



OVERVIEW OF GUILDLINE'S 6625A RESISTANCE MEASUREMENT SYSTEM



Overview

The 6625A is a modular, customer specified Resistance Measurement System. Typically, the System is composed of a 6622A Series Bridge, a 6634A Resistance Standard, 6664C Series Scanners and a 6623A Series Range Extender. Individual data sheets can be located on the Guildline Website for each of these instruments and standards. The purpose of this paper is to discuss how to configure a 6625A System and the benefits of the System to you and your laboratory.



Guildline's 6625A Resistance Measurement System provides demanding users around the world the best in DC Resistance Measurement performance and value. Incorporating some of the most unique standards available for measurement, this system is the only true "turn-key" resistance measurement system available today. This system provides the best in measurement specifications and the widest range of options available from any Manufacturer.

The system is highly configurable to meet wide ranging workload requirements. The 6625A is capable of resistance measurements from 0.1 $\mu\Omega$ at 3000 Amps all the way to 1 G Ω at 1000 Volts – all with a single 6622A DCC Bridge. Add a Guildline 6520 Digital Teraohmmeter and you now have the capability of measurements all the way to an amazing 10 Peta Ohms.

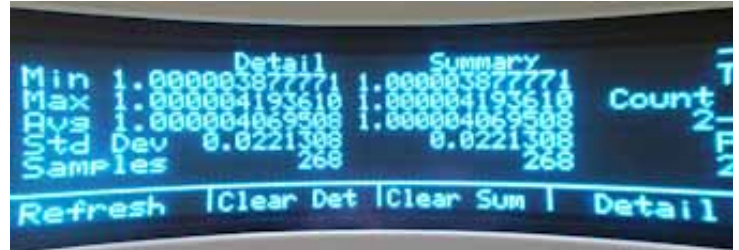
Guildline's unique design and modularity allows customers to purchase what they need today to support calibration of their current work-load and be assured of an upgrade path to support their future requirements. The system is typically delivered ready for use in a single 'fly-away' rack. In fact, a system with a built in 10 Element Resistance Standard, 32 Scanner Channels, any Bridge and a 300 Amp Range Extender **is less than 36" in total height.**

This Resistance Measurement System, along with optional adaptors and utilities, provides militaries and other customers with automated calibration routines for:

- Standard Base Resistance Measurement from 1 m Ω to 100 M Ω !
- Optional 6622A Bridge capabilities for measurements down to 0.1 $\mu\Omega$ and up to 1G Ω !
- Scanner Capabilities to 1000V and 64 Channels
- Optional 6623A Current Extension from 3 Amps to 3000 Amps!
- Transferring the Traceability of Primary Standards from NMI's or other sources!
- Calibration of ESI SR1010, SR1030, SR1060 and SR1050 Transfer Standards!
- Automated procedures for Calibrating Decade Boxes!
- Resistance Verification of High End Calibrators like the Fluke 5700A or 5720A Series!
- Resistance Verification of Long Scale Digital Multi-Meters (DMMs) such as the Agilent 3458A and Fluke 8508A!
- Optional Calibration of Current Shunts including multi-value shunts like Guildline's 9211A!

- Simple Verification Procedures to ensure the 6625A system remains within its operating specifications!
- Optional Internal Temperature Measurement Capability – One button push changes the system into a fully functional Temperature System with an uncertainty of 0.025 mK!

This automation and functionality improves the calibration uncertainties, range of equipment that can be supported, and the efficiency of military and other calibration laboratories. The 6625A Resistance Measurement System can either be operated manually or in a computerized mode via the Standard IEEE488.2 communication. The included GUI based software program, Bridgeworks™, incorporates features and utilities that allow operators to improve measurement effectiveness and provide efficiency for data management. This includes the ability to perform automatic data acquisition, real time graphing of results, real time uncertainty analysis, history logging, charting, and regression analysis. All user definable test variables, such as resistance standard to use, excitation current, etc can be programmed on a per test basis. These features give users full control and flexibility in automating routine calibration procedures and maximizing workload capabilities.



The Guildline Low Thermal Matrix Scanner is recommended to be included with the system. The number of channels can go from 8 all the way to 64 channels. Customers need to evaluate the number of standard resistors they have or plan on having and the number of free channels they wish to use. For example if a user bought a 6625A with the highly stable 6634A Temperature Stabilized Resistance Standard, up to 10 channels would be required to connect all individual resistance standards for automation. The most popular configurations utilize either one or two of the “C” Scanners. This allows for complete measurements up to 1000 Volts at 1GOhms with no uncertainty added to the measurement process. Remember, with Bridgeworks or TeraCal Software, multiple tests can be sequenced and grouped for the Standards to run even when operators are not present! The 6625A is a complete system capable of fully automated multiple-channel calibrations and measurements.

For Military applications, the 6625A System is built on the foundation of Guildline’s 6625AF Resistance Measurement System which has been deployed at all US Air Force Bases worldwide (over 80 systems). The 6625AF Measurement System is also in use at many US Army and Navy bases, as well as with other militaries worldwide. This system is known as the industry standard replacement system for the historical ESI 242. Although some manufacturers have subcomponents that they claim meet the military requirements for resistance measurements and calibrations, Guildline is the original, and the only manufacturer of the 6625AF Resistance Measurement System.

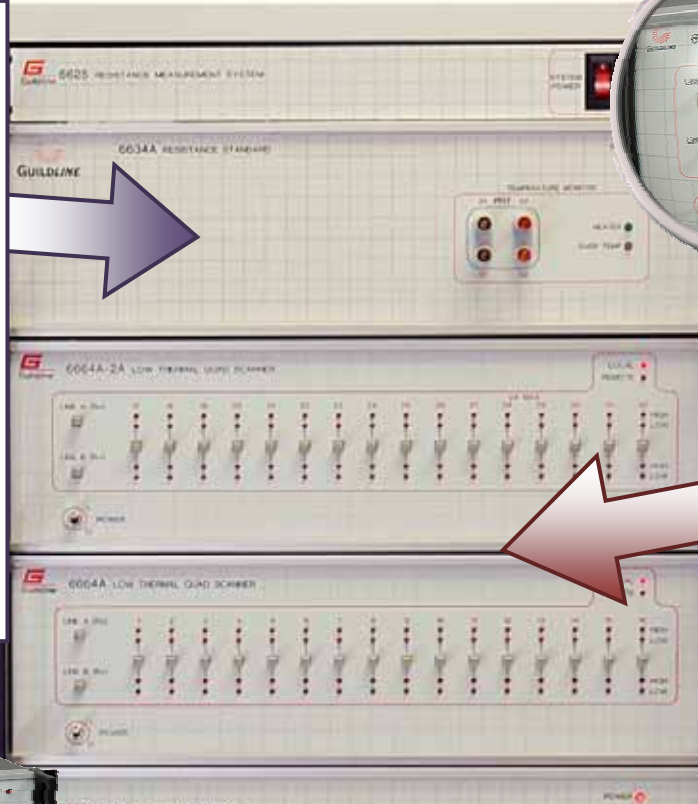
The modularity of the 6625A System is based on over 50 years of innovation, design knowledge, and manufacturing experience that Guildline has in building resistance and temperature measurement instruments. With a single system, the requirement for laboratory space is greatly reduced. There is also a corresponding reduction in the power requirements and associated heat generation when compared with numerous instruments required from multiple manufacturers to meet the same requirements. The following diagrams illustrate how military and other users can take advantage of this flexibility and add additional capability via the expansion options available for this system!

6625A Series Expansion Options

6634A Resistance Standard

The 6634A Temperature Stabilized Resistance Standard provided with the 6625A System eliminates the need to maintain oil based standards, and the messy procedures associated with them. These Standards are simply connected to the scanner in the rear. The performance and uncertainties of these resistors are better than any commercially available oil resistors.

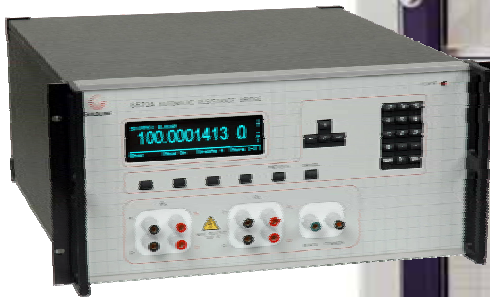
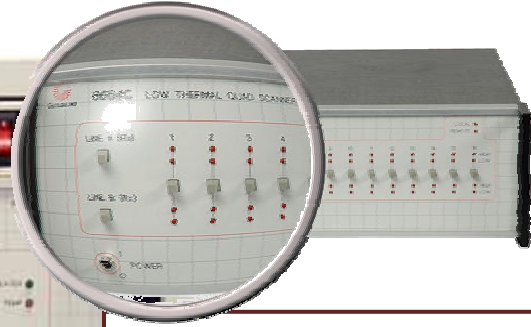
Select from 5 to 10 decade resistance standard or you can also request that the 6625A system be pre-wired for connecting the system to your own laboratories resistance standards.



6664C Series Scanners

The system can be configured with 1 to 4 scanners for a total of 64 available channels. The 6664C is the only 1000V Quad Channel Scanner available today. Two Scanners are shown in this system.

The 6664C is available in either 8 or 16 channel configurations. Programming is the same for all models. The modular configuration is designed to meet your laboratory requirements and budgets.



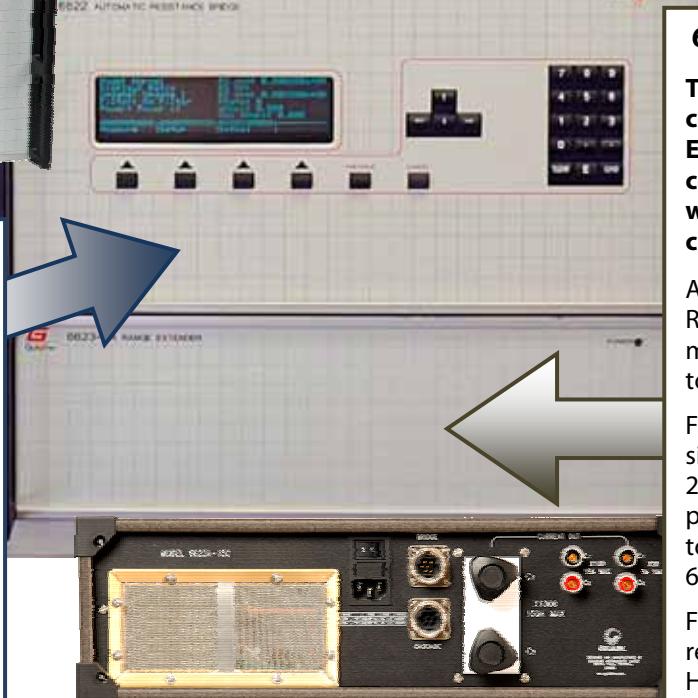
6622A Series DCC Bridge

Select from one of our five 6622A Series of DCC Bridges.

There are five standard bridges covering a range all the way to 1 GΩ with voltages up to 1000 Volts. The entire series is modular and upgradable to fit your workload and budget.

All of our Bridges are the same size and use the same programming language. This feature makes it very easy to customize a system that is perfect for your measurement needs, not ours.

Check out our "Why Buy Paper" on this series of Bridges for more details.



6623A Series Range Extenders

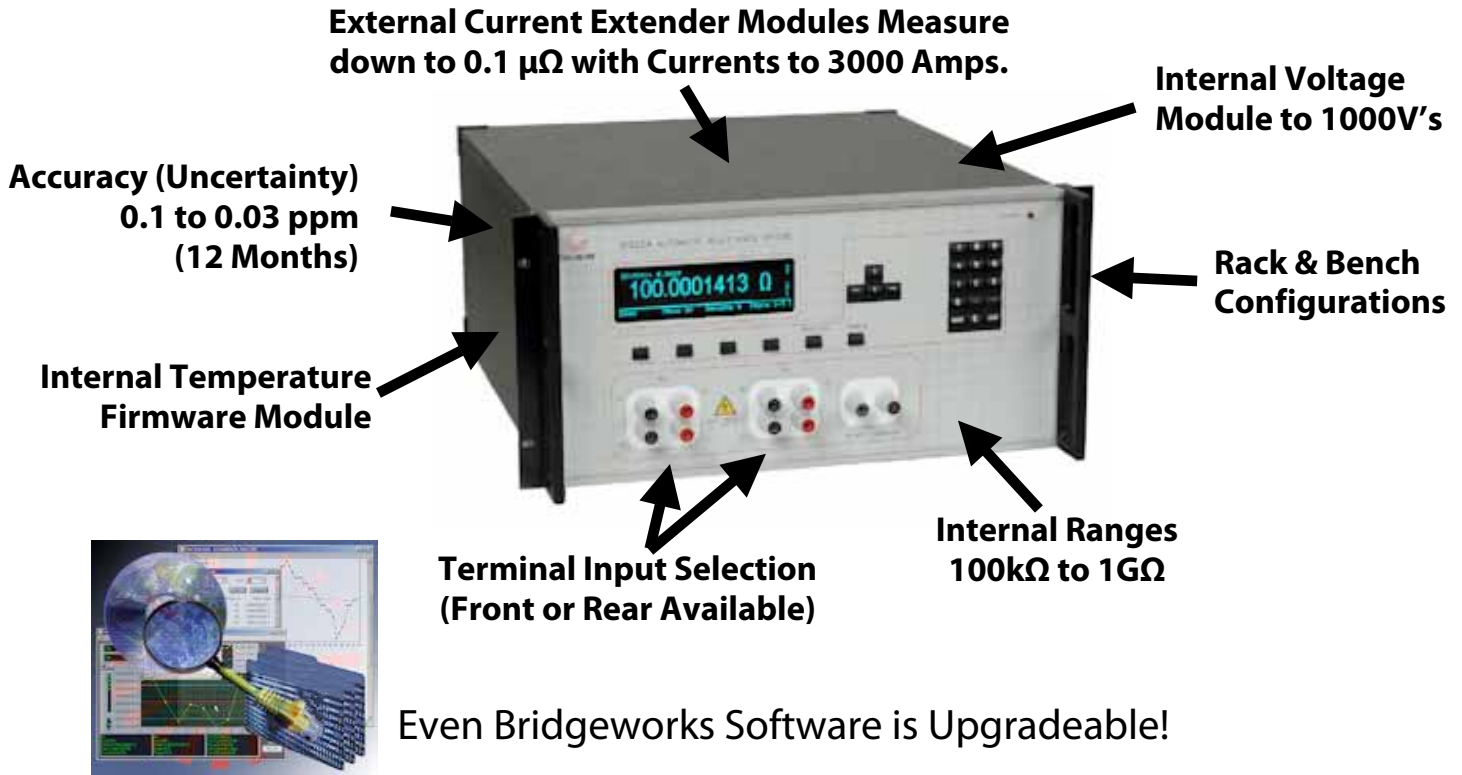
The 6625A system can be configured with optional Range Extenders. This series is configurable from 3 Amps all the way to a whopping 3000 Amps of current output.

As with our Bridge, this Series of Range Extenders is completely modular and upgradable all the way to 3000 Amps!

For extenders up to 600 Amps, the size of the rack only changes by about 2" in height. This is due to the internal power supplies, digital switching, and torrid found in the newly developed 6623A Series!

For units higher the 600 Amps, it is recommended to use a second rack. However, no additional power supplies, external switches requiring compressed air, or external power supplies are required for this series.

Guildline's 6625A Resistance Measurement System is the only modular resistance / temperature measurement system available today from any source. The following diagram illustrates this modularity, which contains many patent-pending innovative features.



This means that customers can upgrade the 6625A Measurement System in the following ways:

Increased Accuracy: From the basic 0.1 ppm accuracy to 0.05 or 0.04 or 0.03 ppm accuracy. This allows customers to expand their calibration scope as new instruments are released into the market place.

Expanded Resistance Measurement Range: From up to 100k Ω to an expanded 1G Ω range. There is no need to purchase a second bridge to cover the extended range of standard resistors. Need to go higher? Add our 6520 Programmable Digital Teraohmmeter to the system and have an automated system measuring all the way to 10 Peta Ohms!

Current Extenders: From an external 2A extender up to 3000A in modular 150A and/or modular 1000A extenders. These current extenders do not require external power supplies or external compressed air operated switching, thus dramatically decreasing overall capital costs and ongoing calibration costs. In addition, a regular power circuit can be used for current extenders up to 300A, and above 300A no 3-phase circuits are necessary. This represents substantial setup and ongoing operating cost savings in comparison to range extenders from other companies. Current Range Extenders allow more accurate measurements to be made at very low resistance levels down to the sub uOhm level. A 6625A system with current extenders can also be used to calibrate DC shunts, such as Guildline's 9211A and 9230A series all the way to 3000 Amps.

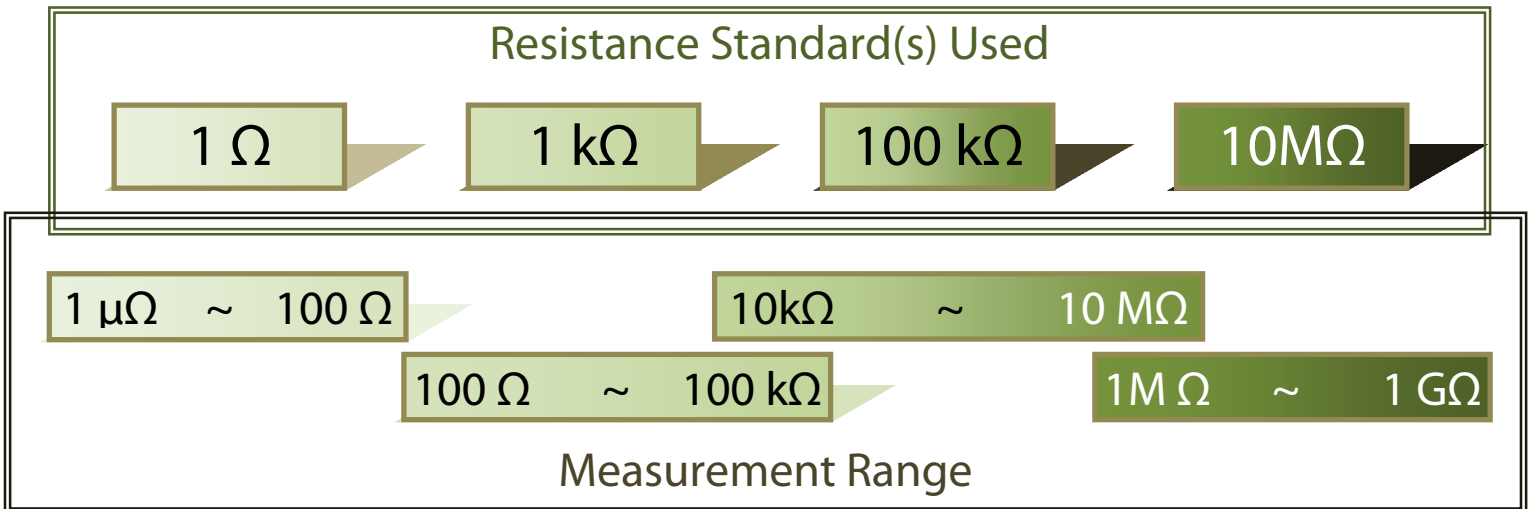
Voltage Extender: Internally installed voltage module that allows operation at 1000 V to provide better measurements and uncertainties for higher value resistance standards, typically above 100k Ω .

DMM Switch - 66252: A switch that allows the built in standard resistors provided with the 6625A system to be used to calibrate any artifact resistors, highly accurate Digital Multi Meters (DMMs), calibrators, and for other metrology applications.

Temperature Option: An expansion internal Bridge option that allows the 6625A System Bridge to also be used as a fully functional Temperature Bridge. A customer simply has to select either Resistance or Temperature mode while using the Bridge. The Temperature Option can measure and convert temperature directly, and display the values on the front panel. The front panel can also display a real time graph so a customer can visually track temperature changes and fixed point plateaus. This option is ideal for calibrating Platinum Resistance Thermometers (PRT's, SPRT's, HTPRT's), other RTD's, and Thermistors. Its wide temperature measurement range covers the calibration range of resistance thermometry fixed points, Cryogenic, and high temperature applications.

Complete Modularity: Militaries and other customers are continually upgrading their calibration procedures. As their requirements for resistance and temperature calibration expand, they are purchasing the upgrade options provided for the 6625A system. Guildline is the only manufacturer in the world to provide these modular expansion features for a resistance and temperature measurement system.

Another key feature of Guildline's 6625A System is its multi-ratio functionality. This feature allows customers to reduce the number of resistance standards required, and associated annual calibration costs. As well, the multi-ratio functionality will reduce calibration uncertainties by optimizing the use of resistance standards that provide lower uncertainties, as in the following example.



- ▶ Multi-Ratio Allows For Lower Uncertainties
- ▶ Using 100 : 1 Ratio @ 100k (calibrate 10M)
- ▶ Temp Coefficients/Drift offset higher Ratio Gain

What's Better to Measure 100M (@ 2°C Lab Temp)?

1M_{RS} (0.6 ppm/TC – 5 ppm/drift) and 6622A-XR 100:1 ratio of 6 ppm
 OR
 10M_{RS} at (5 ppm/TC – 6 ppm/drift) and 6622A-XR 10:1 ratio of 4 ppm

As the preceding diagram shows, the 6625A requires the fewest resistance standards to support the widest range of measurements. For example, measurements from 1 uOhm to 1 GOhm can be made with just four (4) Resistance Standards. This reduces the capital cost for resistance standards, and equally important the ongoing costs to calibrate primary and secondary resistance standards.

When the temperature option is used, the wide measurement range of the 6625A System accommodates Platinum Resistance Thermometers (PRTs) and thermistors from 0.25Ω to 100kΩ. Using the latest DC current comparator technology, the measurement range is designed for thermometry. DC bridges have inherently better noise immunity to external electromagnetic and mechanical noise. With the temperature option the 6622A Bridge is re-configured to take faster readings at four second intervals with best measurements being achieved with 20 second readings. The 6625A is an excellent solution for precision temperature measurements. And since the same system can be used to support both resistance and temperature there is substantial capital and operating cost savings.

With Guildline's integrated 6625A System, customers only have to deploy and support a single system to meet their resistance and temperature calibration needs. Whether you are a commercial or military laboratory this means a substantial reduction in staff training which is important given staff rotations and the cost of training. The flexibility to purchase expansion options and upgrades to the 6625A system means that new calibration procedures can be implemented inexpensively without the additional training and support that is required when new calibration instruments have to be purchased from multiple vendors.

In summary, customers who purchase a 6625A can make precision resistance and temperature measurements and calibrate both resistance and temperature standards. Purchase of a 6625A protects their initial investment, provides a growth path as their requirements change, and enables the expansion of their initial resistance / temperature measurement system to support new calibration procedures and new test and measurement equipment. Equally important, customers have dramatically reduced capital, training and ongoing life cycle support costs.

Equip your calibration laboratories with the best, proven solution – the 6625A. The only system that is being used by leading militaries such as the US Air Force, US Army, National Laboratories, Nuclear Facilities, NASA and others. No other resistance and temperature measurement system in the world offers these advantages, or this flexibility, to customers.

For more information about the 6625A Resistance Measurement System or any of our other primary level instruments contact Guildline Instruments at:

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