

# Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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- Accurate measurement over wide impedance range and wide frequency range
- Basic impedance accuracy:  $\pm 0.08\%$
- 40 Hz to 110 MHz, 3 m $\Omega$  to 500M $\Omega$
- Powerful impedance analysis function
- Ease of use and versatile PC connectivity



4294A

### 4294A Precision Impedance Analyzer



The Agilent 4294A Precision Impedance Analyzer is an integrated solution for efficient impedance measurement and analysis of components and circuits. The 4294A covers a broader test-frequency range (40Hz to 110MHz) with Basic impedance accuracy:  $\pm 0.08\%$ . Excellent High Q/Low D accuracy enables analysis of low-loss components. The wide signal-level ranges enable device evaluation under actual operating conditions. The test signal level range is 5mV to 1Vrms or 200 $\mu$ A to 20mArms, and the DC bias range is 0V to  $\pm 40$  V or 0mA to  $\pm 100$  mA. Advanced calibration and error compensation functions eliminate measurement error factors when performing measurements on in-fixture devices. The 4294A is a powerful tool for design, qualification and quality control, and production testing of electronic components. Circuit designers and developers can also benefit from the performance/functionality offered.

### Wide-Range Accurate Measurement

The 4294A enables impedance measurement using the auto-balancing bridge technique over the frequency range 40 Hz to 110 MHz. The basic impedance accuracy is  $\pm 0.08\%$ , and the typical Q accuracy is  $\pm 3\%$  @ Q=100,  $\leq 10$  MHz. This advantage permits accurate evaluations of impedance characteristics for a wide variety of electronic devices as well as electronic and non-electronic material within a wide frequency range.

### Versatile Analysis

The 4294A graphically displays impedance measurement results. This permits easy analysis of the resonant frequency and impedance values of electronic components using the marker functions. The marker functions offer a simple method to pinpoint the resonant frequency of components, as well, these functions assist users in many other observations. The combination of the accumulate mode (to superimpose traces) and the list sweep functions permits observation of the change in a DUT's characteristics due to a change in the measurement condition. Versatile and high-speed automatic testing is possible using the list sweep function in conjunction with the limit line function. The list-sweep function provides the ability to enhance test throughput by segmenting the sweep to include only necessary measurement frequencies, while the limit-line function (for Go/No-Go Testing) provides the ability to apply test limits within each segment. These functions greatly support the quality and performance required evaluating modern and improved electronic components, equipment and materials.

### Equivalent Circuit Analysis

The equivalent-circuit analysis function provides advanced modeling (three and four element models) based on circuit constant values of five available circuit models. This function simulates the frequency characteristics of components by using derived circuit values or user-specified values. Comparison of design values to measurement values can assist with efficient component design.

### Programming

Full programmability is provided using built-in Instrument (IBASIC). Desired measurements and computations, including graphics analysis, can be programmed simply by storing front-panel keystroke operations. The one-key execution function allows easy selection and execution of customized IBASIC programs. Several forms of storage are built-in (10Mbyte no-volatile memory, RAM disk or Floppy Disk).

### Good PC Connectivity

Features fit to the latest PC environment include LAN (Local Area Network) capability, VGA monitor output, and the TIFF file format. LAN capability permits simplified networking ability when collecting, sharing and analyzing data. VGA monitor output improves productivity and reduces eyestrain. TIFF file format allows easy transfer of graphics to a PC.

### Abundance of Accessories

Various 4-terminal-pair test fixtures can be used with the 4294A. The 42941A Impedance Probe Kit (1.5m), which covers 40 Hz to 110 MHz, enables in-circuit impedance measurement of electronic circuits or components. Grounded devices can also be measured. The 42942A Terminal Adapter, which covers 40 Hz to 110 MHz, converts the 4-terminal-pair port configuration to a 7mm Test Port. This adapter permits the use of familiar 7mm test fixtures. Again, grounded measurement is available.

## Specifications

### Measurement Parameters

|Z|, |Y|,  $\theta$ , R, X, G, B, Cp, Cs, Lp, Ls, Rp, Rs, D, Q

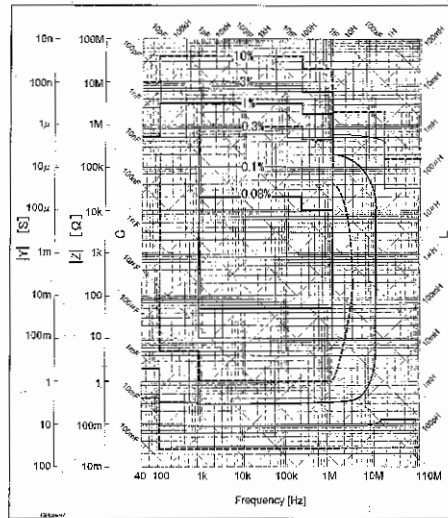
### Basic Measurement Accuracy

**Basic Impedance Accuracy (4 Terminal Pair):**  $\pm 0.08\%$

(See figure in detail)

**Basic Impedance Accuracy with 42941A:**  $\pm 0.8\%$  (typical)

**Basic Impedance Accuracy with 42942A:**  $\pm 0.6\%$



4294A Impedance Accuracy @4-Terminal-Pair, OSC=0.5V)

### Source Characteristics

**Test Frequency:** 40 Hz to 110 MHz

**Frequency Resolution:** 1 mHz

**Frequency Accuracy:**

$\pm 20$  ppm ( $\pm 0.13$ ppm with Opt.1D5)

**OSC Level:** 5mV to 1V/200 $\mu$ A to 20mA

**OSC Level Resolution:** 1mV/20 $\mu$ A

**OSC Level Accuracy**

**Voltage:**  $\pm ((10+0.05 * f(\text{MHz}))\% + 1\text{mV})$  @ UNKNOWN Terminal OPEN

**Current:**  $\pm ((10+0.3 * f(\text{MHz}))\% + 50\mu\text{A})$  @ UNKNOWN Terminal SHORT

**Level Monitor Function:** Voltage, Current

### DC Bias

**DC Bias Level:** 0V to  $\pm 40$ V, 0A to  $\pm 100$ mA (Auto level control function available)

**DC Bias Level Resolution:** 1mV/40 $\mu$ A

**DC Bias Voltage Accuracy:**  $\pm (0.1\% + (5+30 * I_{\text{mon}}(\text{mA})))\text{mV}$

**DC Bias Current Accuracy:**  $\pm (2\% + (0.2 * V_{\text{mon}}(\text{V})/20))\text{mA}$

**DC Level Monitor Function:** Voltage, Current

### Sweep Characteristic

**Sweep Parameter:** Frequency, AC voltage, AC current, DC bias voltage, DC bias current

**Sweep Type:** Linear, Log, List, Zero Span, Manual, Up/Down

**Number of Points:** 2 to 801

### Calibration/Compensation/Adapter Type

**Calibration:** Open/Short/Load

**Compensation:** Open/Short/Load, port extension (electrical length)

**Adapter Type:** None, 1m, 2m, 7mm Adapter (42942A), Probe (42941A)

### Display

**Size:** 8.4 inch

**Type:** Color LCD (TFT)

### Analysis

**Marker:** 8 markers, delta marker function, search function, analysis function

**Equivalent Circuit Function:** Approximation, simulation

**Others:** IBASIC, Limit Line, Accumulate mode

### Interface

**LAN Interface:** 10 Base-T Ethernet, RJ45 Connector, TCP/IP

**Other Interface:** GPIB Interface, Printer (Centronics), 8 bit I/O, 24 bit I/O, VGA monitor output

### Storage

**Type:** Built-in 3.5inch floppy disk drive, 10 Mbyte non-volatile memory, 512kbyte volatile RAM disk memory

**Disk Format:** DOS

**Programming:** IBASIC

## General Specifications

**Operating Temperature and Humidity:** 0° C to 40° C, 15% to 80% RH

**Power Requirements:** 90 V to 132 V, or 198V to 264 V, 47 Hz to 63 Hz, 300 VA Max.

**Size:** 222 mm H x 426 mm W x 502 mm D (8.88 in x 17.04 in x 20.08 in)

**Weight:** 25 kg (55 lb)

## 4294A Material Solution

The dielectric constant of a solid material can be measured with the 16451B dielectric test fixture. The magnetic constant of toroidal core can be also measured using the 16454A magnetic material test fixture with the 4294A/42942A configuration.

In both applications, the dielectric or magnetic constant is calculated from measured impedance value. The measurement sequence of impedance measurement, material constant calculation and data analysis can be automatically executed using built-in IBASIC programming function.

The measurement program is provided as a sample programs in the 4294A operating manual. Users need to learn the IBASIC programming first, then the program can be modified as they like. The electronics knowledge is required to use these fixtures, because it is basically an impedance measurement.

**16451B Frequency Range when used with 4294A:**

40 Hz to 30 MHz

**16454A Frequency Range when used with 4294A:**

1 kHz to 110 MHz

**Applicable Material Size:** See page 492.

## Key Literature

4294A Precision Impedance Analyzer Profile, p/n 5968- 3808E

4294A Technical Specification, p/n 5968-3809E

## Ordering Information

**4294A Precision Impedance Analyzer**

**Furnished Accessories:** Operation manual, floppy disk, and power cable. (No test fixture is supplied with the 4294A.)

**Opt 1D5** Add High-Stability Frequency Reference

**42941A Impedance Probe Kit**

**42942A 7mm Terminal Adapter**

**Opt 001** Delete 7mm Open/Short/Load set

**16047E** Test Fixture for axial lead components

**16034G** SMD Test Fixture

**16043A** 3-Terminal SMD Test Fixture (with slide)

**16043B** 3-Terminal SMD Test Fixture (without slide)

**16044A** Kelvin Contact SMD Test Fixture

**16048G** 1m Cable

**16048H** 1m Cable

**16451B** Dielectric Material Test Fixture

**16454A** Magnetic Material Fixture (used with 42942A)