6520 TERAOHMMETER

ADVANCED PROGRAMMABLE DIGITAL TERAOHMMETER

Ultra Accurate, Ultra High Resistance Measurement

FEATURES

- Resistance Mode: Range 100 kΩ to Over 10 PΩ
- Current Mode: Range 10 mA to 100 fA
- Automatic Sensing of Resistance Range, Integration Time and Threshold Voltage
- Surface and Volume Resistivity Measurements with 65221 Test Fixture
- Test Voltages 1 V to 1000 V
- Environmental Monitoring with 65220 Sensors
- Logging, Graphical Display and Analysis of Measurements
- SofCal™ for On-Board Intelligence and Front Panel Calibration
- TeraCal™ Data Acquisition Software Automates Operation
- SCPI compliant IEEE-488.2 and RS232C Built-In as Standard
- Rear Input Option

Guildline Instruments Limited 6520 Programmable Teraohmmeter incorporates the latest technology to give Metrologists easy direct reading, high resistance measurement capabilities.

THE 6520 PROVIDES VERY ACCURATE, LOW UNCERTAINTY MEASUREMENTS ACROSS A WIDE HIGH TO ULTRA RESISTANCE RANGE WITH VOLTAGES UP TO 1 KVDC!

The 6520 allows users to make resistance measurements up to 10 PΩ. An updated measurement and calibration software package, TeraCal™, is supplied with every instrument. Whether used in automated solutions or stand-along applications, the 6520 now provides a fully automated method for calibrating both high and ultra-high resistance values and allows for direct Surface and Volume measurements.

The 6520's unique design greatly improves accuracy, stability, and functionality for making high resistance measurements. Convenient resistance and current ranges from 100 kΩ to 10 PΩ ohms and 10 mA to 100 fA are provided. When used as a Transfer Standard, uncertainties better than ± 0.0025 % can be achieved.

In manual operation users have control over important test parameters such as Integration Times, Threshold and Test Voltages, and Voltage Reversal Rates. However, an automatic mode allows the 6520 to determine appropriate resistance range, integration time and applied voltage for the entire measurement range. A combination of selected integration times (5 ms to 1000 s) and selected test voltages (1 V to 1000 V) also allows the user to measure voltage coefficients.

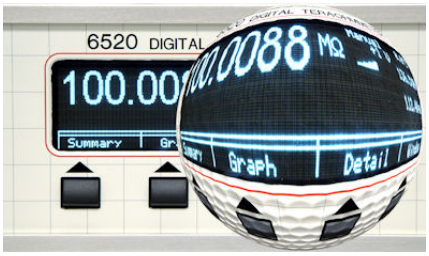
The front panel provides direct measured values and can graphically display on-going measurements as well as environmental conditions. This provides an easy method of determining the settling time of a measurement and the stability of a resistor. The system can also internally calculate and display Min, Max, Average, and Standard Deviation values that allow analysis of measurements, all without the need for a computer.

6520 Programmable Digital Teraohmmeter

With the built-in profiles menu, users have the ability to save threshold, voltage, soak, delay times and other measurement parameters. This allows for expedient setup recall for repetitive measurements. The 6520 utilizes internal firmware menus (Sofcal™) to configure the IEEE-488.2 and the RS232C interfaces. In addition, Sofcal™ provides supply and reference voltage diagnostics, protection resistor compensation, integrator linearity check and standard calibration from the front panel. The calibration is simply achieved by connecting a known reference resistor to the input connectors (accessory 9336-100M) and starting the Artifact calibration procedure.

Production line testing, calibration of electrometers, semiconductor testing, capacitance leakage measurement, film surface and volume resistivity measurement, and other applications (performed in the past by previous Teraohmmeters) can all be automated by using the 6520. In the current mode, the instrument can also be used to measure chemical reaction rates, photo-electric effects and ionization effects. The IEEE-488.2 and RS 232C interfaces come as standard. An external trigger input is also provided to command a measurement from an external device, process or timing mechanism.

More than a Measurement Device – A True Metrologists Tool!

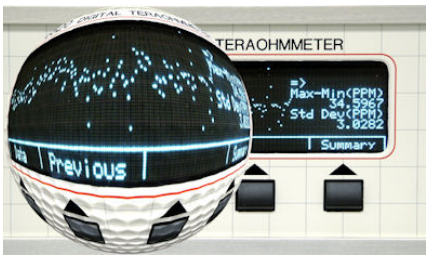


The unique temperature controlled measurement chamber inside the 6520 keeps all internal measurements at the same temperature. The latest in IEEE and RS232 communications, powerful new firmware for complete and easy measurement calculations and test setups, and improved performance will help any Metrologist in achieving difficult measurement and accreditation requirements.

Measurement Collection – It's not enough anymore to just collect the measurements. Variables that affect the measurement must be identified and analyzed. The 6520 provides the ability to collect, store and time stamp temperature, relative humidity and barometric pressure. All variables that adversely impact high resistance measurements! Another unique feature found on the 6520 is the ability to know exactly when you are in an uncalibrated range. A message appears right on the display anytime an operator tries to use parameters that would place the 6520 outside of its calibrated range.

Measurements Setups – The 6520 allows the user, not the manufacturer, to define the measurement sample and test parameters. While Guildline provides some recommended setups, all test configurations can be easily changed and even saved into one of 36 user profiles for fast and controlled measurement setups.

Measurement Analysis – The 6520 provides the capability to fully analyze all measurements without having to use a computer. Important information such as measurement sample size, minimum and maximum readings achieved, calculated average reading and standard deviations of the measurements samples – all there at the push of a button and more….

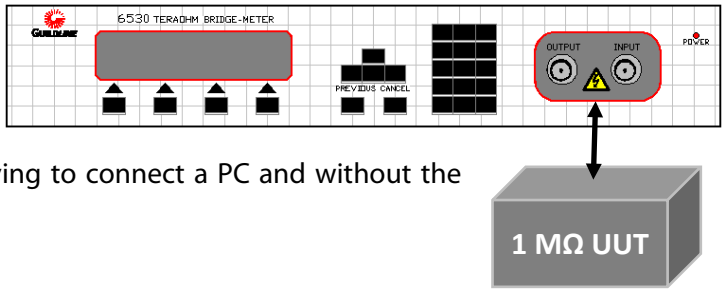


Trending Measurements – The ability to see measurement trends allows users an unparalleled look at the measurement cycle. Visually see the measurement affects when changing setup variables such as voltage polarities, integration times or capacitance values. Also see the measurement affects due to temperature, pressure or humidity changes. The 6520 allows you to see the complete or immediate measurement history. See what you have been missing!

6520 Series Dual Modes of Operations

Direct Measurement Mode – The direct measurement mode is just as the name implies – a direct measurement of a Standard connected to the terminals. This is the easiest mode to operate. Simply connect a Standard to the terminals and press AUTO. The 6520 will find the optimum measurement variables to provide the best possible measurement result. NO operational setup is required!

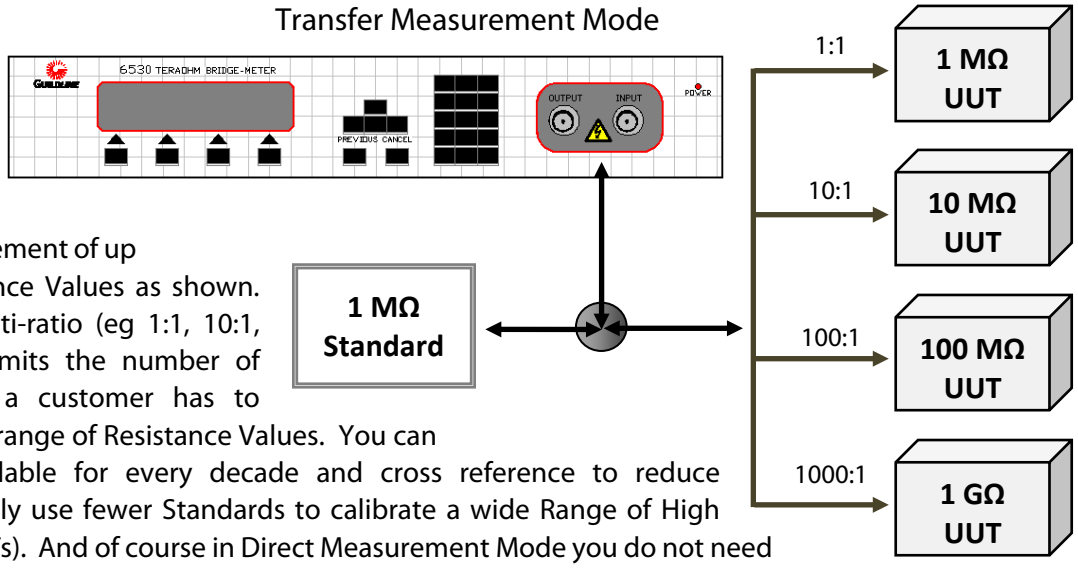
Direct Measurement Mode



Feel free to monitor the measurement while it is running with the Graphical Interface. Examine the intermediate and summary results without ever having to stop the process. Easy to use, easy to monitor and unlike a Dual Source Bridge, measurements can be made without having to connect a PC and without the need of a reference resistance standard.

Transfer Measurement Mode – The Transfer Measurement Mode provides the best possible uncertainties, while at the same time allowing for the minimum number of standards used to cover the broadest possible range of High Resistance Measurements. This transfer/ratio measurement mode can measure values as high as 1000x more than the Reference Resistance Standard. The process is simple and completely automated. Just connect the Reference Resistance Standard you wish to ratio up from (such as a 1 MΩ). The TeraCal Software characterizes the ratio errors and stores the Bridge Mode uncertainties.

Transfer Measurement Mode



The 6520 Transfer Mode will allow for example, a 1 MΩ Resistor to calibrate or measure Resistance standards with very low uncertainties up to 1000:1 Ratios. This means a measurement of up to 100 MΩ or 1 GΩ Resistance Values as shown. The advantages of this multi-ratio (eg 1:1, 10:1, 100:1 and 1000:1) mode limits the number of Resistance Standards that a customer has to maintain to calibrate a wide range of Resistance Values. You can either have standards available for every decade and cross reference to reduce uncertainty or you can simply use fewer Standards to calibrate a wide Range of High Value Resistance Values (UUTs). And of course in Direct Measurement Mode you do not need any Reference Standards.

This process is completely automated with the TeraCal software that is provided. Add a 6564 Scanner, and now you have true automation and the cross-verification of results. In contrast a dual source bridge does not have this flexibility.

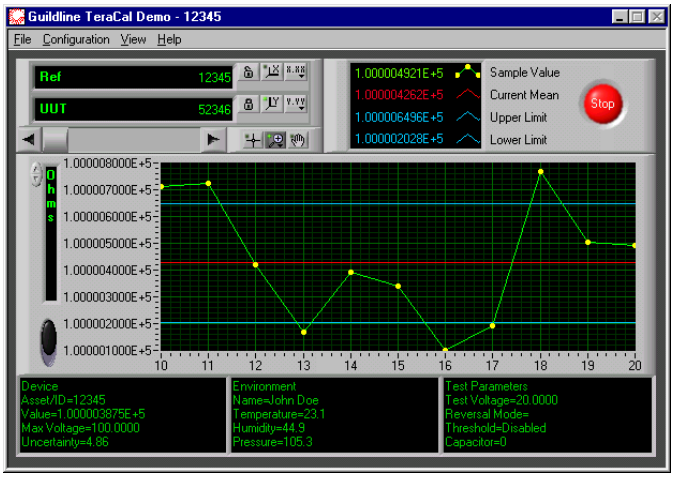
6520 Programmable Digital Teraohmmeter

Now a Complete High Resistance Automated Solution

Looking for complete automation of high resistance measurements? Then look at our NEW 6564 Ultra-High Voltage Scanner. Simply connect the 6520 inputs to input side of the scanner, and connect up to 16 resistors to the remaining scanner channels. Then simply run a batch measurement from TeraCal™ software and you can easily address these difficult high resistance measurements with a cost effective and time saving solution. The 6564 Scanner can handle the complete output voltage range of the 6520 (i.e. up to 1000 V) and adds virtually no uncertainty to the measurement for resistance measurements less than 100 GΩ. 8 channel and 16 channel models are available in this Series. The 6564 isolation within and between channels is > 100 PΩ.

TeraCal Software

The newly improved software, TeraCal™ provides full SCPI based GPIB control of the Model 6520. TeraCal™ is a convenient Windows®-based software program, developed using the National Instruments LabVIEW™ platform and designed specifically for Metrologists. It provides data storage, report generation, and other utilities to allow a variety of other resistance characteristics to be measured. Data can also be easily exported to Microsoft Excel. TeraCal™ calculates uncertainty by either using expanded uncertainties in accordance with ISO/IEC 17025:2005 requirements or alternatively uncertainties can be arithmetically summed.



TeraCal Features Include:

- Measurement Automation
- 6520 Transfer Utility
- Surface/Volume Resistivity
- Voltage Coefficient Utility
- Export to Excel, Crystal, and HTML
- Data and Trend Analysis
- Uncertainty Calculations
- Data Logger Acquisition
- Device Profiling
- New 3D Graphical Look

TeraCal™ provides easy control of the 65221 test fixture to calculate surface and volume resistivity. When the optional 65220 environmental sensors are installed, the ambient temperature, humidity and pressure can be recorded. To run TeraCal™, a Windows computer with an optional National Instruments IEEE-488.2 interface card is required.

6520 Options

With a wide selection of options available, the power of the 6520 is greatly increased. Added features include the ability to automatically record the ambient temperature, humidity and pressure via the 65220 environmental option or via user provided equipment. Other options include the 5032 Programmable Air Chamber, Shielded and Environmental enclosures, Surface and Volume Resistivity fixtures, Calibration Kits, and Lead Kits allow Metrologists to support their own 6520. Refer to the 6520 Series Options Datasheet for a description of available options – all of which work with the new 6530 TeraOhm Bridge-Meter.

For example, the ability to automatically record the ambient temperature, humidity and pressure via the 65220 environmental option (shown to the right) or via user provided equipment. There are rear ports to connect this option (or users sensors) and the information is logged and time stamped so a change in any of these conditions, which may have affected the measurement, is readily available.

65220 Environmental Monitors

Environmental Monitor (65220 Option)	Range	12 Month Uncertainty
Temperature	-50 °C to 100 °C	±0.5 °C
Humidity:	0 % to 100 % RH	±2 RH
Atmospheric Pressure:	15 to 115 kPa	±0.5 kPa

Model 5030 Series of Programmable Precision Air Chambers.

Not only do we provide the best on the measurement side, but Guildline can uniquely address the Resistors you are calibrating! What about the effects of Noise, Temperature, EMI and other variables that also affect these devices?

Take a look at the 5030 Series of Programmable Temperature Air Baths. These Stainless steel, double-walled, dual fan, 1 mK settable resolution Air Baths will not only provide excellent temperature control; but also provide protection against Electrical Noise and EMI due to the excellent shielding and grounding these Air Baths provide!

Like the 6520, this Air Bath is fully programmable via the Standard IEEE 488.2 bus with optional drivers already in the TeraCal™ Software; or you can program this Air Bath right from the front panel with a full menu system!

6520 Programmable Digital Teraohmmeter

The 6520 provides some of the most advanced resistance measurements including a complete built in menu for Surface Volume and Resistivity measurements. The optional 65221 Surface Volume Resistivity Test Fixture shown to the right simply plugs into the back of the 6520 and with the 6520 Internal menus you can make use the Teraohmmeter to make direct measurement of volume resistivity up to $10^{18}\Omega$ cm (on samples 0.1cm thick) and surface resistivity up to $10^{17}\Omega$/square, in accordance with ASTM procedures. The test fixture is supplied with all the necessary interconnect cables for the 6520. A simple series of keystrokes on the 6520 front panel controls starts the measurement process.

Life Cycle Support

User support of the 6520 has never been easier. Users have choice between two levels of calibration philosophies.

Artifact Calibration is achieved by the use of a single 100 MΩ standard resistor connected to the front or optional rear terminals. An internal program (SofCalTM) then uses this resistor to perform an automated procedure similar to techniques used in other manufacturer's artifact calibration routines. A full calibration is achieved by first performing an Artifact Calibration, then using a series of precision high resistance standards to align & verify the remaining ranges required by the laboratory.

Additionally the 6520 allows calibration laboratories to use their own set of standard resistors for verifying linearity and producing drift history. Guildline also produces standard "AIR" resistors, models 9336 and 9337, with values up to 10 PΩ (Peta Ohm) capable of performing this verification. These resistors can also be used for "Transfer" type measurements.

Need The Ultimate In A Primary Resistance Standard?

If you can't afford to spend the large amount of capital required for a tightly controlled laboratory, but still want the best performing Resistance Standards, take a look at our 6634A and 6636 Temperature Stabilized Resistance Standards. With unsurpassed stabilities, its own built-in temperature environment, and temperature coefficients down in the parts per billion (ppb), these standards are an excellent addition to any metrology laboratory.

6636 Temperature Stabilized Resistance Standards

Unparalleled Support

And our support just got even better. Guildline Instruments now provides an industry leading two year warranty on every 6520 and all associated resistance standards. We know that the 6520 will work for you out of the box and in the future… and we back it up. Accredited by A2LA, Guildline can provide some of the best uncertainties you will find from any manufacturer. With an Accredited Range from 1 μΩ (micro ohm) to 10 PΩ (Peta Ohm), Guildline can calibrate not only our own standards, but other manufacturer's as well. Call us today for pricing and turn-around times.

6520 Specifications

Measurement Range[1] (Ohms)	Applied Voltage[2] Threshold	Uncertainty (% of Reading @ 23 °C ± 2 °C)		Temperature[5] Coefficient (± % of reading/°C)
		12 Month3	Transfer4 (4 Hours)	
90k to 200k	1V	0.025	0.006	0.01
200k to 2M	1V	0.025	0.0025	0.0035
2M to 20M	1V	0.025	0.0025	0.0035
20M to 200M	1V to 10V	0.015	0.0025	0.0035
200M to 2G	1V to 100V	0.02	0.0025	0.005
2G to 20G	1V to 1000V	0.06	0.0025	0.007
20G to 200G	10V to 1000V	0.08	0.0025	0.01
200G to 2T	100V to 1000V	0.1	0.008	0.02
2T to 20T	1000V	0.35	0.05	0.03
20T to 200T	1000V	0.6	0.07	0.05
200T to 2P	1000V	2.5	0.2	0.1
2P to 20P	1000V	30	0.5	1

1. Ranges are automatically selected or may be chosen manually. The maximum test voltage is selectable.
2. This column is presented only in this data sheet for purposes of identifying uncertainties with a measurement range via common Engineering units.
3. 12 Month Specification applies to the 6520 after 4 hour warm up, with operating in Auto Mode to 1 TΩ and with a soak time of 5 seconds or more above 1 TΩ and when the current is no less than one picoampere through the unknown resistor.
4. Transfer uncertainty does not include instabilities of the transfer resistance standard or the test resistance (e.g. dielectric effects, voltage coefficients). This is the 6520 stability of the measurements over the characterized 4 hour time period.

Optional 6520 Current Measurement Specifications

Current Range (A)	1 Year Uncertainty (± %) 23°C ± 5°C	Temperature1 Coefficient (±% of reading/°C)
1 µA ► ◄ 10 µA	0.02	0.005
100 nA ► ◄ 1 µA	0.06	0.005
10 nA ► ◄ 100 nA	0.08	0.03
1 nA ► ◄ 10 nA	0.3	0.03
100 pA ► ◄ 1 nA	0.5	0.1
10 pA ► ◄ 100 pA	2.0	0.1
1 pA ► ◄ 10 pA	5.0	0.2
100 fA ► ◄ 1 pA	30.0	1

1. The temperature coefficient only needs to be accounted when the laboratory operating environment is outside the 23°C + /2°C.

9334A's, 9336's and 9337's Resistance Standards are calibrated at one recommended and specified current or voltage. Guildline can calibrate at additional voltages or currents for a nominal fee. To calculate error due to voltage coefficients, simply look at the voltage the unit was calibrated and voltage the resistor is being used at. For example, if a 100 MΩ resistor was calibrated at 100 V, but being used at a 50 V level, than the voltage coefficient uncertainty can be calculated by (100 V – 50 V = 50 V). 50 V x 0.2 ppm/V = 10 ppm uncertainty error contributed to voltage differences. voltage coefficients are provided for all Guildline Standard Resistors above 1 MOhm

6520 Programmable Digital Teraohmmeter

General Specifications

Measurement Ranges		Front Panel Connections	
Resistance Mode	100 kΩ to 10 PΩ	Input Connector:	3 lug Triax
Current Mode	100 fA to 10 µA	Source connector:	Miniature High Voltage (MHV)

Input Impedance		User Profiles	36 Programmable
Resistance Mode	100 kΩ	Display Resolution:	4 to 8 Digits (Selectable)
Current Mode	100 kΩ	Measurement time:	5ms to > 1000 seconds

Power (50 VA)		Standard Interfaces	
50 or 60 Hz (± 5%)	100, 120, 220 and 240 VAC (± 10 %)	IEEE 488.2	RS232

Available Test Voltages	1, 2, 5, 10, 20,50, 100, 200, 500 and 1000 V_{DC}

Temperature	Operating		Storage	
	15 °C to 30 °C	59 °F to 86 °F	-30 °C to 70 °C	-22 °F to 158 °F
Humidity (non-condensing)	20 % to 50 % RH		15 % to 80 % RH	

Dimensions	Height	Length	Width	Weight		
Metric	89 mm	500 mm	444 mm	Instrument	25 lbs	11.4 kg
US	3.5″	19.7″	17.5″	Shipping	40 lbs	18.2 kg

Ordering Information

6520	**Programmable Digital Teraohmmeter**
TeraCal™	Data Acquisition software (included). Requires NI IEEE-488.2 Card
/OM	Operators Manual included
/CC	Calibration Certificate included
/RC	Report of Calibration Available at Additional Charge
SM6520	Service Manual (Optional)

6520 Options (See 6520 Series Options datasheet for more information)

6564 Series	8 or 16 Channel, 1000 Volt High Resistance Scanners
9336-100M	100 MOhm Artifact Calibration Resistor
9336/9337	See 9336/9337 Resistance Standards Data Sheet For More Information
6636	See 6636 Resistance Standards Data Sheet For More Information
5030 Series	See 5030 Series Programmable Precision Temperature Air Baths
65201	Penn Airborne Adapter
65220	Environmental Monitor
65221	Surface/Volume Resistivity Test Fixture
65222	Large Shielded Sample Enclosure
65223	Small Shielded Sample Enclosure
65224	Zero Link
65225	Lead Set
65226	Calibration Kit (Includes 65224 & 9336-100M)

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