式，可以选择滤除谐波的种类
- 实时故障记录和事件记录
- 最高可以直接使用在高达690V电压的场合
- 顶部进线和底部进线方式（对于PQFI是可选的）
- 自动检测电网频率和电流互感器（CT）的极性
- 正常滤波时不产生无功功率
- 可以改变设定以产生无功功率补偿功率因数
- 具备相不平衡补偿能力
- 可以设定不同功能的优先次序
- 设计选型时不需要进行复杂的电网分析
- 不需要采用特制的电流互感器（CT）
- 容易进行容量扩展
- 经工厂调试后才出厂
- 能够自动适应电网的阻抗变化
- 一次回路和控制回路之间以光纤实现完全电气隔离
- 可编程的待机功能和自动重启功能
- 可编程数字式I/O接口
- Modbus RTU通讯协议
- 能同时设定，并存储两套工作参数以针对不同负载状况进行补偿

### PQF：The Ultimate Step in Filtering Efficiency

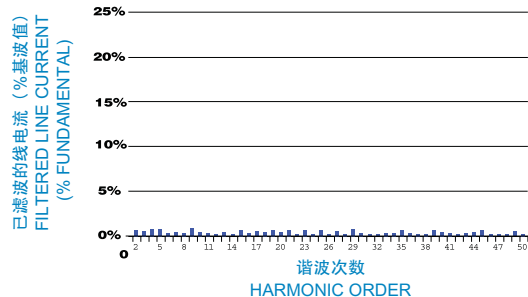
The PQF offers the perfect solution for harmonic filtration. The net effect of a PQF is a clean sine wave due to the elimination of the harmonic content of a distorted current waveform. In other words, the feeding transformer carries a harmonic free current and consequently there is no network pollution introduced by the filtered load.

The closed loop control offers an added advantage of accurate filtering without any need of special measuring devices. The digital controller gives increased flexibility and accuracy in filtering.

The IGBT based power units of the PQF are optimally designed to suit the requirement for each type of PQF. ABB's vast field experience with varied load types gives us added advantage for the best possible design of the PQF. Use of optical fibres ensures complete electrical isolation between the power and control circuits.

The PQF-Manager allows a wide range of choice for measurement of various network parameters, programming and settings of the PQF.

Our PQFs are designed to meet the limitations on harmonic pollution as per various international guidelines like G 5/4, IEEE 519 etc. The complete range of PQF is CE marked. UL recognition and CSA approval are pending for the PQFs up to 600V. PQFs up to 600V will be offered either in CE marked or UL recognised-CSA approved execution. ISO 9001 and ISO 14001 certifications ensure best quality in the manufacturing process.



### Advantages of the PQF

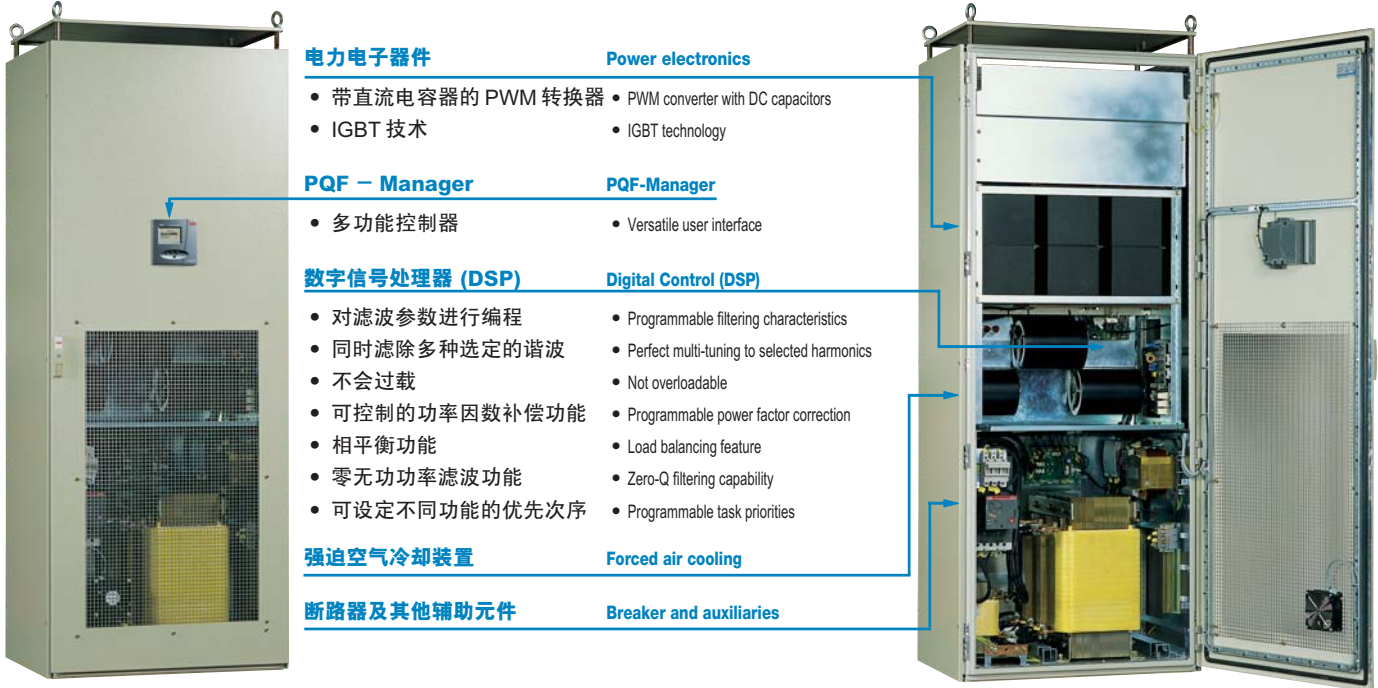
- Filters up to 20 harmonics simultaneously
- Filters up to the 50th harmonic
- Harmonic attenuation factor better than 97%
- Fulfilment of International Guidelines like G5/4, IEEE 519, etc
- Filters with closed loop control for best accuracy
- Is not overloadable
- Has a programmable filtering strategy and free choice of harmonics selection
- Fault and event logging with real time stamp
- Direct connection up to 690V
- Top or bottom cable entry (optional for PQFI)
- Easy commissioning – Auto-detection of CT Polarity
- May filter without generation of reactive power
- May generate reactive power and control power factor
- May balance the load current across the phases
- Has programmable task priorities
- Does not require detailed network analysis
- Does not require special CTs
- Is easy to extend on site
- Comes factory tested
- Auto-adaptation to network impedance changes
- Optical fibre isolation between power and control stages
- Programmable stand-by and re-start functions
- Programmable digital I/O interface
- Modbus RTU communication compatible
- Two sets of compensation parameters for different load type compensation.

# 低压有源滤波器

## PQFI

PQFI : 适用于重工业的大容量有源滤波器

PQFI : The ABB solution for active filtering of harmonics for heavy industrial loads



### 电力电子器件

### Power electronics

- 带直流电容器的 PWM 转换器 • PWM converter with DC capacitors
- IGBT 技术 • IGBT technology

### PQF - Manager

### PQF-Manager

- 多功能控制器 • Versatile user interface

### 数字信号处理器 (DSP)

### Digital Control (DSP)

- 对滤波参数进行编程 • Programmable filtering characteristics
- 同时滤除多种选定的谐波 • Perfect multi-tuning to selected harmonics
- 不会过载 • Not overloadable
- 可控制的功率因数补偿功能 • Programmable power factor correction
- 相平衡功能 • Load balancing feature
- 零无功功率滤波功能 • Zero-Q filtering capability
- 可设定不同功能的优先次序 • Programmable task priorities

### 强迫空气冷却装置

### Forced air cooling

### 断路器及其他辅助元件

### Breaker and auxiliaries

## 产品简述

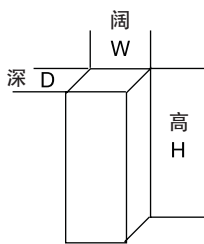
PQFI 有源滤波器由一个控制器和最多可达7个的功率模块组成，与辅助设备一起安装在开关柜中。整个系统由工厂组装，并通过严格测试。PQFI 的标准防护等级为 IP21。

单台 PQFI 有源滤波器标准尺寸为 800 × 600 × 2150mm (宽 × 深 × 高) 构成。如果是主模块和几个从模块安装在一起，那需要考虑安装底座的高度，整体的安装高度将达到 2250mm。

每个单柜单元包括：

- 一个控制器和功率模块 (主滤波单元)
- 一个功率模块 (从滤波单元)

PQFI 滤波器是模块化设计。一个主滤波单元最多可和 7 个从滤波单元并联扩展成为更大容量的滤波系统。PQFI 滤波器提供两组电压等级：208V-480V 和 480V-690V，最高可直接使用在 690V 的系统中。在每组电压等级下均有不同电流规格的功率模块。这些不同电流规格的功率模块在同一电压等级下可按照一定规则组合成新的电流规格。



## Description

The PQFI can consist of one master and up to seven slave units mounted in cubicles together with auxiliary apparatus and wiring to form a factory assembled and tested system. The standard PQFI is offered in IP21 execution.

The dimensions of a single PQFI unit are 800 x 600 x 2150 mm (W x D x H). Large systems consisting of several PQFI units (master + slaves) are mounted on a base frame for a total height of 2250 mm.

The PQFI filter is modular in design. On-site extensions are easily made by adding slave units (maximum seven) in parallel to the master unit. The PQFI is suitable for direct connection up to 690V and is offered in two voltage groups (from 208V to 480V and 480V to 690V). Each voltage group includes units of different ratings. Intermixing of units of both equal and unequal rating is allowed in the same voltage group.



## 典型的应用场合

- 石油和天然气行业
- 钢铁行业
- 水处理行业
- 水泥行业
- 汽车工业
- 过程控制工业
- 造纸业

## Typical Applications

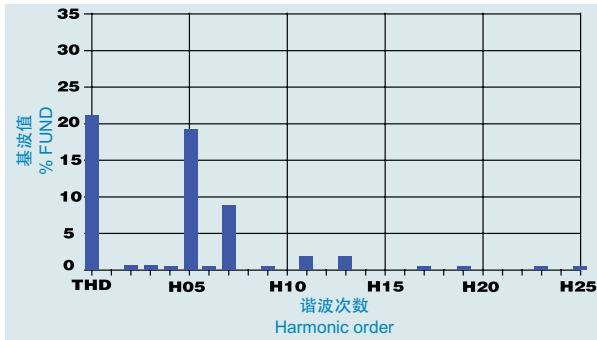
- Oil and gas industry
- Steel industry
- Water industry
- Cement industry
- Automotive industry
- Process plants
- Pulp and paper

# 低压有源滤波器

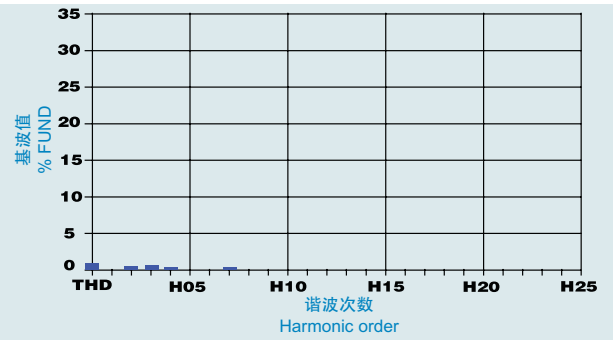
## PQFI

### PQFI 的典型应用效果 (变频装置) Typical result of PQFI application (drives)

没有使用 PQF 的谐波电流  
Harmonic current without PQF



使用了 PQF 后的谐波电流  
Harmonic current with PQF



### 技术参数表

PQFI 有源滤波器连接于电网三相之间，适用于带有中性线或不带中性线的电网系统，可滤除非零序谐波、进行无功功率补偿和相不平衡补偿。

RMS 单模块有效滤除谐波电流能力 (50 Hz / 60 Hz)	208V ≤ U ≤ 480V 250 A 450 A	480V < U ≤ 690V 180 A* 320 A*
CT 的要求	需要 3 个 CT (Class 1.0 或以上精度) 15VA，CT 二次侧电流为 5A	
模块化扩展能力	最多扩展至 8 个功率模块 (同一电压等级下可同时扩展不同电流规格的模块)	
安装组合	一个功率模块	
工作允差	+/- 10% (电压)，+/- 5% (频率)	
可滤除谐波数	从第 2 谐波到第 50 谐波范围内可同时选择 20 种滤波	
滤波程度设定	可对每次谐波进行单独设定	
滤波能力	可高达 97%	
无功功率补偿	功率因数设定范围从感性 0.6 到容性 0.6	
通讯	使用 Modbus RTU 通讯； 采用特定的软件 (PQF-Link) 通过 RS-232 接口通讯	
编程控制	通过 PQF-Manager 和 PQF-Link 软件和计算机 (可选配件)	
有效反应时间	40ms (滤波 10%-90% 以上)	
相平衡补偿	可编程的相平衡功能	
有功功率损耗	损耗少于 5% 额定模块功率	
防护等级	IP21 (开柜门 IP20)，如需更高防护等级请联系 ABB	
安装尺寸 (宽 × 深 × 高)	800 × 600 × 2150mm	
重量 (一个模块)	620kg (450A/320A)、525kg (250A/180A)	
颜色	RAL7032 (米黄色)，可按要求提供其他颜色	
安装环境	室内安装，洁净环境，建议安装海拔高度不超过 1000 米	
环境温度	-5℃ 至 +40℃，更高温的环境，请联系 ABB	
湿度	最大 95%RH (无凝露)	
主要选配件	安装底座 (100mm 高) PQF-Link 软件 RS232-RS485 转换接口 调制解调器接口 打印机 (采用 RS232 接口) 微型断路器位置指示灯 加热器 顶部进线电缆室 IP41 防护等级 浪涌抑制器 温度传感器	

### Technical specifications

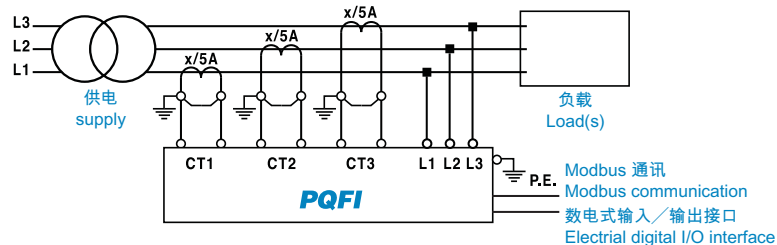
Active filter for three-phase network with or without neutral for filtering of non zero-sequence harmonics and reactive power compensation including load balancing.

RMS current per unit (50 / 60 Hz)	208V ≤ U ≤ 480V 250 A 450 A	480V < U ≤ 690V 180 A* 320 A*
CT requirement	3 CTs required (class 1.0 or better), 15 VA, 5 Amps secondary rating.	
Modularity	Up to 8 units (intermixing of units of both equal and unequal rating is allowed in the same voltage group).	
Physical mounting	One unit per panel.	
Tolerance	+/- 10% in voltage, +/- 5% in frequency.	
Harmonics to filter	20 individual harmonics selectable from 2 <sup>nd</sup> to 50 <sup>th</sup> order.	
Degree of filtering	Individually programmable per harmonic in absolute terms.	
Harmonic attenuation factor (I <sub>s</sub> (source)/I <sub>a</sub> (load))	Better than 97%.	
Reactive Power	Power factor programmable from 0.6 (inductive) to 0.6 (capacitive).	
Communication	Using Modbus RTU. Through RS-232 Port with dedicated software (PQF-Link).	
Programming	Using PQF-Manager. Using optional PQF-Link software and PC (not provided).	
Response time	40 ms (10-90% filtering).	
Load balancing	Programmable load balancing.	
Active Power	Losses less than 5% of the rated power per unit.	
Protection degree	IP21 (IP20 open door). For higher protection degree, please consult us.	
Cubicle dimension (W x D x H)	800 x 600 x 2150 mm.	
Weight (unpacked)	Appr. 620 kg (450A/320A) or 525 kg (250A/180A) per unit.	
Color	RAL 7032 (beige). Other colors on request.	
Environment	Indoor installation in clean environment up to 1000 m altitude. For higher altitudes, please consult us for suitable derating.	
Ambient temperature	-5°C to +40°C. For higher ambient temperature, please consult us for suitable derating.	
Humidity	Maximum 95% RH; non-condensing.	
Main options	Base frame (100 mm). PQF-Link software. RS-232 - RS-485 converter. Modem connection. Printer (RS-232 based). MCB position status lamps. Space heaters. Cubicle for top cable entry. IP41 protection degree. Surge arresters. Temperature probes	

\* 在电压高过 600V (U > 600V) 的系统中使用 PQFI 时，其有效电流规格将随温度升高而自动降容。

\* If the nominal system voltage is higher than 600V (U > 600V) the current rating of PQFI units in this voltage range may be derated automatically depending on the operating temperature.

### 接线图 Connection diagram



# 低压有源滤波器

## PQFM

PQFM : 适用于较小功率工业负载的有源滤波器

PQFM : The ABB solution for active filtering of harmonics for industrial loads of lower capacity



### 接触器和熔断器

### Contactor and fuses

### PQF - Manager

### PQF-Manager

- 多功能的控制器

- Versatile user interface

### 数字信号处理器 (DSP)

### Digital Control (DSP)

- 对滤波参数进行编程
- 同时滤除多种选定的谐波
- 不会过载
- 可控制的功率因数补偿功能
- 相平衡功能
- 零无功功率滤波功能
- 可设定不同功能的优先次序

- Programmable filtering characteristics
- Perfect multi-tuning to selected harmonics
- Not overloadable
- Programmable power factor correction
- Load balancing feature
- Zero-Q filtering capability
- Programmable task priorities

### 电力电子器件

### Power electronics

- 带直流电容器的 PWM 转换器
- IGBT 技术

- PWM converter with DC capacitors
- IGBT technology

### 强迫空气冷却装置

### Forced air cooling

### 顶部 / 底部进线电缆

### Top / bottom cable entry



### 产品简述

PQFM 有源滤波器由一个控制器和最多可达 7 个的功率模块组成，与辅助设备一起安装在开关柜中。整个系统由工厂组装，并通过严格测试。PQFM 的标准防护等级为 IP21，柜内功能板的防护等级为 IP00。

单台 PQFM 有源滤波器标准尺寸为 600 × 600 × 2150mm (宽 × 深 × 高) 构成。如果是主模块和几个从模块安装在一起，那需要考虑安装底座的高度，整体的安装高度将达到 2250mm。柜内功能板的尺寸为 498 × 400 × 1696mm (宽 × 深 × 高)。

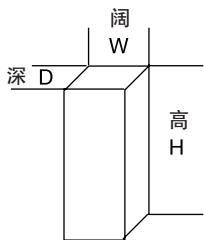
PQFM 滤波器是模块化设计。一个主滤波单元最多可和 7 个从滤波单元并联扩展成为更大容量的滤波系统。PQFM 滤波器提供两组电压等级：208V-480V 和 480V-690V，最高可直接使用在 690V 的系统中。在 208V-480V 电压等级下，有不同电流规格的功率模块。这些不同电流规格的功率模块在 208V-480V 电压等级下可组合成新的电流规格。

### Description

The PQFM can consist of one master and up to seven slave units mounted in cubicles together with auxiliary apparatus and wiring to form a factory assembled and tested system. The standard PQFM is offered in IP21 execution and plate execution (IP00).

The dimensions of a single PQFM unit are 600 x 600 x 2150 mm (W x D x H). Large systems consisting of several PQFM units (master + slaves) can be mounted on a base frame for a total height of 2250 mm. The dimensions of the IP00 execution are 498 x 400 x 1696 mm (W x D x H).

The PQFM filter is modular in design. On-site extensions are easily made by adding slave units (maximum seven) in parallel to the master unit. The PQFM is suitable for direct connection up to 690V and is offered in two voltage groups (from 208V to 480V and 480V to 690V). The 208V to 480V group includes units of different ratings. Intermixing of units of both equal and unequal rating is allowed in this voltage group.



### 典型的应用环境

- 供水和水处理行业
- 钢铁行业
- 石油和天然气行业
- 水泥行业
- 汽车工业
- 过程控制工业
- 造纸业

### Typical Applications

- Water industry
- Steel industry
- Oil and gas industry
- Cement industry
- Automotive industry
- Process plants
- Pulp and paper



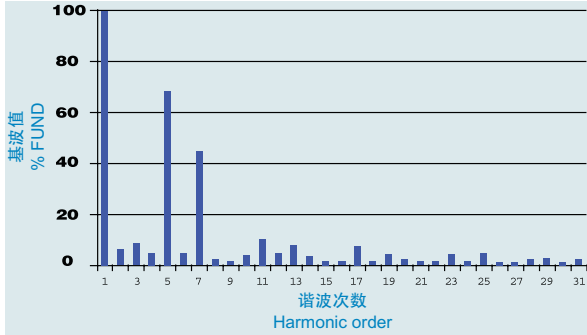
# 低压有源滤波器

## PQFM

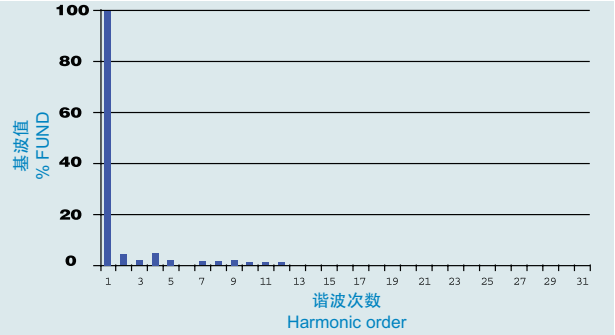
### PQFM 的典型应用效果 (三相 UPS)

#### Typical result of PQFM application (UPS on a three phase network)

没有使用 PQF 的谐波电流  
Harmonic current without PQF



使用了 PQF 后的谐波电流  
Harmonic current with PQF



### PQFM 技术参数表

PQFM 有源滤波器连接于电网三相之间，适用于带有中性线或不带中性线的电网系统，可滤除非零序谐波、进行无功功率补偿和相不平衡补偿。

RMS 单模块有效滤除谐波电流能力 (50 Hz / 60 Hz)	208V ≤ U ≤ 480V 70 A 100 A 130 A	480V < U ≤ 690V 100 A*
CT 的要求	需要 3 个 CT (Class 1.0 或以上精度) 15VA，CT 二次侧电流为 5A	
模块化扩展能力	最多扩展至 8 个功率模块 (同一电压等级下可以同时扩展不同电流规格的模块)	
安装组合	一个功率模块	
工作允差	+/- 10% (电压)， +/- 5% (频率)	
可滤除谐波数	从第 2 谐波到第 50 谐波范围内可同时选择 20 种滤波	
滤波程度设定	可对每次谐波进行单独设定	
滤波能力	可高达 97%	
无功功率补偿	功率因数设定范围从感性 0.6 到容性 0.6	
通讯	使用 Modbus RTU 通讯； 采用特定的软件 (PQF-Link) 通过 RS-232 接口通讯	
编程控制	通过 PQF-Manager、PQF-Link 软件和计算机 (可选配件)	
有效反应时间	40ms (滤波 10%-90% 以上)	
相平衡补偿	可编程的相平衡功能	
有功功率损耗	损耗少于 5% 额定模块功率	
防护等级	IP21 (开柜门 IP20)，如需更高防护等级请联系 ABB	
安装尺寸 (宽 × 深 × 高)	600 × 600 × 2150mm	
重量	IP21: 225kg、IP00: 125kg	
颜色	RAL7032 (米黄色)，可按需提供其他颜色	
安装环境	室内安装，洁净环境，建议安装海拔高度不超过 1000 米	
环境温度	-5℃ 至 +40℃，更高温的环境，请联系 ABB	
湿度	最大 95%RH (无凝露)	
主要选配件	安装底座 (100mm 高) PQF-Link 软件 RS232-RS485 转换接口 调制解调器接口 打印机 (采用 RS232 接口) 主接触器位置指示灯 加热器 IP41 防护等级 浪涌抑制器 温度传感器	

### Technical specifications

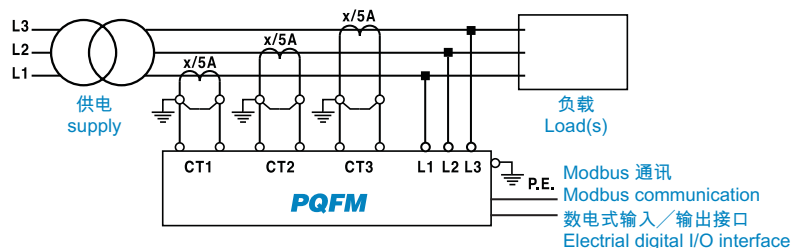
Active filter for three-phase network with or without neutral for filtering of non zero-sequence harmonics and reactive power compensation including load balancing.

RMS current per unit (50 / 60 Hz)	208V ≤ U ≤ 480V 70 A 100 A 130 A	480V < U ≤ 690V 100 A*
CT requirement	3 CTs required (class 1.0 or better), 15 VA, 5 Amps secondary rating.	
Modularity	Up to 8 units (intermixing of units of both equal and unequal rating is allowed in the same voltage group).	
Physical mounting	One unit per panel.	
Tolerance	+/- 10% in voltage, +/- 5% in frequency.	
Harmonics to filter	20 individual harmonics selectable from 2 <sup>nd</sup> to 50 <sup>th</sup> order.	
Degree of filtering	Individually programmable per harmonic in absolute terms.	
Harmonic attenuation factor (I <sub>s</sub> (source)/I <sub>s</sub> (load))	Better than 97%.	
Reactive Power	Power factor programmable from 0.6 (inductive) to 0.6 (capacitive).	
Communication	Using Modbus RTU. Through RS-232 Port with dedicated software (PQF-Link).	
Programming	Using PQF-Manager. Using optional PQF-Link software and PC (not provided).	
Response time	40 ms (10-90% filtering).	
Load balancing	Programmable load balancing.	
Active Power	Losses less than 5% of the rated power per unit.	
Protection degree	IP21 (IP20 open door). For higher protection degree, please consult us.	
Cubicle dimension (W x D x H)	600 x 600 x 2150 mm.	
Weight (unpacked)	IP21:225kg, IP00:125kg	
Color	RAL 7032 (beige). Other colors on request.	
Environment	Indoor installation in clean environment up to 1000 m altitude. For higher altitudes, please consult us for suitable derating.	
Ambient temperature	-5°C to +40°C. For higher ambient temperature, please consult us for suitable derating.	
Humidity	Maximum 95% RH; non-condensing.	
Main options	Base frame (100 mm). PQF-Link software. RS-232 - RS-485 converter. Modem connection. Printer (RS-232 based). Main contactor position status lamps. Space heaters. IP41 protection degree. Surge arresters. Temperature probes.	

\* 在电压高于 600V (U > 600V) 的系统中使用 PQFM 时，其有效电流规格将随温度升高而自动降容。

\* If the nominal system voltage is higher than 600V (U > 600V) the current rating of PQFM units in this voltage range may be derated automatically depending on the operating temperature.

### 接线图 Connection diagram



# 低压有源滤波器

## PQFK

**PQFK : 适用于商业混合型负载的有源滤波器 (包括滤除中性线中的零序谐波)**

**PQFK : The ABB solution for active filtering of harmonics for commercial loads including zero-sequence harmonics in the neutral**



### 接触器和熔断器

### Contactors and fuses

### PQF – Manager

### PQF-Manager

- 多功能的控制器

- Versatile user interface

### 数字信号处理器 (DSP)

### Digital Control (DSP)

- 对滤波参数进行编程
- 同时滤除多种选定的谐波
- 不会过载
- 可控制的功率因数补偿功能
- 相平衡功能
- 零无功功率滤波功能
- 可设定不同功能的优先次序

- Programmable filtering characteristics
- Perfect multi-tuning to selected harmonics (including zero-sequence)
- Not overloadable
- Programmable power factor correction
- Load balancing feature
- Zero-Q filtering capability
- Programmable task priorities

### 电力电子器件

### Power electronics

- 带直流电容器的 PWM 转换器
- IGBT 技术

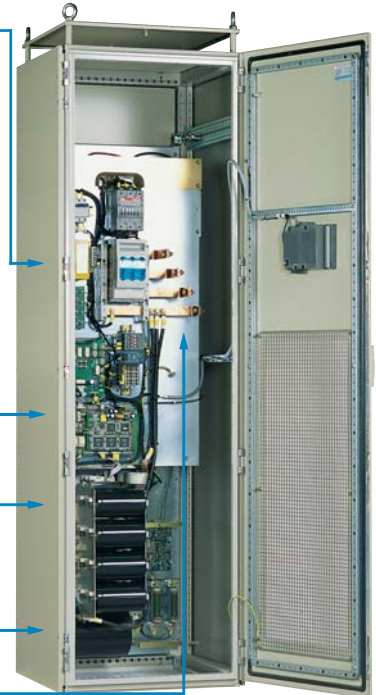
- PWM converter with DC capacitors
- GBT technology

### 强迫空气冷却装置

### Forced air cooling

### 顶部 / 底部进线电缆

### Top / bottom cable entry

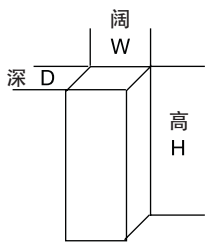


## 说明

PQFK 有源滤波器由一个控制器和最多可达4个的功率模块组成,与辅助设备一起安装在开关柜中。整个系统由工厂组装,并通过严格测试。PQFM 的标准防护等级为 IP21,柜内功能板的防护等级为 IP00。

单台 PQFK 有源滤波器标准尺寸为 600 × 600 × 2150mm (宽 × 深 × 高) 构成。如果是主模块和几个从模块安装在一起,那需要考虑安装底座的高度,整体的安装高度将达到 2250mm。柜内功能板的尺寸为 498 × 400 × 1696mm (宽 × 深 × 高)。

PQFK 滤波器是模块化设计。一个主滤波单元最多可和 3 个从滤波单元并联扩展成为更大容量的滤波系统。PQFK 滤波器最高可直接使用在 415V 的系统中。在 208V-415V 电压等级下,有不同电流规格的功率模块,但是不同电流规格的功率模块不可相互组合。



## Description

The PQFK can consist of one master and up to three slave units mounted in cubicles together with auxiliary apparatus and wiring to form a factory assembled and tested system. The standard PQFK is offered in IP21 execution and plate execution (IP00).

The dimensions of a single PQFK unit are 600 x 600 x 2150 mm (W x D x H). Large systems consisting of several PQFK units (master + slaves) can be mounted on a base frame for a total height of 2250 mm. The dimensions of the IP00 execution are 498 x 400 x 1696 mm (W x D x H).

The PQFK filter is modular in design. On-site extensions are easily made by adding slave units (maximum three) in parallel to the master unit. The PQFK is suitable for direct connection up to 415 V. The PQFK is offered in units of different ratings. Intermixing of units of unequal rating is not allowed.

## 典型的应用环境

- 办公大楼、商业大厦
- UPS 系统
- HVAC
- 计算机中心
- 升降机

## Typical Applications

- Offices and buildings,
- UPS systems,
- HVAC,
- Computer centers,
- Lifts





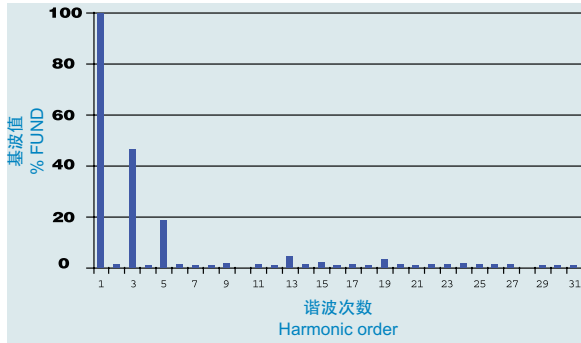
# 低压有源滤波器

## PQFK

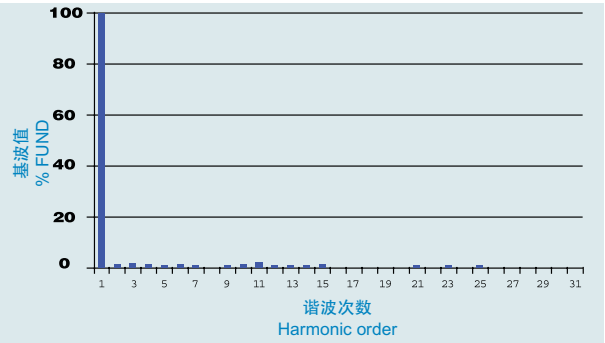
### PQFK 的典型应用效果（商业性负载）

#### Typical result of PQFK application (commercial building)

没有使用 PQF 的谐波电流  
Harmonic current without PQF



使用了 PQF 后的谐波电流  
Harmonic current with PQF

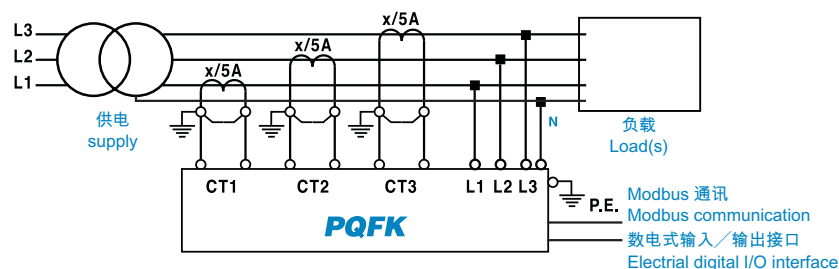


### PQFK 技术参数表

PQFK 同时滤除流过相线和中性线的谐波，包括零序谐波

RMS 单模块有效滤除谐波电流能力 (50 Hz / 60 Hz)	208V ≤ U ≤ 415V 40 A 70 A 100A	RMS current per unit (50 / 60 Hz)	208V ≤ U ≤ 415V 40 A 80 A 100 A
中性线滤波能力	3 倍 RMS 相线滤波	Neutral Current	3 times the line RMS current mentioned above.
CT 的要求	需要 3 个 CT (Class 1.0 或以上精度) 15VA，CT 二次侧电流为 5A	CT requirement	3 CTs required (class 1.0 or better), 15 VA, 5 Amps secondary rating.
模块化扩展能力	最多扩展至 4 个功率模块	Modularity	Up to 8 units (intermixing of units of both equal and unequal rating is allowed in the same voltage group).
安装组合	一个功率模块	Physical mounting	One unit per panel.
工作允差	+/- 10% (电压)，+/- 5% (频率)	Tolerance	+/- 10% in voltage, +/- 5% in frequency.
可滤除谐波数	从第 2 谐波到第 50 谐波范围内可同时选择 15 种滤波	Harmonics to filter	20 individual harmonics selectable from 2 <sup>nd</sup> to 50 <sup>th</sup> order.
滤波程度设定	可对每次谐波进行单独设定	Degree of filtering	Individually programmable per harmonic in absolute terms.
滤波能力	可高达 97%	Harmonic attenuation factor (I <sub>s</sub> (source)/I <sub>r</sub> (load))	Better than 97%.
无功功率补偿	功率因数设定范围从感性 0.6 到容性 0.6	Reactive Power	Power factor programmable from 0.6 (inductive) to 0.6 (capacitive).
通讯	使用 Modbus RTU 通讯； 采用特定的软件 (PQF-Link) 通过 RS-232 接口通讯	Communication	Using Modbus RTU. Through RS-232 Port with dedicated software (PQF-Link).
编程控制	通过 PQF-Manager、PQF-Link 软件和计算机 (可选配件)	Programming	Using PQF-Manager. Using optional PQF-Link software and PC (not provided).
有效反应时间	40ms (滤波 10%-90% 以上)	Response time	40 ms (10-90% filtering).
相平衡补偿	可编程的相平衡功能	Load balancing	Programmable load balancing between phases.
有功功率损耗	损耗少于 5% 额定模块功率	Active Power	Losses less than 5% of the rated power per unit.
防护等级	IP21 (开柜门 IP20)，如需更高防护等级请联系 ABB	Protection degree	IP21 (IP20 open door). For higher protection degree, please consult us.
安装尺寸(宽 × 深 × 高)	600 × 600 × 2150mm	Cubicle dimension (W x D x H)	600 x 600 x 2150 mm
重量	IP21 : 250kg、IP00 : 175kg	Weight (unpacked)	IP21:250kg, IP00:175kg
颜色	RAL7032 (米黄色)，可按需提供其他颜色	Color	RAL 7032 (beige). Other colors on request.
安装环境	室内安装，洁净环境，建议安装海拔高度不超过 1000 米	Environment	Indoor installation in clean environment up to 1000 m altitude. For higher altitudes, please consult us for suitable derating.
环境温度	-5℃ 至 +40℃，更高温的环境，请联系 ABB	Ambient temperature	-5°C to +40°C. For higher ambient temperature, please consult us for suitable derating.
湿度	最大 95%RH (无凝露)	Humidity	Maximum 95% RH; non-condensing.
主要选配件	安装底座 (100mm 高) PQF-Link 软件 RS232-485 转换接口 调制解调器接口 打印机 (采用 RS232 接口) 主接触器位置指示灯 加热器 IP41 防护等级 浪涌抑制器 温度传感器	Main options	Base frame (100 mm). PQF-Link software. RS-232 - RS-485 converter. Modem connection. Printer (RS-232 based). Main contactor position status lamps. Space heaters. IP41 protection degree. Surge arresters. Temperature probes.

### 接线图 Connection diagram



# 低压有源滤波器

## PQF 软件概述

### PQF – Manager

PQF – Manager是图象显示用户界面 (GUI) 设备，作为全系列 PQF 的一个标准配件。它无需通过计算机，即可提供直接控制、编程和监测等功能，还具备通讯功能以及详细的故障和事件记录功能。PQF – Manager (144 × 144mm) 安装在 PQF 前面板上，显示界面为液晶显示屏 (64 × 132 像素)，便于用户随时掌握滤波器的工作状态。

PQF – Manager 提供以下主要功能：

- 启动、终止和重启滤波器
- 测量、分析、记录和打印各种参数
- 对滤波器进行设定
- 监测滤波器的负荷和故障记录
- 提供滤波器各种标识信息

### 操作键

共5个按键(包括上、下、OK、取消、帮助等功能)。使用这些按键，用户可轻松地往返于各种菜单之间和控制 PQF。

### 菜单

有 4 项主菜单：

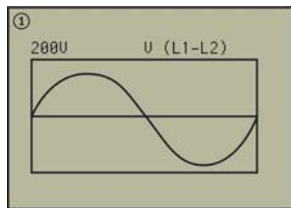
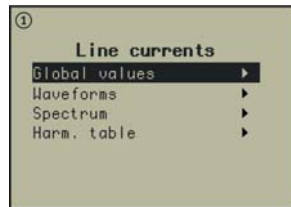
- 数据测量
- 参数设定
- PQF 状态监视
- 关于 PQF

### 数据测量

PQF – Manager 监测以下参数：

- 线路电压\* (RMS 值和基波值)
- 线路电流\* (RMS 值和基波值)
- 频率
- 电压畸变
- 电流畸变
- 相不平衡
- 有功功率 (kW)
- 无功功率 (kvar)
- 视在功率 (kVA)
- 目标功率因数
- 实际功率因数
- DC 直流电压指示
- 最大 IGBT 温度

\* 各次谐波可用表格、柱状图和波形等形式显示。



### The PQF-Manager

The PQF-Manager is the Graphical User Interface provided in all the PQF types as a standard accessory. It offers direct control, programming, monitoring capabilities without a PC, communication facilities and detailed fault and event logging with real time stamp. The PQF-Manager (144 x 144 mm), fitted in the front panel of the PQF with its large LCD screen display (64 x 132 pixel) makes operating the filter very convenient.

The PQF-Manager provides the following main functions :

- Starting, stopping and resetting the filter
- Measurement, analysis, logging and printing of characteristic parameters
- Setting up the filter
- Monitoring the filter load and fault logging
- Providing filter identification information

### Keypad

There are 5 keys which include Up, Down, OK, Escape and Help functions. Using these keys the user easily navigates through the various menus and controls the PQF.

### Menus

Four main menus exist:

- Measurements
- Settings
- PQF monitoring
- About PQF

### Measurements

The PQF-Manager measures all parameters like

- Line voltages\* (RMS and fundamental)
- Line currents\* (RMS and fundamental)
- Filter currents\* (RMS)
- Frequency
- Voltage distortion
- Current distortion
- Line imbalance
- Active power (kW)
- Reactive power (kvar)
- Apparent Power (kVA)
- Displacement PF
- PF
- DC voltage indication
- Max. IGBT temperature

\* Harmonic charts, harmonic tables and waveforms can be displayed.

PQF – Manager 可通过两个温度探头 (可选配件) 来监测两处的温度，可动态指示 PQF 不同部分的温度。

PQF – Manager 具备卓越的最大/最小值记录功能，可显示几乎所有电网参数的限值、最大/最小值和持续时间，以及 2 个外部温度传感器测量到的系统温度。它也能显示电网频率的限值 (最大、最小值)。

As the PQF-Manager allows monitoring of temperatures using two temperature probes (optional), these two temperatures too are displayed.

The PQF-Manager offers an excellent min/max logging function which can display the threshold value, the maximum value and its duration for almost all network parameters listed above and the two temperatures measured by the external temperature probes. It also displays the threshold value for network frequency (both maximum and minimum possible values).

### 参数设定

参数设定菜单有多种子菜单，让用户可设定一系列的PQF参数、目标值、任务优先级和系统的其他参数，如CT的变比、功率模块的额定电流等以及电网参数如电压、频率等...

调试设定是用来设定一些基本的参数，其中包括电网参数、功率模块的额定电流、实时时钟设定、打印和通讯的设定。还有一个CT自动检测程序，可监测CT的连接是否正确，并建议CT的变比。

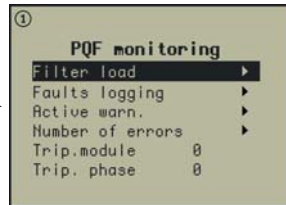
PQF - Manager 不仅具备密码保护功能，而且可在提供侧面加锁功能，防止未经许可擅自更改设置。

### PQF 状态监测

该菜单允许用户察看 PQF 的运行情况，其中包括故障及事件记录。PQF 能够让让用户了解滤波器负荷百分比，并对故障及事件进行实时记录。

### 关于 PQF

在菜单下能够显示 PQF 的产品序列号和软件版本。



### Settings

The Settings menu has various sub menus allowing a wide range of possibilities for the user to set up the PQF parameters, target values, task priorities and installation settings like CT ratio, derating factor, unit current rating, network parameters like voltage and frequency,...

The commissioning settings are used to set the basic parameters which include the network characteristics, unit rating, derating, real time clock settings, print and communication settings. There is also an automatic CT detection program which finds wrong CT connections and proposes CT ratio.

The settings may be protected by a password. A hardware lock is also available on the rear side of the PQF-Manager to avoid any unauthorized or accidental change of PQF-Manager settings.

### PQF Monitoring

This menu allows an overview of the PQF operation including the fault and event log. The PQF loading indicates the percentage of filter capacity used. The faults and events logged have a real time stamp.

### About PQF

This menu shows the serial number and software version of the PQF.

## 强大的功能管理

### 全图形显示

PQF - Manager 的超大液晶显示屏，清楚的显示各种信息、提示和图标。

### 菜单浏览便捷

简单、清晰的菜单结构让浏览更加轻松、直观。

### 实时通讯

PQF - Manager 采用Modbus通讯协议，通过RS485接口(可选配件)，可与用户的监控系统互联。所有的参数调整、设置以及测量均可实现远程操作。

### 帮助按钮

使用帮助按钮可直接进入有关 PQF 功能和特点的介绍。

### 调试简便

自动探测和修正 CT 的极性和变比，并自动检测电网的频率。

### 主设置 / 从设置两套参数

PQF - Manager 可同时设定，并存储两组工作参数。

### 数字式可编程输出、输入端口

PQF - Manager 提供6个数字式输入端口，6个可编程数字式输出端口和2个报警触头。

### 最大 / 最小值记录

PQF - Manager 可记录任何超过设定值的电网参数的持续时间和监测到的最大或最小值。

## Powerful features

### Full graphics display

With its large dimensions and the clear positioning of information, prompts and icons, the PQF-Manager offers a high level of readability and an unprecedented level of viewing comfort.

### Menu navigation

A simple and user friendly organization of menus and items makes the navigation easy and intuitive.

### Communication

The PQF-Manager is provided with Modbus RTU communication features. Through a Modbus RS-485 converter (optional), the PQF can be linked to a supervision system of the customer. All parameters, settings and measurements are accessible remotely.

### Help button

The Help button gives an instant access to a comprehensive description of most of the features and functionality of the PQF.

### Easy commissioning

With automatic detection and correction of CT reversal commissioning is made easy.

### Main /auxiliary parameters

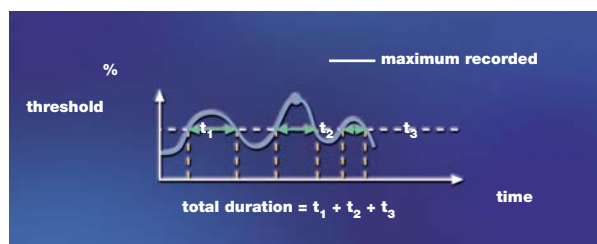
The PQF-Manager allows two sets of parameters for harmonic filtering and reactive power compensation.

### Programmable electrical digital I/O

The PQF-Manager has two opto-isolated digital inputs, six programmable digital outputs and two potential free alarm contacts.

### Min/Max logging

The PQF-Manager can record the total duration any specific network parameter has exceeded the set value as well as record the extreme values measured.



# 低压有源滤波器

## PQF 软件概述

### PQF – Link 软件（可选配件）

PQF – Link 软件安装在计算机上，然后将通过 RS232 串行端口和 PQF 相连，就可实现直接控制、编程和监测功能。

点击 PQF – Link 软件的菜单，就可进入 PQF – Link 的所有功能。

根据登录者的不同级别和权限，会显示不同的功能图标。

### The PQF-Link software (optional)

The PQF-Link software offers direct control, programming and monitoring capability from a PC through the RS-232 serial port.

All the features of the PQF-Link are directly accessible by clicking on the icons of the shortcut menu.

According to the login level of the user, different icons are displayed.

Three different access levels are defined in the login procedure.

### PQF – Link 功能介绍

- **PQF 的详细工作状态信息：**

- ▲ 滤波器已消耗的滤波能力  
(以百分比显示)
- ▲ 故障的历史记录

- **在同一视窗同时显示各种数据的条形图和表格**

- ▲ 线路电压
- ▲ 线路电流
- ▲ 滤波器工作电流

- **显示在一段时间内的电网和滤波器参数波形**

- ▲ 线路电压
- ▲ 线路电流
- ▲ 滤波器工作电流

- **电网信息 (RMS、THD...)**

- **同时显示 3 相波形**

- **动态更新显示的信息和图表**

- **远程对 PQF 进行控制和设置**

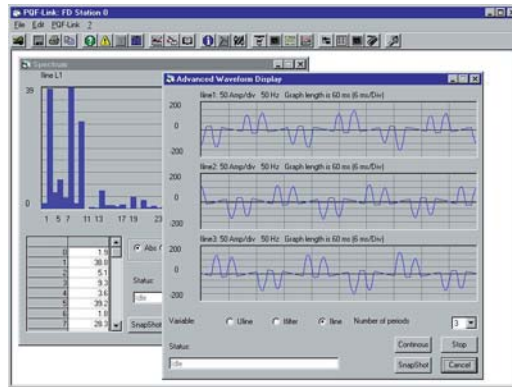
- ▲ 启动 / 关闭
- ▲ 模式选择
- ▲ 无功功率补偿控制和相平衡补偿
- ▲ 谐波滤波程度的设定

- **远程调试设定**

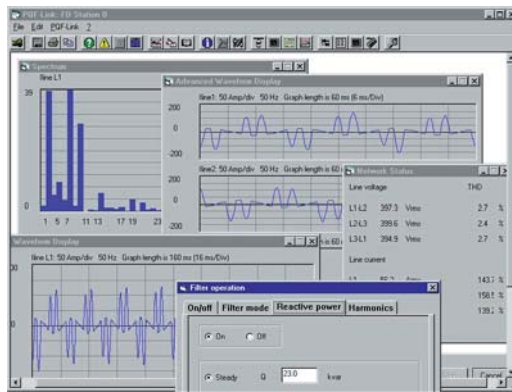
- ▲ 电网基本参数
- ▲ 滤波器传感器设置
- ▲ 滤波器的硬件设置

- **可同时动态显示多个窗口**

- **添加和取消用户名，定义用户级别和权限**



线电流频谱和波形（三相同时显示）  
Line current spectrum and waveform (3 phases) displayed simultaneously



同时显示 多个窗口  
Simultaneous display of several windows

### Particular features include:

- **Detailed information on PQF status:**
  - ▲ % of filter capacity used
  - ▲ Fault history
- **Advanced spectrum display - bar graph and table of values in the same window:**
  - ▲ Line voltages
  - ▲ Line currents
  - ▲ Filter currents
- **Display of the PQF and network waveforms with a variable time base:**
  - ▲ Line voltages
  - ▲ Line currents
  - ▲ Filter currents
- **Network information (RMS, THD, ...)**
- **Simultaneous waveform display for the 3 phases**
- **Continuous updating of displayed information or snapshot display**
- **Remote control and programming of the PQF**
  - ▲ On/off
  - ▲ Mode selection
  - ▲ Reactive power control and load balancing
  - ▲ Harmonic requirements set up
- **Remote installation set-up**
  - ▲ Network characteristics
  - ▲ Filter sensors
  - ▲ Filter hardware
- **Display of several windows simultaneously**
- **Add/remove users and define their access level**

PQF – Link 在 Windows NT（至少第 3 版以上）或 Windows 2000 操作系统下运行。连接计算机的专用电缆随同软件附带。

The PQF-Link works under Windows NT® 4 (Service Pack 3 minimum), or Windows 2000®. A cable for PC connection is supplied with the PQF-Link.

# 低压有源滤波器

## PQF 选型表

### 模块组合例子

### Examples of units combinations

#### PQFI

#### 208V - 480V (电压组 voltage group V1)

#### PQFM

滤波电流 Filter current	PQFI 模块组合 Units combinations for PQFI
250 A	PQFI - V1 - M25
450 A	PQFI - V1 - M45
700 A	PQFI - V1 - M45 + S25
900 A	PQFI - V1 - M45 + S45
1150 A	PQFI - V1 - M45 + S45 + S25
1350 A	PQFI - V1 - M45 + S45 + S45
1600 A	PQFI - V1 - M45 + S45 + S45 + S25
1800 A	PQFI - V1 - M45 + S45 + S45 + S45
2050 A	PQFI - V1 - M45 + S45 + S45 + S45 + S25
2250 A	PQFI - V1 - M45 + S45 + S45 + S45 + S45
2500 A	PQFI - V1 - M45 + S45 + S45 + S45 + S45 + S25
2950 A	PQFI - V1 - M45 + S45 + S45 + S45 + S45 + S45 + S25
3600 A	PQFI - V1 - M45 + S45 + S45 + S45 + S45 + S45 + S45 + S45

M25: Master 250 A      S25: Slave 250 A  
M45: Master 450 A      S45: Slave 450 A

滤波电流 Filter current	PQFM 模块组合 Units combinations for PQFM
70 A	PQFM - V1 - M07
100 A	PQFM - V1 - M10
130 A	PQFM - V1 - M13
170 A	PQFM - V1 - M10 + S07
200 A	PQFM - V1 - M10 + S10
260 A	PQFM - V1 - M13 + S13
300 A	PQFM - V1 - M10 + S10 + S10
360 A	PQFM - V1 - M13 + S13 + S10
400 A	PQFM - V1 - M10 + S10 + S10 + S10
490 A	PQFM - V1 - M13 + S13 + S10 + S10
520 A	PQFM - V1 - M13 + S13 + S13 + S13

M07: Master 70 A      S07: Slave 70 A  
M10: Master 100 A     S10: Slave 100 A  
M13: Master 130 A     S13: Slave 130 A

#### PQFI

#### 480V - 690V (电压组 voltage group V2)

#### PQFM

滤波电流 Filter current	PQFI 模块组合 Units combinations for PQFI
180 A	PQFI - V2 - M18
320 A	PQFI - V2 - M32
500 A	PQFI - V2 - M32 + S18
640 A	PQFI - V2 - M32 + S32
820 A	PQFI - V2 - M32 + S32 + S18
960 A	PQFI - V2 - M32 + S32 + S32
1140 A	PQFI - V2 - M32 + S32 + S32 + S18
1460 A	PQFI - V2 - M32 + S32 + S32 + S32 + S18
1780 A	PQFI - V2 - M32 + S32 + S32 + S32 + S32 + S18
1920 A	PQFI - V2 - M32 + S32 + S32 + S32 + S32 + S32
2100 A	PQFI - V2 - M32 + S32 + S32 + S32 + S32 + S32 + S18
2560 A	PQFI - V2 - M32 + S32 + S32 + S32 + S32 + S32 + S32 + S32

M18: Master 180 A\*      S18: Slave 180 A\*  
M32: Master 320 A\*      S32: Slave 320 A\*

滤波电流 Filter current	PQFM 模块组合 Units combinations for PQFM
100 A	PQFM - V2 - M10
200 A	PQFM - V2 - M10 + S10
300 A	PQFM - V2 - M10 + S10 + S10
400 A	PQFM - V2 - M10 + S10 + S10 + S10
500 A	PQFM - V2 - M10 + S10 + S10 + S10 + S10
600 A	PQFM - V2 - M10 + S10 + S10 + S10 + S10 + S10
700 A	PQFM - V2 - M10 + S10 + S10 + S10 + S10 + S10 + S10
800 A	PQFM - V2 - M10 + S10 + S10 + S10 + S10 + S10 + S10 + S10

M10: Master 100 A\*      S10: Slave 100 A\*

#### PQFK

#### 208V - 415V

#### PQFK

滤波电流 Filter current	PQFK 模块组合 Units combinations for PQFK
40 A	PQFK - M04
70 A	PQFK - M07
100 A	PQFK - M10
140 A	PQFK - M07 + S07
200 A	PQFK - M10 + S10
210 A	PQFK - M07 + S07 + S07

滤波电流 Filter current	PQFK 模块组合 Units combinations for PQFK
300 A	PQFK - M10 + S10 + S10
400 A	PQFK - M10 + S10 + S10 + S10

M1: Master 40 A      S1: Slave 40 A  
M2: Master 70 A      S2: Slave 70 A  
M3: Master 100 A     S3: Slave 100 A

\* 如电压高于 600V (U > 600V) · PQFI 和 PQFM 模块的滤波电流将会相对工作温度而降容

\* If the nominal system voltage is higher than 600V (U>600V) the current rating of PQFI and PQFM units in this voltage range may be derated automatically depending on the operating temperature.



#### ABB (Hong Kong) Ltd.

低压部：  
香港新界大埔  
大埔工业邨大喜街3号  
电话：(852) 2929 3838  
传真：(852) 2929 3505

#### Asea Brown Boveri Jumet S.A.

Zoning Industriel de Jumet  
B-6040 Charleroi  
Belgium  
Tel : +32 71 250 811  
Fax : +32 71 344 007

#### ABB (中国) 有限公司

北京总部：  
中国北京市 100016  
朝阳区酒仙桥路 10 号  
恒通大厦  
电话：(010) 8456 6688  
传真：(010) 8456 9907

长春分公司：  
中国吉林省长春市 130061  
西安大路 16 号  
国际大厦 A 座 7 层 709 室  
电话：(0431) 8926 821 / 23 / 25  
传真：(0431) 8926 835

杭州分公司：  
中国浙江省杭州市 310007  
杭大路 1 号  
黄龙世纪广场 C 区 6 楼 0606 室  
电话：(0571) 8790 1355  
传真：(0571) 8790 1151

成都分公司：  
中国四川省成都市 610041  
人民南路四段 19 号  
威斯頓联邦大厦 10 楼  
电话：(028) 8526 8800  
传真：(028) 8526 8900

广州分公司：  
中国广东省广州市 510620  
天河北路 183 号  
大都会广场 21 楼 1-8 及 16 室  
电话：(020) 8755 8080  
传真：(020) 8755 0172

天津分公司：  
中国天津市 300141  
中山路 290 号  
万科中心办公大楼 2505 室  
电话：(022) 2621 6488  
传真：(022) 2621 6485

哈尔滨分公司：  
中国黑龙江省哈尔滨市 150090  
南岗区长江路 99-9 号  
辰能大厦 14 层  
电话：(0451) 8287 6400/6410  
传真：(0451) 8287 6404

南京分公司：  
中国江苏省南京市 210002  
中山东路 90 号  
华泰证券大厦 17 楼  
电话：(025) 8664 5645  
传真：(025) 8664 5338

重庆分公司：  
中国重庆市 400060  
南坪北路 15 号  
重庆扬子江假日饭店 2 楼  
电话：(023) 6282 6688  
传真：(023) 6280 5369

深圳分公司：  
中国深圳市 518033  
福田区·福虹路  
世贸广场 A 座 23 楼 2302-2304 室  
电话：(0755) 8367 9990  
传真：(0755) 8367 6437

大连分公司：  
中国辽宁省大连市 116011  
西岗区中山路 147 号  
森茂大厦 12 楼  
电话：(0411) 8369 6021/6632  
传真：(0411) 8360 3380

上海分公司：  
中国上海市 200001  
西藏中路 268 号  
来福士广场 (办公楼) 35 楼  
电话：(021) 6122 8888  
传真：(021) 6122 8500

济南分公司：  
中国山东省济南市 250011  
泉城路 17 号  
华能大厦 8 楼 8801 室  
电话：(0531) 6092 726  
传真：(0531) 6092 724

昆明分公司：  
中国云南省昆明市 650011  
青年路 399 号  
邦克饭店 6 楼 601 室  
电话：(0871) 3158 188  
传真：(0871) 3158 188

西安分公司：  
中国陕西省西安市 710075  
高新开发区高新路  
高新国际商务中心数码大厦 16 层  
电话：(029) 8833 7288  
传真：(029) 8833 7297

武汉分公司：  
中国湖北省武汉市 430071  
武昌中南路 7 号  
中商广场写字楼 34 楼 B3408  
电话：(027) 8725 9222  
传真：(027) 8725 9233

郑州分公司：  
中国河南省郑州市 450007  
中原西路 220 号  
裕达国际贸易中心 A 座 2207 室  
电话：(0371) 7713 588  
传真：(0371) 7713 873

福州分公司：  
中国福建省福州市 350003  
五四路 158 号  
环球广场 30 层 B 室  
电话：(0591) 8785 8224  
传真：(0591) 8781 4889

沈阳分公司：  
中国辽宁省沈阳市 110001  
和平区南京北街 206 号  
沈阳假日大厦城市广场二座 3-166 室  
电话：(024) 2334 1818  
传真：(024) 2334 1306

青岛分公司：  
中国山东省青岛市 266071  
香港中路 12 号  
丰合广场 B 区 310 室  
电话：(0532) 5026 396 / 97 / 98  
传真：(0532) 5026 395

长沙分公司：  
中国湖南省长沙市 410005  
黄兴中路 88 号  
平和堂商务楼 12B01  
电话：(0731) 2562 898  
传真：(0731) 4445 519

南宁分公司：  
中国广西省南宁市 530012  
新民路 34-18 号  
大明大厦 10 楼 D 座  
电话：(0771) 2827 123  
传真：(0771) 2827 110

<http://www.abb.com>

ABB 低压产品客户服务热线

电话：800-820-9696

电邮：LV-hotline@cn.abb.com