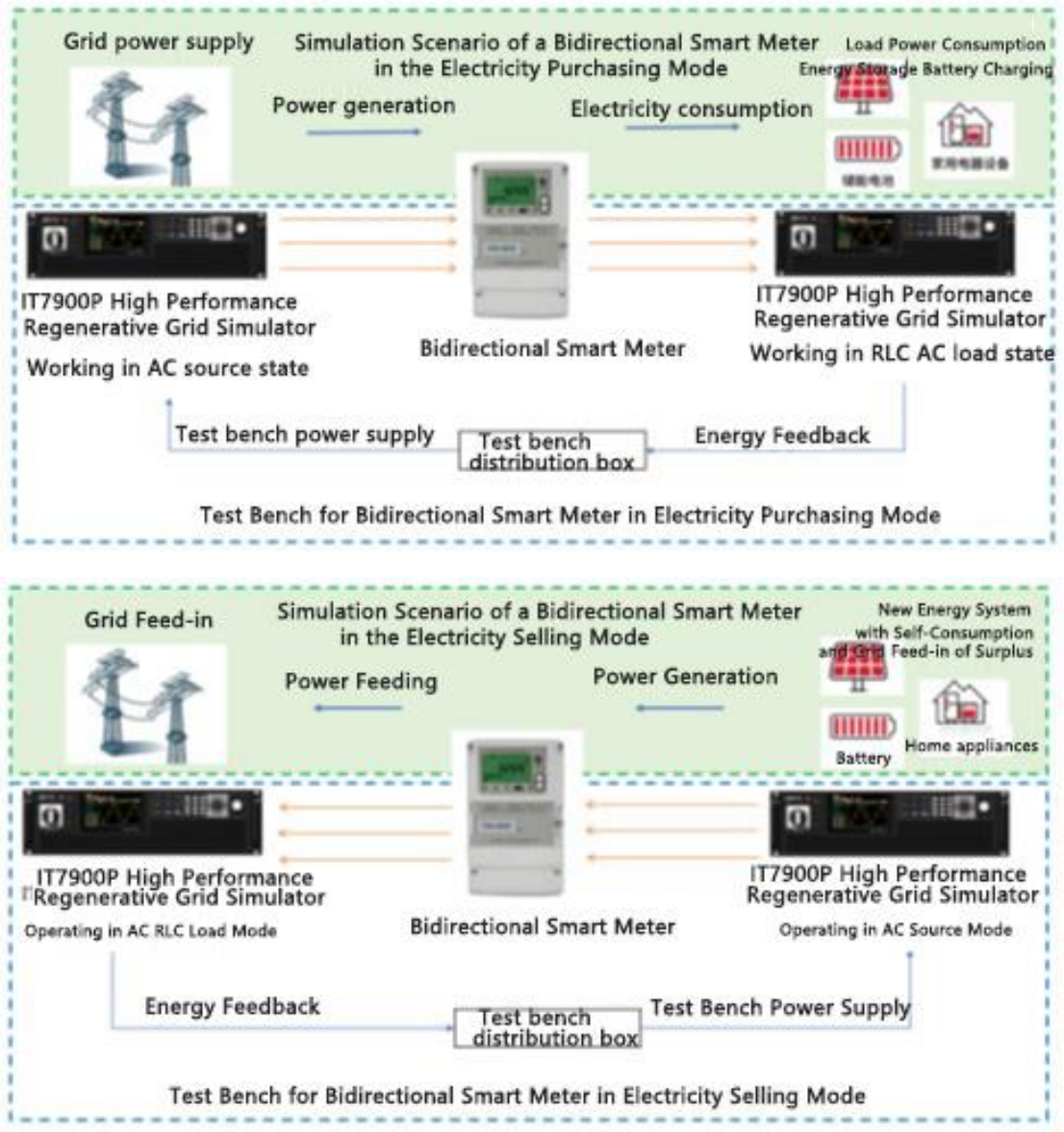
Bidirectional Smart Meter Testing Implemented with the IT7900P High-Performance Grid Simulator

At present, the imbalance between global energy supply and demand has become increasingly pronounced, while mounting environmental protection pressures have created an urgent need to promote renewable energy generation and to strengthen power management. With the continuous expansion of renewable power generation, its impact on grid architecture, power quality, and operational stability has grown significantly. Consequently, power equipment is advancing toward higher levels of intelligence, wireless communication, and system integration, in order to meet the ongoing demand for upgrades. At the end-user level, where millions of households are connected to the grid, meters serving as instruments for grid monitoring and management have also evolved accordingly, leading to the emergence of new models such as smart meters and bidirectional smart meters.

Bidirectional Smart Meter Testing

When a household installs photovoltaic (PV) solar panels, the generated electricity can be consumed locally to reduce electricity purchase costs, while any surplus energy can be fed back into the grid for financial compensation. This model is commonly referred to as “self-consumption with surplus feed-in.” In the process of applying for residential PV generation, the utility company typically upgrades the user’s meter to a bidirectional smart meter. Such meters are capable of separately measuring the energy fed into the grid and the energy consumed from the grid. Compared with the earlier solution of using two unidirectional meters, bidirectional smart meters provide advantages in terms of lower cost, reduced installation complexity, easier maintenance, and more straightforward operation.

Based on the structural characteristics of bidirectional smart meters, both meter manufacturers and testing institutions seek to employ dedicated bidirectional testing equipment to establish platforms for evaluating the electrical performance and electromagnetic compatibility (EMC) of such meters. However, four-quadrant AC power sources available on the market have long been scarce, and their parameter specifications are often not well suited to the requirements of meter testing. The IT7900P High-Performance Grid Simulator, part of ITECH’s new generation of AC testing solutions, integrates high performance, flexibility, precision, and power density. It provides a simplified and more efficient testing approach for smart meter verification.



ITECH Bidirectional Smart Meter Test Solution

The IT7900P high-performance grid simulator provides a leading integrated testing solution. In source mode, it functions as a high-power AC power supply and can also operate as a grid simulator. In load mode, it acts as a regenerative AC/DC electronic load. Bidirectional testing can be performed without changing the wiring. Its highly efficient energy regeneration capability allows power to be fed back into the local grid without pollution, reducing electricity consumption and heat dissipation while meeting energy-saving and environmental protection requirements.

Electrical Performance Testing of Smart Meters

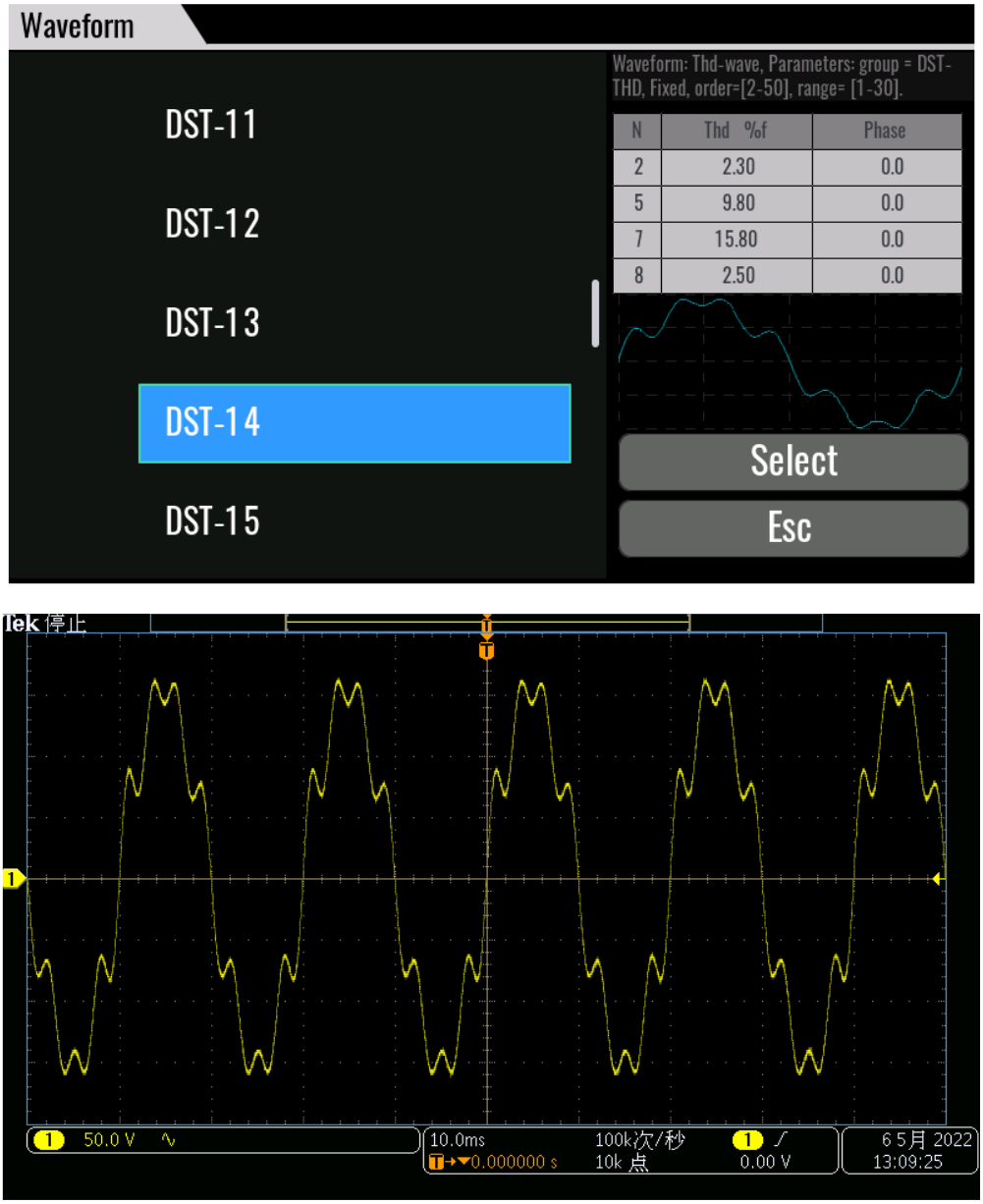
ITECH's new-generation AC testing solutions also include products such as the IT7800 high-power AC power supply, the IT7900 regenerative grid simulator, and the IT8200 regenerative AC/DC electronic load, which are compatible with unidirectional meters. These products demonstrate excellent performance:

- **High power density:** 2U units reach up to 6 kVA, 3U units up to 15 kVA, and master-slave parallel operation can expand power up to 960 kVA, covering the full range of smart meter power requirements.
- **Single-machine single/three-phase switching:** The maximum phase voltage of a single unit can reach 700 V,

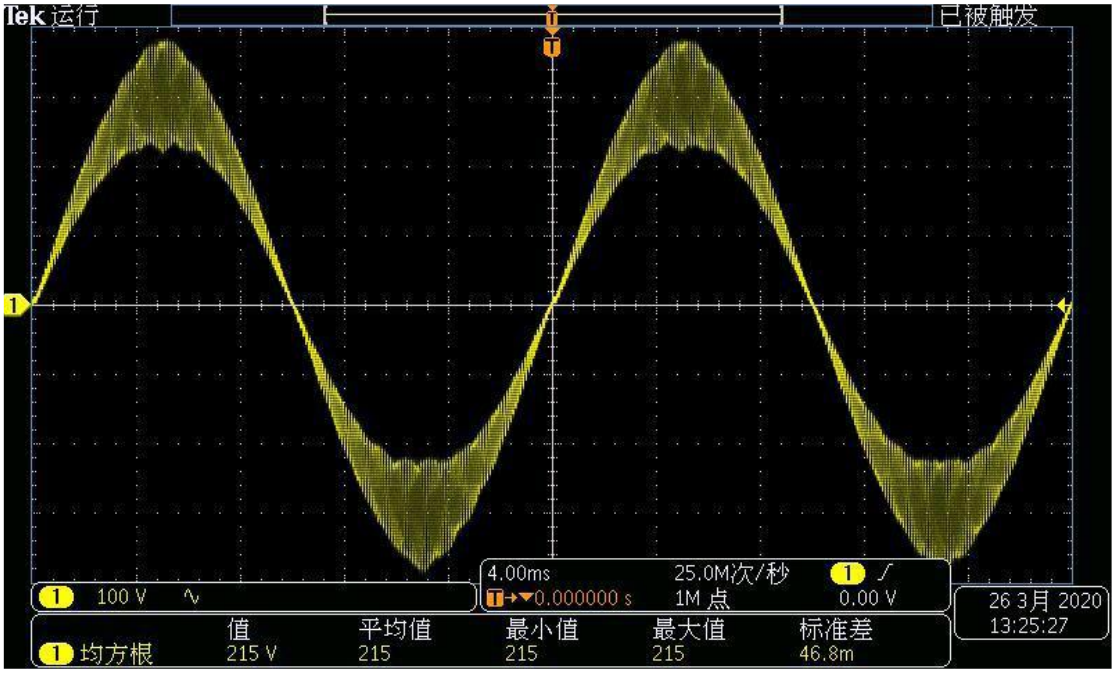
accommodating wide-range meter testing needs.

- **Built-in IEC power supply anti-interference testing standards:** No waveform editing is required.
- 50th harmonic, subharmonic simulation function, 30 built-in harmonic waveforms, surge and notch, user-defined waveform function, simulation of three-phase unbalance, three-phase harmonic unbalance, phase loss test, etc., enabling evaluation of meter performance under various complex grid conditions.
- The 79P and 82 load function products support both rectified and non-rectified, providing multiple operating modes including CC, CR, CP, CS, CC+CR, and CE. The CE mode can simulate single-phase rectified RLC circuits and parallel RLC circuits, replicating diverse complex load scenarios.
- **User-friendly interface:** Features a color touchscreen, integrated power meter, and waveform display. At a minimum recording interval of 100 ms, a single unit can continuously record data for 7 hours, capturing complete test curves from start to finish, enabling long-duration testing and data logging.

One global smart meter customer highlighted the IT7800 high-power AC power supply during its application, particularly noting the convenience of arbitrary waveform generation and the 30 built-in harmonic waveforms, which allow rapid verification of meter performance under non-standard power network conditions.



IT7800 built-in harmonic waveform interface and output



ITECH AC power arbitrary waveform generation function test smart meter case

The comprehensive measurement capabilities of ITECH's new-generation AC power supply series make them widely applicable across multiple stages of R&D, production, and quality inspection in fields such as renewable energy, power electronics, and academic research. The IT6000C bidirectional DC power supply can also be used for testing DC meters. For more application information, please visit the ITECH official website at www.itechate.com.

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

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