How to evaluate the performance of an APF (active power filter)

Something you need to know before we talk about APF

Most equipment in the power industry are powered by AC. Ideally, the power supply provides a voltage of sin waveform to the grid at a fixed frequency (50Hz or 60Hz). The grid can be viewed as a linear system. The voltage and current values in this system will have sinusoidal changes of the same frequency as the power supply. The only differences are their amplitude and phase.

However, with the rapid development of power electronics technology, nonlinear loads in the power system increase rapidly. There is a big gap between the actual system and the ideal system. It is directly manifested as periodic distortion of voltage and current waveforms. From the perspective of frequency domain analysis, these waveforms not only contain fundamental sinusoidal components of the same frequency as the power supply, but also include a series of high-frequency sinusoidal components whose frequencies are integer multiples of the

fundamental frequency. These high frequency components are collectively referred to as power system harmonics.

Harmonics are an important factor affecting the normal operation of the power grid. It may endanger the stability of the power system, the security of communications, and the application of electrical appliances. Now the ''harmonic pollution' has gradually attracted people's eyes. At this time, the application of APF (active power filter) has gradually become the focus of researchers.

What is APF ?

Active power filters (APF) are filters, which can perform the job of harmonic elimination. Active power filters can be used to filter out harmonics in the power system which are significantly below the switching frequency of the filter. The active power filters are used to filter out both higher and lower order harmonics in the power system.

There are different active power filters according to their type —shunt and series.

Shunt active filters are used to compensate current harmonics of nonlinear loads to perform reactive power compensation and to balance the imbalance currents. A shunt active filter senses the load current and injects a current into the system to compensate current harmonics or reactive load.

The series active power filter injects a voltage fundamental component in series with the supply voltage and, consequently, can be regarded as a controlled voltage source, compensating voltage sags, and swells on the load side.

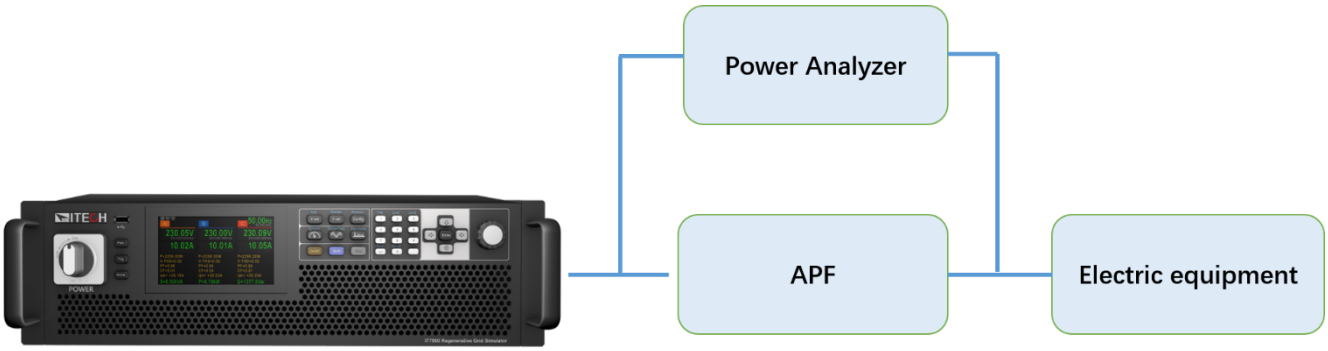

figure 1

Test equipment for APF performance evaluation – ITECH IT7900 regenerative grid simulation

ITECH IT7900 regenerative grid simulator can simulate harmonic, inter-harmonic and harmonic synthesis. By setting the amplitude and phase, it can simulate up to 50 harmonics (fundamental frequency is 50Hz or 60Hz), and form a periodic distorted waveform. At the same time, it has built-in 30 harmonic distortion waveforms for users to quickly recall. It helps achieve single-phase harmonic, three-phase harmonic and three-phase harmonic unbalanced output.

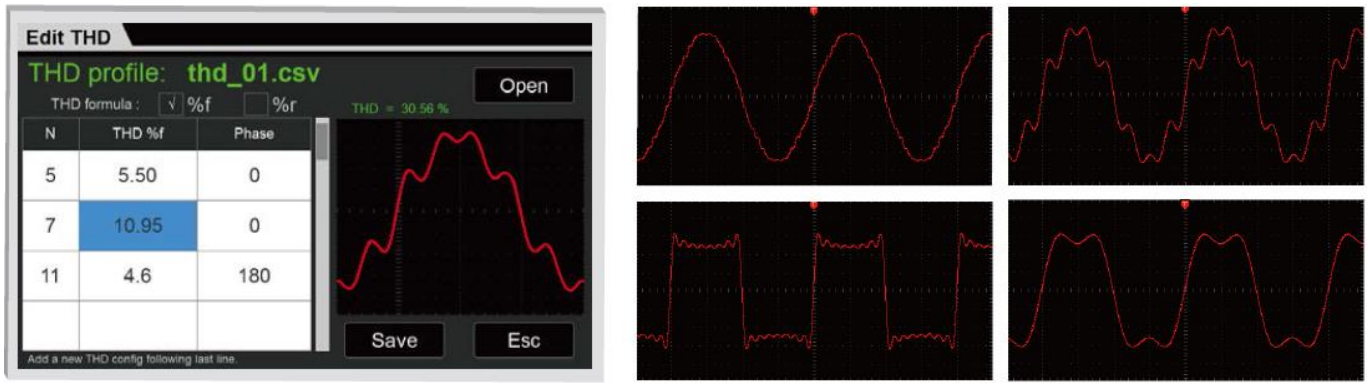

figure 2

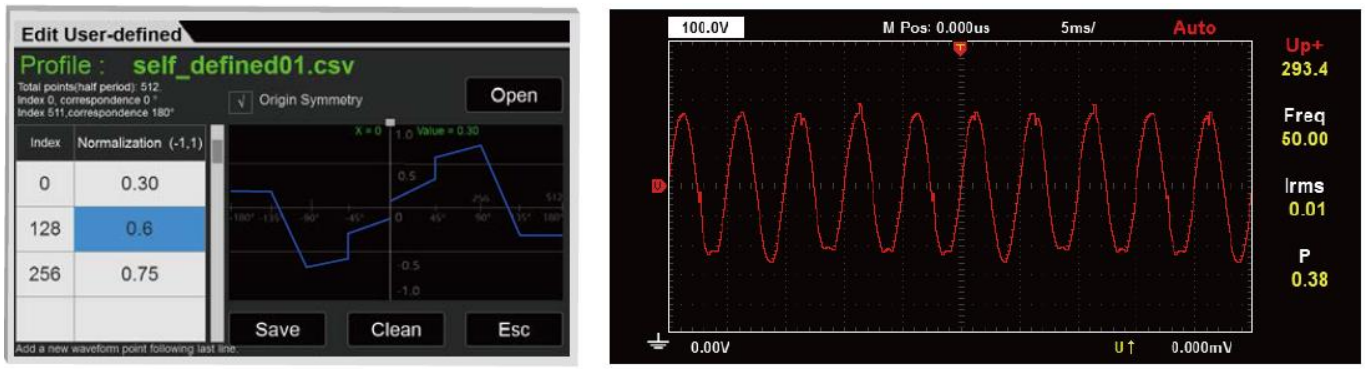

figure 3

At the same time, IT7900 regenerative grid simulator allows users to edit harmonic waveforms, which make it much easier for testing of harmonic output.

IT7900 regenerative grid simulator, a full four-quadrant power source, can be used to the applications of various grid-connected products, such as PCS, energy storage system, micro grid, BOBC (V2X), power hardware in the loop (PHiL) and so on. With its built-in islanding test mode and settable parameters like R, L, C, active and reactive power, it can simulate the nonlinear load of the power grid, which helps to fulfill the anti-islanding protection test well. The IT7900 grid simulator is also regenerative, which means it can feedback the power to the grid with high efficiency of maximum 95%, saving your electricity cost and eco-friendly too.

IT7900 Regenerative Grid Simulator

Highlighted Features

- High power density/minimum rack space, 3U up to 15kVA,16Hz~150Hz
- Regenerative grid simulator & full 4-Quadrant AC&DC power sources
- Power Amplifier function for PHiL applications
- Professional anti-islanding test mode, can set and simulate the RLC (resistive-inductive-capacitive), active and reactive power circuit for anti-islanding detection
- Three working modes: CV/Current Limit/Power Limit
- AC, DC, AC+DC or DC+AC output capability
- Comprehensive working modes selectable: single-phase, three-phase, reversed phase and multi-channel*2
- Programmable Output Impedance, allows simulation of Real-World Utility Grid Impedance*1
- Compliance tests incl LVRT /Phase Jump/Frequency variation /Harmonic Injection
- Supported regulatory testing include IEC61000-4-11/4-13/4-14 /4-28 etc.

Related information

- IT7900 Regenerative Grid Simulator

ITECH
YOUR POWER TESTING SOLUTION

For more information, pls. visit www.itechate.com or send email to info@itechate.com .

We are always here for you.