



NEW

6640T AMS Series

ADVANCED MEASUREMENT SERIES OF TEMPERATURE BRIDGES

WORLD'S MOST ADVANCED SERIES EVER OF TEMPERATURE BRIDGES



6640T SERIES FEATURES

- ◆ Best Accuracy: ± 0.02 ppm of Reading with 1 mA of Current
- ◆ Full Pre-Heat and Individual Channel and Current Control with model 3210!
- ◆ New Design Toroid Specifically for Temperature Measurements Applications!
- ◆ Measurement Rates fast as 0.5 Seconds!
- ◆ Built-in Windows 8 Computer and Touch Screen Display Providing Complete Measurement Results and Graphs!
- ◆ Available USB ports for data collection and/or ancillary items such as hard drives, mouse, keyboard and other.
- ◆ System Control via USB or IEEE!
- ◆ Widest Available Range up to 100k Ω !
- ◆ Modular Design, **Expandable** Capabilities, Complete Investment Protection!
- ◆ Full 10.5 Digits (0.1 ppb) Display Resolution
- ◆ Change All Key parameters "on-the-fly" while the measurement is running!
- ◆ Linearity: ± 0.01 ppm of Full Scale!
- ◆ Resolution: ± 0.0001 ppm of Full Scale!
- ◆ Wide Range of Ratios: 0.1:1 ~ 100:1!
- ◆ BridgeWorks™ Data Acquisition Software!
- ◆ Unique Calibration Support Strategy!
- ◆ Complete Measurement Systems Available!

GUILDLINE INSTRUMENTS 6640T TEMPERATURE BRIDGE SERIES is a completely redesigned DCC Based Bridge to provide better uncertainties, faster measurement rates and more operational capability in Temperature Bridges.

The 6640T Series is not merely a touch screen interface centered around the same old technology used for the last 20 years, but incorporates the most advanced design and best operational features. The 6640T is based on almost 60 Years of Guildline's experience designing and manufacturing DCC Bridges; and incorporates customer feedback from over two hundred Guildline 6622A Bridges in use at NMIs, militaries, and calibration laboratories.

The 6640T incorporates a new patent-pending toroid design, low current measurement improvements, new picovolt meter, new latest processor, new internal communications structure, and new firmware. The new Windows 8 touch screen interface makes the 6640T easy to use while providing complete functionality for measurements and addressing the requirements for 17025 Accreditation of temperature measurements.

The 6640T Series Provides the Best in Innovations, Cutting Edge Technology, and Most Importantly, the Best in Leading Measurement Specifications of Any Temperature Bridge Manufactured Today!

In fact, many of the designs concepts incorporated into this new bridge have had patents applied for. While the design enhancements are not visible, the end measurement result is clearly visible.

These new techniques will allow for considerably less noise, faster measurement cycles, improved repeatability and most of all, world's most advanced operator interface found on a Temperature Bridge.

While still maintaining the same form and fit of the widely fielded 6622T and older 6675A Series, customers will be able to simply replace their current bridge without having to buy a new rack and any other equipment to accommodate for a difference bridge size.

6640T AMS SERIES OF TEMPERATURE BRIDGES

6640T SERIES – THE BEST IN ENGINEERING DESIGN AND INNOVATION

For quality in measurements, you must have quality design and quality manufacturing in your standard. If you examine the internal layout of the new 6640T Series Bridge you will see the absolute quality in the entire bridge with special attention paid to insulating and use of ground planes to reduce noise, the latest in modern components to reduce affects due to temperature and power, increased resolution and stability in voltage and current, increased reliability, and faster measurement cycles. Add to this the new patent pending designs and a carefully thought out and designed internal layout, and you will find a bridge series that will meet customer requirements today, as well as years into the future.



While the design and measurement improvements are many, we did not forget what has made Guildline the leader in Laboratory Standards - the ability to buy what you require today - and ensure your investment is protected in modularity and upgradability for future requirements.

Like the world's most used DCC Bridge, the Guildline 6622A Series, the 6640T Series modular design allows you to buy what is required today with existing budgets, and when workload requirements change, simply expand your bridge to meet these requirements without any loss of your original investment! Modular design provides a single solution reducing life cycle costs not only for equipment support, but also for software development and technician training.

Customers should be wary of other manufacturer claims of providing modular and upgradeable solutions in Temperature Bridges. When you decide to improve the measurement uncertainty on a 6640T Series Bridge, this is accomplished by upgrading your existing 6640T Bridge. With competitors a customer has to purchase a brand new bridge.

A Modular design, when implemented properly, provides the perfect solution for current and future needs, whether you need secondary uncertainties or as a Primary Laboratory Standard.

Available 6640T AMS Series Models



6640T-Base Model - The entry level 6640T Base Temperature Bridge provides uncertainties down to 0.05 ppm at 1 mA and with a complete measurement range to 100 k Ω . That's a 10x larger range than the competition provides in their high end models! The Base model is fully upgradeable to the XP Model for future requirements.

6640T-XP Model - The eXtended Performance (XP) Temperature Bridge provides uncertainties down to 0.02 ppm at 1 mA and with a complete measurement range to **10 k Ω** ! Instrument control and internal menus will be the same, and your software procedures will still work – the same instrument operation and calibration support but with the improved uncertainties you need!



6640T AMS SERIES OF TEMPERATURE BRIDGES

The choices are yours and designed to meet your workload, not ours! Best of all, your current software programming will work and the menus will be the same, thus dramatically reducing learning curves and training requirements. Ongoing operating costs are also dramatically reduced because a **SINGLE 6640T TEMPERATURE BRIDGE** offers reduced support costs when the time comes for calibration.



And the best yet is the 6640T Series will continue to work with your current Guildline Bridge accessories. If you own a 3210 Thermometry Adaptor / Scanner, 5032 Air Bath, or 5600 Fluid / Oil Bath they will continue to work with a 6640T Bridge. The design is so complete, you can simply remove an older Guildline Automated Bridge and replace with a new 6640T Series and all you need to do is reconnect the terminal wires.

6640T SERIES OPERATORS INTERFACE

NEW 10 inch VGA capacitive touch screen with full color graphical user interface. The most visible feature on the new 6640T Series is the NEW 10 Inch embedded touch display running the latest Windows 8 Software. This display not only has low noise characteristics, but is designed to provide maximum protection from Electromagnetic Interface (EMI) and noise in the internal measurement circuitry, and also from the Bridge terminals.



When you buy any 6640T Series Bridge it's as if you know them all. Menu operation, measurement setup, and software are identical among all models. The easy-to-use, embedded display is based on the Windows 8 operating system. The **menu system is common to all models** eliminating in-depth operator learning requirements. **USB** is standard on all models with the universally recognized **Standard Code Programmable Interface (SCPI)** based commands incorporated as the programming language of choice. Optionally **IEEE 488.2** can be provided in addition to USB. You can have a rack or bench mount model and even have your choice of **front or rear terminals**. Your requirements, your needs - one family of instruments.

All 6640T Bridges now provide a full $10^{1/2}$ digits of resolution and the ability to **graphical see** the data (trending). You can have the data presented in a **summary or detailed format** right on the Bridge Screen or available via PC Base BridgeWorks Software. Measurement and **Uncertainty Analysis** you need as a Metrologist or to meet the requirements of ISO 17025 Accreditation!

Every effort has been taken in the 6640T Series design to reduce noise and error. **Thermal EMF effects are eliminated** by automatic current reversal. The **unique architecture** of the bridge and its **control algorithm** further removes gain and offset errors in the **picovolt balance detector** and the **new precision toroid**. The end results are shown by **long term accuracy and linearity** without the need for routine, frequent verification tests or calibrations. Included are the same **wide measurement ratios** up to 100:1 that made the 6622A Series so successful.

The 6640T bridges can be used in either a **fixed or automatic** mode of operation. In fixed mode, **measurement rate** is programmable, updating measurements from every 0.5 seconds to 14 minutes. A unique computerized measurement mode provides automatic reversal rates, optimizing the measurement rate to the required uncertainty.

6640T AMS SERIES OF TEMPERATURE BRIDGES

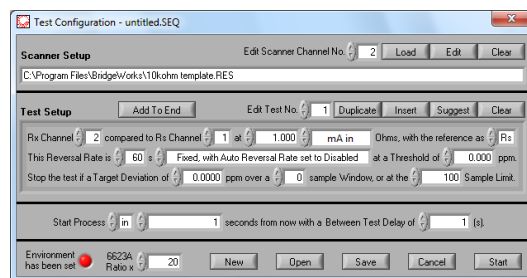
In addition a customer can specify a **measurement rate that is independent from the reversal rate**. So many measurements can be made while on a single polarity. The customer can also specify a **wait time** after polarity reversal prior to taking measurements, in order to allow the measurement circuitry to settle. These are unique features that are only available with Guildline's 6640 Temperature Bridge.

The 6640T Series, when used with the **Guildline Instruments Model 6634A Temperature Stabilized Resistance Standards**, effectively **eliminate errors** due to the affects of temperature environment, even when used in a calibration laboratory environment of **23 °C @ ± 3 °C**.

6640T BRIDGEWORKS SOFTWARE

Not only does Guildline provide unique DCC Temperature Bridge hardware, but we offer complete new solutions for software as well. Guildline's proven **BridgeWorks** software provides for setup, control, measurements, and reporting. BridgeWorks is provided free with any of the Bridges in the 6640T Series. **Optional BridgeWorks plug-in** are available to expand BridgeWorks functionality.

BridgeWorks software is extremely powerful, yet **straight forward and user friendly**. The software comes with all of the useful and convenient features commonly found in **Windows based** commercial software programs. **On-line context help** is available to provide added assistance in understanding the functions of the software. BridgeWorks was **developed in LabVIEW®** offering direct compatibility to all National Instruments GPIB interfaces. These interfaces come in a wide variety of connection options to your PC such as **USB, FireWire, Ethernet, PCI, PCMCIA, RS232/485**, and more. Guildline can even provide a complete Temperature Measurement System with the 6640T Series by adding Resistance Standards, Thermometry Adaptors/Scanners, and software. This System is integrated, verified and tested in a rack a little more than 36" high (i.e. less than 1 meter). **Complete turnkey solutions!**



For a **complete, automated resistance** measuring system, a 6640T Temperature Bridge can be used with Guildline's 3210 Low Thermal Thermometry Adaptors / Scanners which have programmable pre-heat on an individual channel basis, and Guildline's 6634A Temperature Stabilized Resistance Standards. When the Bridge is used with a Guildline model 3210 **Low Thermal Thermometry Adaptor / Matrix Scanner**, the software can turn the bridge into a **multiple-channel** calibration and measurement system. Timed, sequenced single or multiple tests can be initiated while the Bridge is unattended. All user **definable test variables**, such as excitation current, pre-heat current, measurement speed, reversal rate etc can be **programmed on a per test basis**, giving the **users full control and flexibility** in conducting well designed experiments. Additionally, internal utilities reside within the software to enhance and **simplify the calibration of the 6640T Series DCC Bridge** by using the Guildline 6634A Series of Temperature Stabilized Resistance Standards.



BridgeWorks Software provides comprehensive graphic display, math functions and trend analysis. Data can be **easily exported** to MS-Excel®, Crystal Reports® and in HTML format. All reports generated conform to traceability requirements of ISO-17025.

BridgeWorks enhances temperature capabilities on other laboratory standards through the use of plugins and utilities. These optional utilities include control of connected Guildline Air Baths and Fluid/Oil Baths.

6640T AMS SERIES OF TEMPERATURE BRIDGES

6640T SERIES SPECIFICATIONS

DCC bridges have inherently **better noise immunity** to external electromagnetic and mechanical noise. Measurements are conducted in **true four-terminal mode** so long test leads can be used. Since excitation current is DC, reactance introduced by the probe and probe leads does not affect measurement accuracy. **Thermal EMF is eliminated** by periodic polarity reversal that is **programmable by the user**. The built-in, extremely stable current supply permits selection of output currents between 20 μ A and 150mA to satisfy a wide range of sensitivity requirements. Root square values can be conveniently chosen from the instrument front panel or via software. **Temperature conversion and display** is done on the front panel, or on a PC using the BridgeWork software

One of the **key features** of Guildline's 6640T DCC Temperature Bridge is how the unit is calibrated. This option means that the 6640T is specifically **tested** at the **lower currents** (1 mA) found in thermometry and the calibration coefficients are stored separately for each decade of resistance and ratio. In contrast competitive DCC temperature bridges are all calibrated and specified for 10 mA to 150 mA of operation, rather than the 1 mA required for temperature measurements.

DON'T BE FOOLED BY OTHER MANUFACTURERS SPECIFICATIONS! The specifications listed by other manufacturers are not complete specifications based on real laboratory conditions. The 6640T Series specifications are **3 Year specifications** based on a 23°C \pm 3°C laboratory temperature, not limited to +0.5° or -0.5° C (1°C change), have minimal filtering (controllable) and have been verified for repeatability! Guildline's specifications are also based on 1 mA of current typically used for temperature measurements in contrast to competitive DCC bridge manufacturers whose specifications are based on 10 mA to 150 mA and can never be achieved under 1 mA thermometry conditions. Want to see how a Bridge really performs? Ask for a demo (available starting in 2nd qtr, 2015) - then stop and start the measurements to check for repeatability!

6640T SERIES GENERAL SPECIFICATIONS			
Linearity		\pm 0.01 ppm (1:1 to 13.4:1)	
Display resolution (ppm)		Selectable (Programmable) from 0.0001 ppm to 10 ppm	
Temperature Coefficient		0.01 ppm/°C of reading (Outside 23°C \pm 3°C)	
Automatic current reversal rate (in seconds)		4 to 1637 programmable, increment of 1 second	
Fastest Measurement Sample Rate		0.5 seconds	
Communication		USB, IEEE 488.2 (Optional), SCPI Based Language Instructions	
Test current (for measurements to 100 k Ω)	Usable range (\pm 30V compliance) (A)	10 μ A ~ 150 mA (extension to 10,000A available for resistance measurements)	
	Resolution (μ A)	1 μ A	
	Accuracy [error(ppm) + offset(A)]	\pm 100 ppm \pm 10 μ A	
Bridge Operating Temperature to Full Specifications		23°C \pm 3°C	73°F \pm 5°F
Bridge Maximum Operating Range (<50% RH)		+18°C to +25°C	+65°F to +82°F
Bridge Temperature Storage Range		-20°C to +60°C	-4°F to +140°F
Power Requirements		VAC: 100V, 120V, 220V and 240V \pm 10% / 50 or 60Hz \pm 5%, 200VA	
Dimensions (Width x Height x Depth)			Weight
440 mm x 200 mm x 465 mm		17.3" x 7.8" x 18.3"	27 kg 59.5 lbs

6640T AMS SERIES OF TEMPERATURE BRIDGES

Note: The 6640T-Base and 6640T-XP models are limited to a maximum of 100 kΩ with a maximum Rs (Resistance Standard) of 10 kΩ. Because of the unique variable ratios available on all models, it is possible to measure UUT's with a variety of Rs Standards. For example, a 10 kΩ UUT could be measured with a 100 Ω, 1 kΩ and 10 kΩ Resistance Standard (Rs). To determine the measurement uncertainty due to the bridge, simply look at the Rs you are using, and then go to the appropriate UUT Sub range.

Base Range: max 100 kΩ			6640T-BASE			
INTERCHANGE ¹ SPECIFICATION	RESISTANCE STANDARD	3 YEAR RATIO SPECIFICATIONS ²				
0.8 > Rx < 6.3	◀ ACTUAL RATIO ▶	0.08 > Rx < 0.8	0.8 > Rx < 6.3	6.3 > Rx < 13.4	13.4 > Rx < 107.5	
1 : 1	◀ NOMINAL RATIO ▶	0.1 : 1	1 : 1	10 : 1	100 : 1	
± 0.05 ppm	◀ 1 Ω ▶	± 0.6 ppm	± 0.1 ppm	± 0.1 ppm	± 0.1 ppm	
± 0.05 ppm	◀ 10 Ω ▶	± 0.6 ppm	± 0.1 ppm	± 0.1 ppm	± 0.1 ppm	
± 0.05 ppm	◀ 100 Ω ▶	± 0.6 ppm	± 0.1 ppm	± 0.1 ppm	± 0.3 ppm	
± 0.05 ppm	◀ 1 kΩ ▶	± 0.6 ppm	± 0.1 ppm	± 0.1 ppm	± 0.8 ppm	
± 0.07 ppm	◀ 10 kΩ ▶	± 0.6 ppm	± 0.1 ppm	± 0.2 ppm	RESISTANCE OPTION	

XP Range: max 100 kΩ			6640T-XP			
INTERCHANGE ¹ SPECIFICATION	RESISTANCE STANDARD	3 YEAR RATIO SPECIFICATIONS ²				
0.8 > Rx < 6.3	◀ ACTUAL RATIO ▶	0.08 > Rx < 0.8	0.8 > Rx < 6.3	6.3 > Rx < 13.4	13.4 > Rx < 107.5	
1 : 1	◀ NOMINAL RATIO ▶	0.1 : 1	1 : 1	10 : 1	100 : 1	
± 0.02 ppm	◀ 1 Ω ▶	± 0.4 ppm	± 0.05 ppm	± 0.05 ppm	± 0.1 ppm	
± 0.02 ppm	◀ 10 Ω ▶	± 0.4 ppm	± 0.05 ppm	± 0.05 ppm	± 0.1 ppm	
± 0.02 ppm	◀ 100 Ω ▶	± 0.4 ppm	± 0.05 ppm	± 0.05 ppm	± 0.3 ppm	
± 0.02 ppm	◀ 1 kΩ ▶	± 0.4 ppm	± 0.05 ppm	± 0.05 ppm	± 0.8 ppm	
± 0.03 ppm	◀ 10 kΩ ▶	± 0.4 ppm	± 0.05 ppm	± 0.15 ppm	RESISTANCE OPTION	

1 - Interchange specification (i.e. sometimes referred to as a self-calibration) with minimal filtering.

2 - 3 Year Calibration interval with annual performance verification (automated).

3 - Specifications are based on 1 mA maximum current in Rs and temperature of 23°C ±3°C.

Check out our full line of thermometry options including our **new 3210 Thermometry Auto-Switch**. This adaptor provides programmable and individual constant keep warm current to all SPRT's connected substantially reducing the time for calibration over the competition.

6640T SERIES OF DCC TEMPERATURE BRIDGES

MAKING THE 6640T SERIES EVEN BETTER

Guildline provides a variety of standards to **support the 6640T Series** of Bridges. For the **ultimate in ease of use and wide** temperature operating environment, look at our 6634A Temperature Controlled Resistance Standards. These resistance standards are a rack or bench mount unit with up to 10-resistance values. The values are in a **shielded, self contained 30°C** temperature environment and usable in a laboratory environment of **23°C ± 5°C**. No more need for oil baths. For the **best in air resistances** see our 9334A Series of Air Resistance Standards.



For **multi-channel operation** look at our 3210 Thermometry Adaptors with Scanning capability. Each model has a built-in switch to automatically measure multiple connected devices, while using individual programmable pre-heat/keep-warm currents in between measurements. Both IEEE 488.2 and USB connections are provided and the 3210 Thermometry Adaptor can be controlled by Guildline's PC based BridgeWorks software package. The 3210 Thermometry adaptor provides easy access for automating up to eight PRT's or SPRT's with user programmable channel currents!



For the best Unit Under Test (UUT) environmental control Guildline produces the **5030 Series of Precision Air Baths**. This series of programmable Air Baths not only maintain an **ultra stable 0.015°C** environment but also provide **EMI and EMF Shielding** within the high quality dual wall Stainless Steel Chamber. Dual Heaters/Coolers/Fans provide for operational redundancy and the unit is **fully IEEE 488 programmable**. **Control Resolution** is a **0.001°C** and a second channel is available for a second user programmable temperature sensor that can be read directly on the front panel. This bath incorporates an extensive **Metrology based menu operation**.



The 5030 Series can be programmed right from Bridgeworks Software. With the large chamber capacity and when used with the 6664C Scanners, **sequences of multiple resistors** verified at multiple temperatures can be entered and run at one time. An operator simply has to review data when the multiple tests have finished.

And Guildline is back providing precision Fluid/Oil Baths. Guildline is now providing the most advanced Fluid Baths ever. The 5600 Series of Programmable Fluid Baths is a new design taking the best features, such as Guildline's highly reliable and extremely stable analogue control, and adding fine control via an additional proportional-integral-derivative (PID) digital overlay. A windows table allows storing and accessing 17025 required Metrology Based data on resistors configurations, environmental and bath operation. A true Metrologist too! The 5600 Series of Baths can be used with oil, water, or salt water for oceanography applications. The 5600 provides uniform constant fluid temperature over a wide range from -5°C to 55°C with best stability < 0.0015°C. Three sizes of EMI shielded Fiberglass Tanks are available.



6640T SERIES OF DCC TEMPERATURE BRIDGES

Guildline also provides **full system solutions and full system integration**. Need a base system with one thermometry adaptor / scanner and a resistance standard in a rack? Not a problem. Need a **6640T-XP with 32 channels**, and Resistance Standards? We can do it! In fact, Guildline has produced over one hundred 6625 Measurement Systems complete with Bridge, Multi-Channel Scanners, and Resistance Standards all in a single rack. 6625T Systems are supplied with all hardware and software installed, tested and verified. Need the **ultimate temperature measurement** in a single rack solution? Combine any one of the 6640T Series Bridges with a 6634A Temperature Stabilized Resistance Standard, and Thermometry Adaptors / Scanners with individually programmable pre-heat per channels. Just ask what **Guildline can make for you**.



VERIFICATION OF PERFORMANCE

Bridges are not self-calibrating. All Bridges must have an initial calibration done at time of manufacture, and subsequently must be verified or re-calibrated on a periodic time schedule. Competitors misleadingly state that their Bridges are self-calibrating but in reality their Bridges are calibrated the same way as all commercial bridges including Guildline's – via external resistance standards.

Historically the verification that a precision DCC Bridge is operating as per its last calibration was challenging. A Harmon type transfer standard was needed for the verification of a bridge's non 1:1 measurement ratios along with high technical skill levels. With the introduction of the 6640T Series, and previous 6622A, multi-ratio bridges the verification of performance can be carried out with ease. Frequent verification of the bridge performance can also provide insight into the bridge's short and long-term stability to improve user's confidence levels and uncertainties.

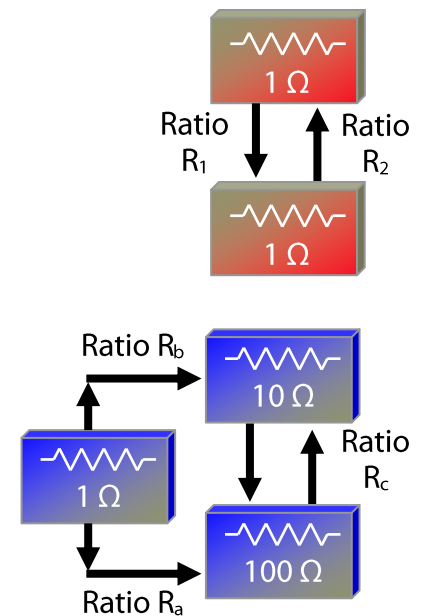
The 1:1 measurement ratio can be easily verified by interchange measurement tests using two stable standard resistors of same nominal values, as illustrated by the block diagram to the right. Bridge 1:1 measurement ratio error e_i (in ppm) is calculated using the following formula:

$$e_i = (1/2) \cdot |R_1 \cdot R_2 - 1| \cdot 10^6$$

Non 1:1 measurement ratios, such as 10:1 and 100:1 ratios can be easily verified by closure measurement tests using three stable standard resistors, as illustrated by the block diagram to the right. Bridge non 1:1 measurement ratio error e_c (in ppm) is calculated using the following formula

$$e_c = (1/3) \cdot |R_a - R_b \cdot R_c| / R_a \cdot 10^6$$

Note: Resistance values in these block diagram are only representative values and are selected for the illustration of methodology only. Other ratios can be verified in the same manner.



6640T SERIES OF DCC TEMPERATURE BRIDGES

WARRANTY AND SERVICE

Over 58 Years of Guildline innovation in engineering and design. The **6640T TEMPERATURE BRIDGES** provide complete expandability and flexibility that meets your current and future measurement needs. Options that satisfy real measurement needs and provide complete investment protection. How can you improve? Simple! Offer an industry leading **2-Year Warranty** to show your confidence. All 6640T Series of DCC Temperature Bridges come with a 2-year Warranty that covers both parts and labour.

ORDERING INFORMATION	
Model	Specify One Of Following Models (Bench or Rack)*
6640T-B	Base Accuracy, Range 100 kΩ
6640-XP	Extended Performance, Range 100 kΩ *All Bridges include Calibration Certificate, Operator and Software manual, and one set of Rs/Rx Low Thermal Leads
/R	Add's Resistance Option to Bridge
/RC	Report of Calibration Available at Nominal Charge
/RT	Specifies Rear Terminals versus Front Terminals (Default)
SM6640	Service Manual (Extra Charge)
6640T SERIES OPTIONS	
/Controller	System Controller with IEEE and Software Integrated
IEEE-PCI	NI IEEE-488.2 Interface for a PCI slot (Win 9X/NT/ME)
IEEE-2m	NI IEEE-488.2 Interface cable, 2m double shielded
6634A-X	Temperature Stabilized Resistance Standard for 6640T Series
3210	8 Channel Thermometry Adapter with Pre-Heat
6664A-12	SCW Lead pair with gold plated banana plugs, 2m in length
SCW/18-30	30 Meters Shielded, Copper, Low Thermal Wire 18 Gauge
Many other types of test and communication leads and accessories are available.	

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