

Compact Modular and Upgradeable Thermometry Measurement Systems



Guidline Instruments 6625T Temperature Measurement System provides demanding users around the world with the best in temperature measurements and value. Incorporating unique features, this System is a true "Turn-Key" Temperature Measurement System. The 6625T System provides leading measurement specifications with uncertainties as low as 0.005 mK (± 0.02 ppm) and the widest range of options available from any manufacturer.

BASED ON THE WORLD'S LEADING 6622T THERMOMETRY BRIDGE, THE 6625T PROVIDES AN ADVANCED TEMPERATURE MEASUREMENT STANDARD WHILE MAXIMIZING FLEXIBILITY AND EXPANSION PATHS FOR FUTURE REQUIREMENTS!

The system is highly configurable to meet wide ranging workload requirements. The 6625T is capable of resistance measurements from 0.1 $\mu\Omega$ all the way to 100 k Ω (and up to 1 G Ω if an optional internal Resistance Measurement capability is installed). Guildline's Temperature Measurement System is the only commercially available system that covers the calibration range of thermometry fixed points as well as cryogenic and high temperature applications!

FEATURES

- Complete Turn-Key System: Fully Integrated, Wired, Tested and Ready to Use
- 0.025 mK, 0.013 mK and 0.005 mK Uncertainties available
- Wide Range of Ratios: 0.1:1 ~ 100:1
- Resolution: ± 0.1 ppb of Full Scale
- Unique Measurement Results and Trending Display
- Includes Manual and Automated Modes of Operation
- Modular Design, Expandable Capabilities, Investment Protection
- BridgeWorks™ Data Acquisition Software
- Unique Calibration Support Strategy
- Change Key parameters "On-the-Fly" While Measurements are Running in Manual and Automated Modes
- 2 Year Warranty Standard on Complete System

The 6622T Temperature Bridge has the range of operation to accommodate Platinum Resistance Thermometers (PRT's, SPRT's, HTPRT's) as well as Thermistors and other RTD's from 0.001 Ω to 100k Ω ! For example, the 6622T extends beyond the ITS-90 Temperature Range, supporting high value RTD's such as Ruthenium Oxide which will reach a resistance of 75 k Ω in Cryogenic applications where they are typically used.

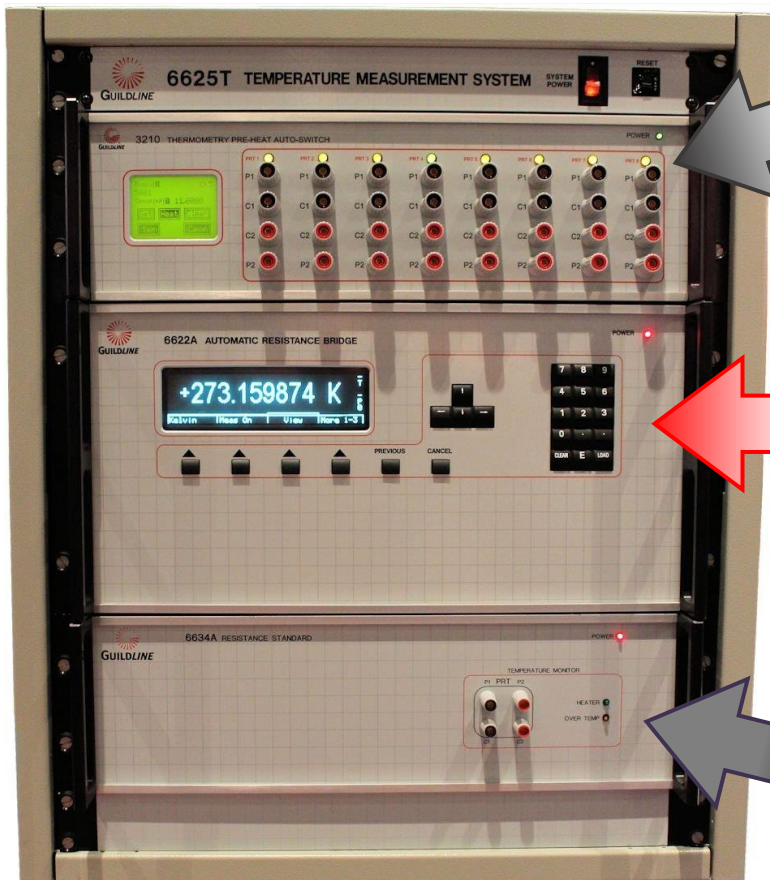
Guildline's unique design and modularity allows customers to purchase what they need today for research and to support calibration of their current work-load; and be assured of an upgrade path to support their future requirements. The system is typically delivered ready for use in a single rack.

In fact, a system with a built in 5 to 10 Element Resistance Standard, Temperature Bridge and Guildline's unique Thermometry Adaptor **is only 12U in Height (approximately 21" or 53 cm).**

6625T Series Precision Temperature Systems

The 6625T Temperature Measurement System, along with optional adaptors and utilities, provides NMIs, research laboratories, militaries and other customers with:

- Standard Temperature Measurement of 0.025 mK
- Expanded Performance (XP) Measurement of 0.013 mK and XPS Measurement of 0.005 mK)
- Standard Base Resistance Measurement of 1 m Ω to 100 k Ω 's
- 3210 Thermometry Adaptor with Pre-Heat and Automated Measurements
- Temperature Stabilized Resistance Standards with 5 to 10 Values
- Recommended Calibration Interval for 6622T Bridge of Once Every 3 Years
- Fast Measurements down to 2 Seconds with Minimal Latency
- Superior Noise Immunity to External Electromagnetic and Mechanical Noise
- Automated Procedures for Calibrating PRTs and SPRTs
- On Instrument Graphics and Statistical Analysis
- On Instrument Temperature Conversion for ITS-90, IPTS-68, and IEC-751 PRTs
- Automation of the Traceability of Primary Standards from NMI's or Other Sources
- Wide Ratio Range from 0.1:1 to 100:1
- Simple Verification Procedures to Ensure the 6625T System Remains Within its Operating Specifications
- Optional Internal Resistance Bridge Capability – One Button Push Changes the System into a Fully Functional Resistance Measurement System
- Optional 6623A Current Extension from 3 Amps to 10,000 Amps



3210 Thermometry Adaptor

The 3210 Thermometry Adaptor is designed to connect up to 8 devices from the front including PRTs and SPRTs. Every channel has its own settable preheat functionality and can be controlled via the IEEE 488.2 bus. This capability allows for complete automation in thermometry applications.

6622T Series Thermometry Bridge

There are three standard temperature bridges providing either 0.025 mK or an eXpanded Performance (XP) 0.013 mK measurement capability. A special 6622T-XPS model is also available. The entire 6622T Bridge 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.

6634A Resistance Standard

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

6625T Series Precision Temperature Systems

The 6625T automation and functionality improves the calibration uncertainties, range of equipment that can be supported, and the efficiency of calibration laboratories and research facilities. The 6625T Temperature 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 temperature probe or resistance standard to use, excitation current, etc can be programmed on a per test basis. Guildline's new 3210 Thermometry Adaptor provides preheat functionality and allows multiple temperature probes to be calibrated simultaneously thus dramatically speeding up the calibration process. These features give users full control and flexibility in automating routine calibration procedures and maximizing workload capabilities.

For example, a customer can purchase a 6625T Temperature System with the highly stable 6634A Temperature Stabilized Resistance Standard (e.g. with one or more 1 Ω, 10 Ω, 25 Ω, 100 Ω, 400 Ω, 1 kΩ or other required resistance values). These standards can be connected to a Guildline 3210 Thermometry Adaptor and Scanner to fully automate calibrations and research experiments. Remember, with BridgeWorks software, multiple tests can be sequenced and grouped to run even when operators are not present! The 6625T is a complete system capable of fully automated multiple-channel calibrations and measurements.

The modularity of the 6625T System is based on over 60 years of innovation, design knowledge, and manufacturing experience that Guildline has in building temperature and resistance measurement instruments. With a single System, the requirement for laboratory space is greatly reduced. There is also a corresponding improvement in noise immunity, and a 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 customers can take advantage of this flexibility and add additional capability via the expansion options available for this system!

Guildline's 6625T Temperature Measurement System is the only modular system available today from any source. The innovative technology found in the system contains many innovative and patented features that can be expanded as shown. The following diagram shows the flexibility of this precision Bridge.

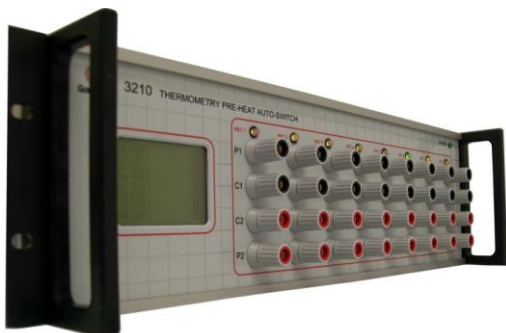
External Current Extender Modules Measure down to 0.1 μΩ with Currents to 10,000 Amps



6625T Series Precision Temperature Systems

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

Increased Accuracy: From the basic 0.025 mK (i.e. 0.1 ppm) accuracy to 0.013 mK (i.e. 0.05 ppm) extended performance accuracy. This allows customers to expand their calibration scope as new instruments are released into the market place.

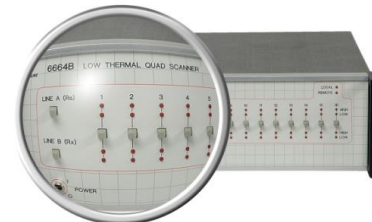


New Thermometry Adapter: The new Guildline 3210 Thermometry Adaptor, and optionally a Low Thermal Matrix Scanner, is included with the System. Every one of the eight channels on the model 3210 Thermometry Adaptor has its own pre-warm capability and automation support. The channels in pre-warm are identified with a yellow LED indicator while the selected channel being measured has an active Green LED indication.

Each channel can have its own specified current independent of the other channels. The channels can be set manually via the easy to use graphical display or full automation is provided via the IEEE 488.2 Bus connection on the rear. At only 3U in height, a customer can place multiple 3210's in a system configuration if required.

Increased Automation and Speed: The 6625T System also has the ability to optimize the measurement rate (i.e. use the standard deviation over a specified number of measurements to automatically optimize the speed versus accuracy trade-off). For example, the 6625T System can automatically use a faster reversal rate to track a moving temperature, then automatically switch to a longer reversal rate to get a best measurement once a temperature plateau is reached. This system also provides the important capability for a customer to make parameter changes without having to stop and restart the system. No other DC or AC based temperature measurements system has this capability

Channel Availability: If you require multiple Resistance Standards (Rs) you can simply add an 8 or 16 channel scanner. This Scanner allows you to connect 8 or even up to 64 additional resistance standards to your system for complete hands-free operation.



6625T System Resistance Standard

With the 6625A Resistance and Current Measurement System you have your choice in modular resistance standards. A 6634A Series Temperature Stabilized Resistance Standard can also be included or simply have the system pre-wired for your own Resistance Standards.

The 6634A Series provides a set of precision resistance standards enclosed in a temperature controlled chamber. Temperature monitoring is provided by a precision PRT sensor installed in the chamber with 4 terminal connectors provided on the front panel. There are up to 10 standard resistance values available covering the decade range of 0.1 Ω to 100 M Ω 's. Each resistance element is isolated and has a 4 terminal connection at the back panel. The resistance elements are maintained at $(30 \pm 0.01)^\circ\text{C}$ in a temperature stabilized chamber. Resistance elements are electrically isolated and bonded to an aluminum block to reduce thermal gradients in the inner chamber. The inner chamber is designed to electrically shield the individual elements and an electrical connection is provided to a guard terminal at the back panel. Full specifications can be found on the Guildline website for this standard.



6634A Resistance Standard Specifications					
Nominal Resistance	Nominal Initial Tolerance (\pm ppm)	24 Hour Stability (\pm ppm)	12 Month Stability (\pm ppm)	Temp Coefficient (\pm ppm/ $^{\circ}$ C)	Maximum Voltage (Volts)
0.1	10	0.1	3	0.01	0.1
1	10	0.01	2	0.005	0.32
10	10	0.01	2	0.005	1.0
25	10	0.01	2	0.005	1.0
100	10	0.01	2	0.005	3.2
400	10	0.01	2	0.005	6.3
1k	10	0.01	2	0.005	10
10k	10	0.01	2	0.005	32
100k	15	0.02	5	0.01	100
1M	25	0.04	5	0.02	320
10M	35	0.2	6	0.2	1000
100M	50	0.5	15	0.2	1000

Resistance Measurement Option: This option allows the Thermometry Bridge to function as a DCC Resistance Bridge. No changes are required other than to select this internal option via the installed firmware and now you have dual capabilities. A customer simply has to select either Resistance or Temperature Mode while using the Bridge.

Expanded Resistance Measurement Range: From up to 100 k Ω to an expanded 1 G 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 6530 Programmable Digital Teraohm-Bridge Meter to the system and have an automated system measuring all the way to 10 P Ω 's!

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

Current Extenders: From an external 3 A_{dc} extender up to 10,000 A_{dc} in modular 150 A_{dc} and/or modular 1000 A extenders. These current extenders do not require external power supplies or external compressed air driven mechanical 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 300 A_{dc}, and above 300 A 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 $\mu\Omega$ level. A 6625T system with current extenders can also be used to calibrate DC shunts, such as Guildline's g211A and g230A series all the way to 10,000 Amps.



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

6625T Series Precision Temperature Systems

The 6625T is an excellent solution for precision temperature measurements. DC bridges have inherently better noise immunity to external electromagnetic and mechanical noise. Coupled with this better noise immunity, the 6622T Bridge is designed to take faster readings at two second intervals with best measurements typically being achieved with 10 second readings.

Guildline's integrated 6625T System provides customers with the best value for their investment. Customers only have to deploy and support a single system to meet all of their temperature research and calibration needs including high temperature and cryogenic applications. The recommended calibration interval of once every three years will save customers over \$100,000 given the 20 year expected life span of the 6625T System. This is a substantial savings over other manufacturer's offerings! Finally, the flexibility to purchase expansion options and upgrades for the 6625T 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.

Customers who purchase a 6625T Temperature Measurement System can make precision temperature measurements faster and with better uncertainties. The Guildline 6625T also provides more automation features than any competing approach, thus providing more efficiencies and cost savings. The 6625T is the least expensive approach to equipping a temperature laboratory because of substantially reduced purchase, operating, calibration, training and ongoing life cycle costs; and is backed by a two year Guildline warranty. No other Temperature Measurement System in the world offers these advantages, or this flexibility, to customers.

Specifications

6625T System specifications listed below are a two sigma, absolute specification (including all secondary specifications) for the standards listed and in a laboratory environment of (23°C +/- 2)°C. Note that height and weight are based on a 6625T 24 inch rack, fully wired including standard grounding plane, rear door and fans, a power bar, a 6634A Resistance Standard, 6622T Bridge, 3210 Thermometry Adapter and the optional drawer with Laptop Controller integrated.

6625T Series General Specifications			
Linearity		± 0.01 ppm of Full Scale Ratio	
Display resolution (ppm)		Selectable (Programmable) from 0.0001 ppm to 10 ppm	
Temperature Coefficient		0.02 ppm/°C of reading	
Automatic current reversal rate (in seconds) s		4 s to 1637 s programmable, increment of 1second	
Communication		IEEE 488.2 (SCPI Based Language Instructions)	
System Power Requirements		VAC: 100V, 120V, 220V and 240V ± 10% / 50 or 60Hz ±5%	
System Operating Temperature to Full Specifications		23°C ± 2°C	73°F ± 4°F
System Maximum Operating Range (<50% RH)		+10°C to +40°C	+50°F to +104°F
System Temperature Storage Range		-20°C to +60°C	-4°F to +140°F
Operating Humidity	20% to 70% RH	Storage Humidity	15% to 80% RH
Typical 300 Amp System Dimensions (Width x Height x Depth)			Weight
445 mm x 609 mm x 609 mm		19" x 24" x 24"	65 kg 143 lbs

6625T Series Precision Temperature Systems

The following tables show the uncertainty contribution of the model 6622T Bridges to the total measurement. Because of the **wide range of R_x/R_s ratios available**, it is possible to measure UUT's with a **variety of R_s standards**. For example, a 25 Ω PRT can be measured with a 10 Ω , 25 Ω or 100 Ω reference standard (R_s). To determine the bridge's contribution to measurement uncertainty, simply look at the R_s you are using, and go to the appropriate UUT range. The base model 6622T Bridge has a best uncertainty $\pm 25 \mu\text{K}$ for a 25.5 Ω SPRT at 0°C measured against a 25 Ω reference resistor (i.e. 0.1 ppm). The 6622T-XP Bridge has a **best uncertainty of 13 μK** (i.e. 0.05 ppm), while the 6622T-XPS has an amazing 0.02 ppm.

R_s 1 Ω	RX/RS MEASUREMENT UNCERTAINTY				24 Hour Stability
	0.08 Ω ► R_x ◀ 0.8 Ω	0.8 Ω ► R_x ◀ 6.3 Ω	6.3 Ω ► R_x ◀ 13.4 Ω	13.4 Ω ► R_x ◀ 107.5 Ω	
Base Model	± 0.4 ppm	± 0.1 ppm	± 0.1 ppm	± 0.2 ppm	$< \pm 0.05$ ppm
XP Model	± 0.3 ppm	± 0.05 ppm	± 0.05 ppm	± 0.1 ppm	$< \pm 0.03$ ppm
XPS Model	± 0.02 ppm	± 0.02 ppm	± 0.02 ppm	± 0.1 ppm	$< \pm 0.015$ ppm

R_s 10 Ω	RX/RS MEASUREMENT UNCERTAINTY				24 Hour Stability
	0.08 Ω ► R_x ◀ 0.8 Ω	0.8 Ω ► R_x ◀ 6.3 Ω	6.3 Ω ► R_x ◀ 13.4 Ω	13.4 Ω ► R_x ◀ 107.5 Ω	
Base Model	± 0.4 ppm	± 0.1 ppm	± 0.1 ppm	± 0.2 ppm	$< \pm 0.05$ ppm
XP Model	± 0.3 ppm	± 0.05 ppm	± 0.05 ppm	± 0.1 ppm	$< \pm 0.03$ ppm
XPS Model	± 0.02 ppm	± 0.02 ppm	± 0.02 ppm	± 0.1 ppm	$< \pm 0.015$ ppm

R_s 25 Ω	RX/RS MEASUREMENT UNCERTAINTY				24 Hour Stability
	2.5 Ω ► R_x ◀ 20 Ω	20 Ω ► R_x ◀ 157.5 Ω	157.5 Ω ► R_x ◀ 335 Ω	335 Ω ► R_x ◀ 2687 Ω	
Base Model	± 0.4 ppm	± 0.1 ppm	± 0.1 ppm	± 0.2 ppm	$< \pm 0.05$ ppm
XP Model	± 0.3 ppm	± 0.05 ppm	± 0.05 ppm	± 0.1 ppm	$< \pm 0.03$ ppm
XPS Model	± 0.02 ppm	± 0.02 ppm	± 0.02 ppm	± 0.1 ppm	$< \pm 0.015$ ppm

R_s 100 Ω	RX/RS MEASUREMENT UNCERTAINTY				24 Hour Stability
	10 Ω ► R_x ◀ 80 Ω	80 Ω ► R_x ◀ 630 Ω	630 Ω ► R_x ◀ 1340 Ω	1.34k Ω ► R_x ◀ 10.75k Ω	
Base Model	± 0.4 ppm	± 0.1 ppm	± 0.1 ppm	± 0.4 ppm	$< \pm 0.05$ ppm
XP Model	± 0.3 ppm	± 0.05 ppm	± 0.05 ppm	± 0.2 ppm	$< \pm 0.03$ ppm
XPS Model	± 0.02 ppm	± 0.02 ppm	± 0.02 ppm	± 0.1 ppm	$< \pm 0.015$ ppm

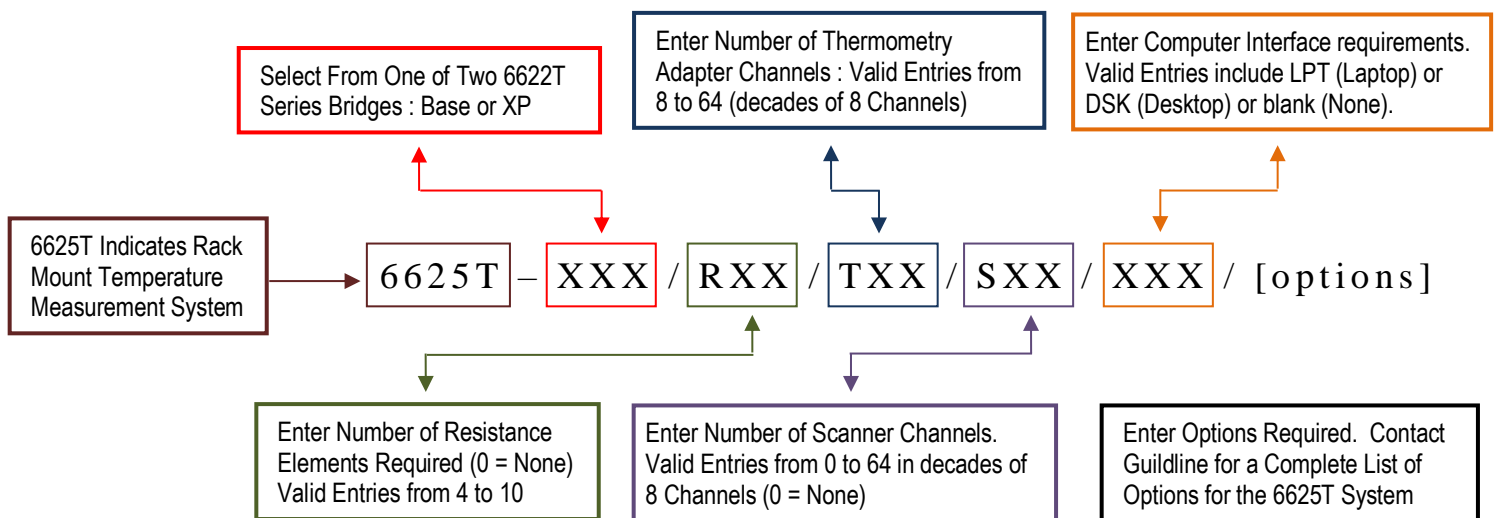
R_s 1 k Ω	RX/RS MEASUREMENT UNCERTAINTY				24 Hour Stability
	100 Ω ► R_x ◀ 800 Ω	800 Ω ► R_x ◀ 6.3 k Ω	6.3k Ω ► R_x ◀ 13.4k Ω	13.4k Ω ► R_x ◀ 107.5k Ω	
Base Model	± 0.4 ppm	± 0.1 ppm	± 0.1 ppm	± 1.0 ppm	$< \pm 0.05$ ppm
XP Model	± 0.3 ppm	± 0.1 ppm	± 0.1 ppm	± 1.0 ppm	$< \pm 0.04$ ppm
XPS Model	Optional ³	Optional ³	Optional ³	Optional ³	Optional ³

6625T Series Precision Temperature Systems

Rs 10 kΩ	RX/RS MEASUREMENT UNCERTAINTY				24 Hour Stability
	1kΩ ► Rx ◀ 8kΩ	8kΩ ► Rx ◀ 63kΩ	63kΩ ► Rx ◀ 134kΩ	Resistance Option	
Base Model	± 0.4 ppm	± 0.1 ppm	± 0.3 ppm	Optional ⁴	< ± 0.05 ppm
XP Model	± 0.3 ppm	± 0.1 ppm	± 0.3 ppm	Optional ⁴	< ± 0.04 ppm
XPS Model	Optional ³	Optional ³	Optional ³	Optional ⁴	Optional ³

- 1 - Specifications are based on 20 second reversal rate (10 Second Measurement Rate), 100 μW power dissipation in Rx and environment temperature of 23°C ±2°C.
- 2 - Lowest possible Rx is defined as Rx(low) = Rs x .08 and Maximum possible Rx is determined by Rx(high) = Rs x 107.5.
- 3 - Extended Temperature Ranges and Ratios are available upon request. Calibration must be requested upon order and is optional for an XPS (Extended Performance Series) Bridge.
- 4 - Resistance Option (Voltage Module) is available for Resistance Measurements to 1GΩ. Option and Calibration must be requested upon order.

CONFIGURING YOUR 6625T RESISTANCE MEASUREMENT SYSTEM



ORDERING INFORMATION	
Example Number: 6625T-XP/R6/T8/So/LPT/GPIB/TRAY Includes	
6625T*	Precision Resistance and Current Measurement System Includes:
	6625T System Rack, Fans, Ground Plane and Fully Wired, Tested
	6622T Thermometry Bridge (wired)
	6634A Temperature Stabilized Resistance Standard (Wired)
	3210 Thermometry Adapter (Includes Built In Switching Matrix)
	No Additional Scanners
	Laptop Controller Interface with Bridgeworks Software Installed
	Technical Manual (Hardware and Software)
	Calibration Certificate and Certificate of Conformance
	2 Year Standard Warranty
Available Options (More Added on a Regular Basis)	
/Resist	Adds Resistance Option
/Tray	Laptop Stow-Away Tray (Installed)

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