Low Voltage Power Quality
Active Harmonic Filters

Increase the operating life of equipment and prevent expensive downtimes with Active Filters for mitigation of Harmonic Distortion on Low Voltage Networks

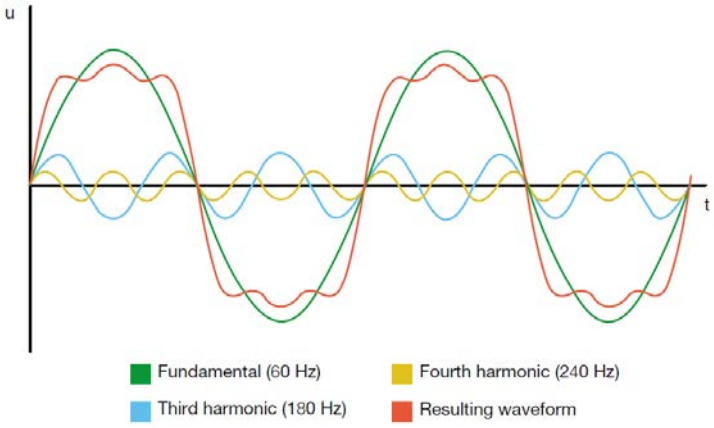
What are Harmonics?

A harmonic is defined as an integer multiple of the fundamental frequency of any given waveform. In the process of manipulating the power drawn, most non-linear devices throw back disturbances right at the source, which then spreads across the network. This manifests itself as smaller amplitude waveforms of higher frequencies that are multiples of the fundamental frequency. Each of these multiples constitutes a harmonic and the cumulative result is a highly distorted waveform, very different from the sinusoidal waveform it originally was. These harmonics are best represented by the Fourier series below and are defined as total harmonic distortion (THD) of current and voltage or as total demand distortion (TDD) of current. IEEE 519-1992 stipulates that TDD should be 5% or less, at the point of common coupling (PCC) on networks below 69kV.

$$THD = \frac{\sqrt{\sum_{k=2} C_k^2}}{C_1} \qquad TDD_I = \frac{\sqrt{\sum_{k=2} I_k^2}}{I_L}$$

Where do Harmonics originate?

An increasing number of electrical devices in recent years tend to incorporate some form of electronic switching, which typically involves rectifying, chopping and inverting the waveform in order to achieve a specific output and it is this manipulation of waveforms which creates harmonics. Such devices are called non-linear and include LED & CFL lighting, UPS, computers, battery chargers and most significantly, variable frequency drives (VFD).



What are the effects of Harmonics on an LV network?

The unwanted effects of harmonics can be significant andoften manifest themselves when least expected ...

- Heating of equipment/cables due to I^2R loss and Skin effect
- Negative torque in motors, leading to overload and overheating
- Nuisance tripping of breakers & fuses due to "ghost" currents
- Increased risk of resonance conditions
- Inefficient operation and unnecessary downtime
- Disturbance to nearby equipment (critical issue in hospitals)
- Disturbance to neighbouring networks
- Reduced equipment operating life, higher maintenance costs

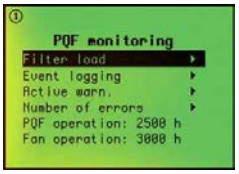
The key risk lies in the fact that harmonics, being invisible for the most part, often go unnoticed until there's a problem. Some measurement and site-analysis is needed to detect these disturbances in the first place, all the more on networks that have non-linear equipment installed on them.

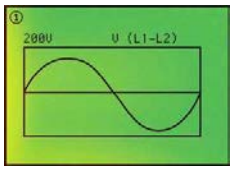
How do ABB Active Filters help remove harmonics?

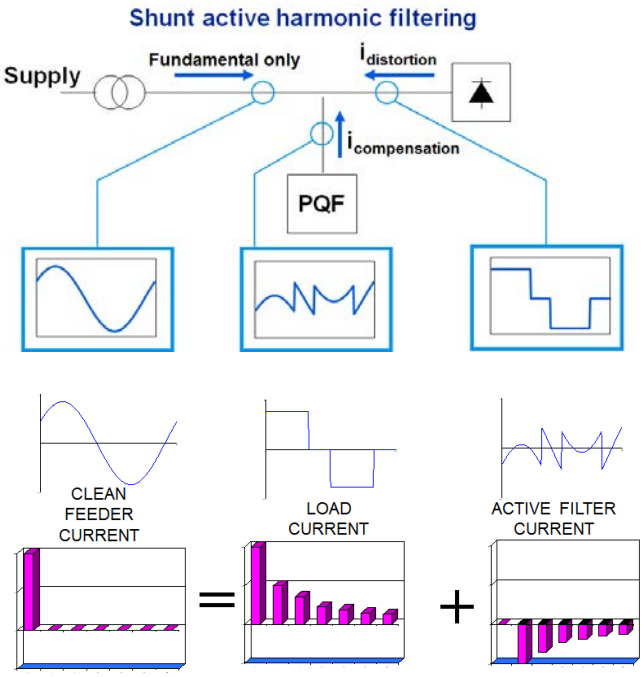
ABB PQFI and PQFM active harmonic filters measure the harmonic distortion at the supply side and send out a corrective waveform that cancels out or minimizes distortion across the network, resulting in a near-perfect simusoidal waveform, which is as it should be. Our filters cancel out up to 20 harmonics simultaneously, all the way up to the 50th harmonic based on set values, always in a closed loop process that is both precise and near-instantaneous (<0.5ms). Any capacity left over from harmonics mitigation is available for balancing loads on the network and also to provide a small degree of incremental reactive compensation if required. Performance wise, ABB active filters are the very best available today.

What Active Harmonic Filter options does ABB offer?

The **cULus** approved ranges sold in Canada are as follows: **PQFI** is a robust product designed for heavy industrial loads more commonly found in mining and O&G. It is available in 600V versions, for 180A_{rms} or 320A_{rms} and multiples thereof. Scalable master-slave combinations with upto seven slaves allow for higher ratings. Master-master combinations allow for fully redundant solutions when needed. **PQFM** is designed for light industrial environments such as water/wastewater, factories, office towers, etc., and comes with a smaller footprint compared to PQFI. It is available in 600V versions for 100A_{rms} or multiples thereof with the master-slave option. Here again, we have the master-master option for redundancy. Both PQFI and PQFM are floor-standing and come with top or bottom cable entry options. A common controller called **PQF-Manager** allows easy, menu-driven parameter settings together with alpha-numeric and graphical displays of status and values on a monochrome LCD display. Communication options include Modbus and Ethernet.







Typical applications and verticals:

- Water pumping and wastewater plants
- Mining and extraction operations
- Hospitals, office towers and data centres
- Oil & gas installations (both onshore and offshore)
- Marine and railway applications
- Any process plants that have VFD's installed

Key customer benefits:

- Robust design & build suitable for demanding applications
- Simple to select, setup and operate
- Reduced downtime and higher efficiency of operation
- Reduced maintenance and replacement costs
- Longer equipment operating life
- Compliance to utility guidelines helps avoid penalties

PQFI PQFM

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