

Technical Article

Great expectations: why engineers demand form and function from modern test devices

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Abstract: *Engineers increasingly expect test equipment to combine advanced functionality with intuitive, user-friendly design, mirroring the seamless experiences of consumer electronics. This article explores how modern AC programmable power sources meet these demands by delivering high performance, flexibility, and ease of use, enabling more efficient, reliable, and productive testing across industries.*

There has been a strong emphasis on user experience within the consumer electronics sector, with suppliers working hard to ensure that devices such as mobile phones are intuitive and easy to use. Efforts to elevate the look and feel of handsets have led to clean, logical designs and interfaces that support smooth performance and provide a sense of emotional satisfaction.

This focus on user experience has also started to influence the B2B market, with engineers – shaped by their experience of the electronics they use at home – expecting the same level of intuitive design and ease of use in professional devices such as test equipment. They want to use equipment that can be set up quickly and operated efficiently, allowing them to work more productively in their day – and ultimately deliver greater value to their organisations.



Theme image. (Source: stock.adobe.com/Orkhan)

AC power sources in action

Let's look at what that means in practice with the latest generation of test devices, specifically alternating current (AC) power sources, a foundational building block for our more electrified world. These advanced instruments generate highly controllable AC waveforms, allowing users to select different parameters such as voltage, frequency, phase, and waveform shape.

The outputs confirm the performance, reliability, and safety of a broad range of electrical and electronic devices by simulating various power conditions they might encounter in the real world. In aerospace, for instance, aircraft power systems operating at 115 Vac and 400 Hz are susceptible to harmonics from nonlinear loads, such as converters and lighting systems, which can degrade power quality. AC power sources are used to validate avionics systems, including communication equipment, flight controls, and cockpit lighting, ensuring stability under real-world aircraft power conditions and confirming the robustness of critical avionics systems against harmonic interference in aircraft power networks.

Meanwhile, in the automotive sector, electric vehicles (EVs) are charged using various global power grids, which often contain harmonics. Programmable AC sources can simulate these conditions for testing, verifying the functionality of EV chargers and DC-DC converters under harmonic influence, ensuring protection mechanisms operate correctly during high distortion and complying with international standards (e.g., IEC 61000-4-7) to ensure global compatibility of chargers.

These scenarios indicate how modern AC programmable power can be used across a diverse range of industries and applications, and functionality is key. Increasingly, test and development engineers are seeking high-power density AC programmable power sources with advanced capabilities such as waveform generation and harmonics analysis as standard. These devices must deliver rated current across the full voltage range with high-purity signals so that tests can be performed comprehensively, reliably, and repeatably, making the best use of time and resources.

Why ease of operation is key

Yet, as mentioned, modern-day test engineers want form as well as function, preferring to work with AC programmable power sources that help them go about their daily tasks in the most time-efficient manner. These individuals want highly automated and easily programmable settings that can be accessed without restrictions, making the most of their time in the laboratory, leading to productivity and cost savings. They also want these devices to be lightweight, flexible, robust, and easy to integrate. Intuitive design with ease of use in mind is also a need-to-have, allowing quick and easy integration into testing operations with minimum setup times and, therefore, supporting more streamlined working for time-pressed engineers.

Here, again, the last generation of AC programmable power sources manages to fit the bill in a number of different ways. From a usability point of view, pre-programmed test standards for common IEC, aerospace, and marine tests in the graphical user interface (GUI) software are an attractive feature. This functionality means engineers can quickly set up and complete complex test sequences, saving time. The latest devices are also designed to be field upgradeable, allowing engineers to update equipment with the latest features and capabilities while maintaining continuity and eliminating the need to return devices to the manufacturer. No programming limitations are a boost, too. This functionality is crucial because it allows engineers to create specific test conditions without constraint.

Usability can also be enhanced with a consistent GUI across AC and DC units, reducing the learning curve for test engineers working with both unit types. Newer devices also have full-colour LCD, multi-language, capacitive touch panel displays that simplify interaction and reduce setup times. Front-panel touch displays eliminate the need for mechanical switches, making for a more robust interface for end users. The latest units are also designed for 1U high rack or bench mounting, with a high power density that saves space in laboratory settings.

In terms of data acquisition and energy efficiency, pre-installed software means test engineers can often control unit and program sequences remotely and use pre-programmed test standards, which can be reported in PDF format for streamlined data acquisition. Modern units can be controlled with standard lab and test software using SCPI commands, allowing easy data integration into analysis programs, with multiple remote programming methods, including built-in LAN, USB, RS232, RS485, and optional IEEE/GPIB interface, facilitating seamless integration into various setups.

Meanwhile, the latest devices operate with high efficiency, which can reduce operational costs and support sustainability initiatives. In specific configurations, some programmable AC power modules are designed to deliver energy efficiency rates of 87 %, reducing through-life operational costs.

Flexible and reliable AC power sources

Fortunately, new devices now commonly integrate a comprehensive suite of advanced functionalities. As an example, the GENESYS™ AC and GENESYS™ AC PRO series from TDK-Lambda, which provide power levels of 2 kVA and 3 kVA

(Figure 1). These sources offer adjustable AC voltage from 0 to 350 V, and the PRO models extend this to include DC voltages up to ± 500 V. They can deliver currents up to 30 Arms and operate across a frequency range of 16 Hz to 1200 Hz, with an extended 5000 Hz option available on the GAC-PRO variant.



Figure 1: TDK-Lambda GENESYS™ AC power source (Source: TDK-Lambda)

For scenarios demanding greater output, the 2 kVA and 3 kVA units can be readily combined to achieve higher power levels or to create multi-phase configurations, supporting parallel arrangements up to 27 kVA in both single and three-phase setups. Characterised by a high-density 1U form factor, these units present a compact footprint and weigh less than 8 kg, facilitating both rack and benchtop integration. Standard features encompass sophisticated waveform generation and harmonics analysis, enabling extensive programmability.

Where next? The future of programmable AC power

Looking to the future, continued product evolution will deliver enhanced capability. This could mean automatic over-the-air updates, the addition of new test routines and profiles, and the capability for remote software/firmware adaptations to meet changing standards and test environments without operational disruptions.

Test and development engineers want a continually refined AC programmable power offering, representing increasing demand for precise and flexible power

control in various industries. Many end users also want commonality with DC programmable power devices, enabling them to streamline operations.

Ultimately, test and development engineers have grown used to the combination of form and function of electronic devices in their personal lives. Now, they can expect the same high performance from test equipment, which will help them operate more effectively and productively for the benefit of all.

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<https://www.emea.lambda.tdk.com/uk/products/programmable-power-supplies/?type=ac>

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TDK-Lambda Corporation is aligned for fast responses to any customer need with R&D, manufacturing, sales and service locations in five key geographic regions, namely Japan, EMEA, Americas, China and ASEAN.

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