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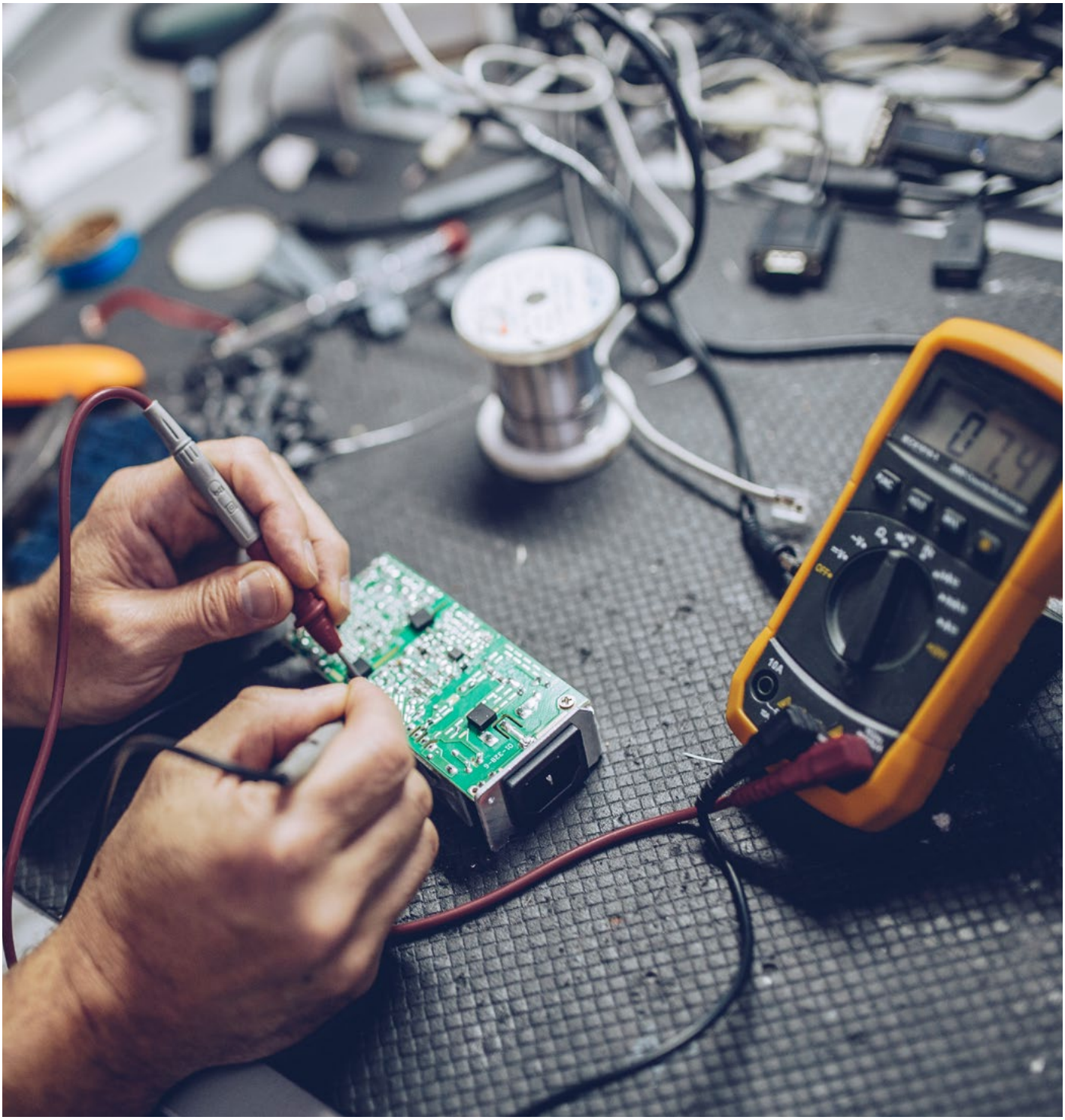
Boost Your Power

with Test & Measurement Solutions



Introduction

Many types of test and measurement (T&M) equipment are necessary across all industries to properly monitor and control the quality and output of the power supplied, and this test equipment is also extremely useful in preventative maintenance.

T&M equipment supports the product design process, allowing engineers to check that their design is performing as intended. Electronic T&M equipment is used to generate signals and record responses from electronic devices under test (DUTs). These instruments are widely used in research, product development, prototyping, production, and field testing applications. In this article, we will go through the following core pieces of test equipment, such as Bench PSUs, SMUs, AC source and DC loads and many more.

Bench Power Supply Units (PSUs)

A bench power supply is a popular type of T&M equipment that gives DC (current/voltage) power to a DUTs. There are many types of benchtop power supplies, including single vs. multi-channel, bipolar vs. unipolar, and linear vs. switching power supply. A single channel power supply has one controllable output, whereas a multiple channel power supply has two or more. A unipolar power supply can only produce positive voltage. Although the leads connected to the power supply can be switched to generate a negative voltage, bipolar power supplies operate in both the positive and negative voltage realms. A bipolar power supply can handle a wider range of power applications. The most common PSU design implementations are linear and switching regulation techniques. Linear power supplies are commonly used in R&D and production test systems due to their high performance, low ripple and noise, good line and load control, with good transient recovery time specifications. Switching power supplies, on the other hand, are more compact and deliver more power, but they are prone to high-frequency noise and have less precise readings. The greatest aspects of switching and linear topologies have been combined in recent power supply designs.

The measurement and programming precision determines how close the output will be to the specified point. When specified as a percentage of the output plus an offset, it is possible to determine whether or not the power supply meets the required accuracy. Furthermore, many power supplies include built-in voltmeters and ammeters for measuring the output. User programmable power supplies can provide the voltage and current with the required precision. As shown in below fig 1 for Bench PSUs, there are manufacturers such as KEITHLEY (Click Here), EA ELEKTRO-AUTOMATIK (Click Here) and AIM-TTI INSTRUMENTS (Click Here) that provide a wide range of Bench Power Supplies.

Fig 1: Multi- channel Bench PSU

Source Measurement Units (SMUs)

An SMU is a multipurpose, multifunctional tool. For a bench, it can be a five-in-one instrument that acts as a power supply, digital multimeter (DMM), electronic load, current source, and pulse generator, all in a single, tightly synchronized instrument with a small form factor. SMU instruments are commonly used in test applications for instance for current-voltage (I-V) characterization of semiconductor components, structures, and materials, where both voltage and current must be regulated across positive and negative values. Such applications require high accuracy, measurement flexibility, and resolution. A conventional DMM is a single-purpose device that cannot measure voltage and current at the same time. A single arrangement consequently necessitates the use of two DMMs. A source measure unit (SMU), on the other hand, is a single instrument capable of simultaneously sourcing and measuring current and voltage with high precision and resolution in a precise and straightforward setup. Below Figure 2 shows the schematic of a SMU with the force functions in red and the measure functions in blue. Only one source function can be active at a time. Depending on the SMU, either one or both measure functions can be active simultaneously. For more information on SMU Products Click Here.

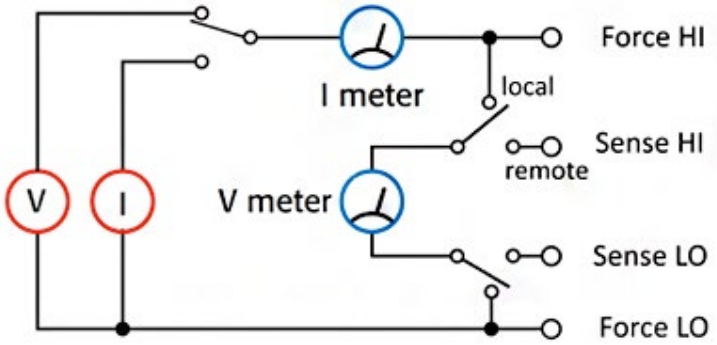


Fig 2: The Schematic of a Source Measure Unit (SMU)

Power Analysers

A power analyser is a device that measures the flow of electricity in an electrical system. This relates to the rate of electrical transmission between a power source and a sink, hence why power is sometimes expressed as energy per second (J/s). Measuring power flow is an important yet simple procedure that may be accomplished with simplicity with a conventional power analyser. The determination of the True RMS time period of an electrical signal underpins all subsequent computations made by the measuring equipment. This is compounded by the fact that root mean square is often reported as an equivalent DC value for AC measurements. An average must be determined over the cycle of the AC frequency to correctly compute the True RMS of an AC waveform. This is known as the circuit's fundamental frequency. Power analysers can identify frequency cycles digitally and offer consistent RMS periods during power conversion. A power analyser must additionally detect the system's voltage and current. Power Quality Analysers can correctly measure MW, MVA, and PF, as well as the voltage and currentof the 3 phases. They can also display Active Power (kW), Apparent Power (kVA), Reactive Power (kVAR), and Power Factor. Below Fig 3 is an example of power analyzer from manufacturer CHAUVIN ARNOUX (Click Here).For more information on products please Click Here.

Fig 3: Power Analyzer

Digital Oscilloscope

A digital oscilloscope is a device that measures the change in an electrical signal over time and produces data such as amplitude, frequency, rise time, distortion, and noise, among other factors. Using a 2-D axis, it displays waveforms of instantaneous electrical signal voltages as a function of time. Depending upon the type of oscilloscope used, waveforms can also be stored and compared for future reference. The electrical analogue signal is sampled, stored, processed, and then reconstructed on the screen in a digital Oscilloscope. Some popular features would be for 2 to 4 fully differential high-impedance inputs, a 20 MHz bandwidth, and flexible 12 or 14-bit resolution. Non-ground-referenced measurements, safe probing of 1 phase and 3 phase voltages and currents. Mains quality testing, SMPS design, motor drives and inverters are typical applications. As shown in below Fig 4 for Digital Oscilloscope, there are manufacturers such as Tektronix (Click Here), KEYSIGHT (Click Here), and ROHDE & SCHWARZ (Click Here) that provide a great selection of products in this category.

Fig4: Digital Oscilloscope

Electrical Safety Analysers

An electrical safety analyser is a device that performs several electrical safety tests, such as ground continuity testing, insulation testing, high voltage testing, and line leakage testing, to ensure that the item under test meets electrical safety regulations. These tests are needed for the following international standards: IEC990, IEC335, IEC1010, IEC601, IEC204, IEC950, IEC598, IEC61215 (solar panel test), and IEC61646 (solar panel test). For traceability, these analysers can be equipped with interfaces such as RS232, GPIB, PLC, and Ethernet. Below Fig 5 is an example of electrical safety analyser from manufacturer GW INSTEK. For more information on products Click Here.

Fig 5: Electrical Safety Analyser

AC Sources

An alternating current power source, also known as an alternating current power supply, is a device that can deliver changeable voltage, current, and frequency to a load. The programmable linear AC sources may have a maximum output power of 1500 VA and are delivered via the universal line output terminals on the front and also the output connections on the back. It can create alternating current signals at frequencies of up to 500 Hz. The output may be adjusted from 0 to 300 V with a 0.1 V precision. Vrms, Irms, Ipeak, frequency, power factor (PF), apparent power, actual power, and elapsed output time are all displayed. For simulation of typical power grid faults and disturbances, these AC sources include a power line disturbance (PLD) simulator, list mode, and sweep mode. It also has a built-in dimmer function for testing motors and LEDs, and it supports typical USB, RS232, LAN, and GPIB interfaces. Below Fig 6 shows an example of AC Power Source from manufacturer **B&K PRECISION**, for more information on the product Click Here.

Fig 6: Programmable AC Power Sources

DC Loads

An electronic load is a device that applies voltage and sinks current. DC electronic loads, often known as DC electronic loads, characterise a power supply's reactions to varied load circumstances. FET switches and non-reactive power electronics are used in electronic loads to reduce ringing and manage less-than-ideal behavior. These DC electronic loads are widely used by power supply, battery, solar, wind, and other manufacturers that wish to comprehensively evaluate their power sources by dynamically increasing and decreasing the load in a repeatable manner to verify compliance with quality and safety standards. This form of testing is made considerably easier by programmable electronic loads, which eliminate the need to configure resistors or resistive parts for each test. As shown in the below Fig 7 is an example of an electronic DC Load, for more information on the product Click Here.

Fig 7: Electronic DC Loads

Accessories

Oscilloscope probes, multimeter probes, environmental probes, banana test leads, crocodile test leads, other test probes and test leads are available for a wide range of test and design applications. High-voltage and current probes reduce the high voltages and currents to lower levels that T&M equipment can detect safely. Temperature probes turn T&M equipment into convenient digital thermometers. High-frequency voltages may be measured with RF probes. For more details on T&M Accessories please Click Here and Here.

Farnell has partnered with many different suppliers such as Aim TTi, BK Precision, Chauvin Arnoux, EA, GW Instek, Keithley, Keysight, Rohde & Schwarz, Sefram, Sorensen, Tektronix and many more, who produce a broad portfolio of products such as Bench PSUs, SMUs, Power Analysers, Digital oscilloscopes and many more Test and Measurements Electronic instruments (For more information please Click Here).