

Very High Stability Calibration Laboratory Resistance Transfer Standards



### FEATURES

- Transfer Accuracy better than 1 ppm
- Exact ESI SR1010 Series Replacement
- Six models Available with decade values from 1 Ω/step to 100 kΩ/step
- Establish decade resistances from 0.1 Ω to 1 MΩ
- Each device configurable to 10R, 1R, and R/10
- Leakage Resistance  $>10^{12}$  Ω from terminal to case
- ISO 17025 Accredited Calibration
- Only Manufacturer that can provide fully automated calibration solutions to support the SR/GL 1010 Series!

**GUILDLINE INSTRUMENTS GL 1010 SERIES** of Resistance Transfer Standards are designed as very high stability calibration laboratory transfer standards for customers looking to replace the old ESI 1010 series.

For over 15 years Guildline has been the only manufacturer who not only makes exact SR 1010 equivalents, but also builds the only fully automated measurement system that can calibrate the GL 1010 or SR 1010 to full manufacturer specifications. The 6625A Resistance Measurement System with the SR 1010 adapter allows a user to make a single connection and then verify a complete ESI or GL 1010 Resistance Transfer Standard. No Switches are used or oil baths required.

**GL 1010 TRANSFER MODELS ARE AVAILABLE FROM 1 Ω TO 100 KΩ PER STEP WITH THE LOWEST AVAILABLE UNCERTAINTIES TODAY USING THIS TRANSFER METHOD.**

Every GL 1010 meets or exceeds all of the requirements for resistance transfer standards in precision measurement applications, and all the specifications of the SR1010 series. They can be configured to transfer resistances up or down a decade from their initial resistance value. A special model GL 1010 can provide transfer accuracies as low as 1 ppm when using the connecting networks and shorting bars.

Like the older ESI SR1010 standards, each GL 1010 Transfer Standard contains twelve equal value precision resistors connected in series by specially designed true 4-terminal junctions (Low Thermal Binding Posts). These special junctions assure that a 4-terminal measurement of a series of resistors agrees with the sums of the individual resistors in the series. Additionally, binding posts are available for guard and ground connections.

Accuracy to the ppm level is assured as the series value is equal to 100 times the parallel value to better than 1 ppm. The series / parallel value relative to either the series value or the parallel value can be found to better than 1 ppm by making a 1:1 comparison with the remaining tenth resistor and a simple calculation can be made dividing by ratios of 1:1, 1, 100:1 and 1000:1 with respective uncertainties of 0.05, 0.1, 0.2 and 0.5 μV/V.

# GL 1010 Series of Resistance Transfer Standards

The design of the GL 1010 Resistance Transfer Standard and its accessories facilitates the transfer of resistance calibration from one resistance level to another. The Resistance values are twelve equal, 4-Terminal resistors connected in series. The series, parallel and series-parallel connections for resistor groups in a GL 1010 give resistance values of 0.1, 1, and 10 times the individual resistor value. This is particularly useful in calibrating a set of GL 1010's to a short-term low uncertainty, high accuracy, level that is much better than any long-term certification.



The Shorting Bars and Series Parallel Compensation Networks are used to eliminate loss of accuracy at the lower resistance levels in making four-terminal measurements of ten resistors in parallel and nine resistors in series-parallel. As a result of the special design of the four-terminal junctions between binding posts and resistors, and the use of the parallel and series-parallel compensation networks, the actual values for four-terminal series, parallel and series-parallel resistor groups will agree with their values calculated from individual resistor values to better than  $\pm 0.1 \text{ m}\Omega$ .

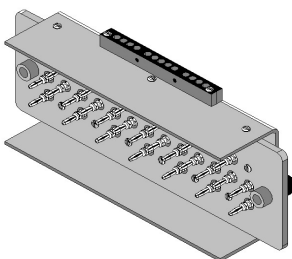
Accurate parallel connections can be made with the Series Parallel Compensation Network and the Shorting Bars connected to the junctions. GL 1010 Series are compatible with optional /BAR Shorting Bars, /PCN Parallel Compensation Network and /SPCN Series Parallel Compensation Networks, for the connecting resistors in parallel or series-parallel combinations.

The use of Guildline Shorting Bars or Series Parallel Compensation Networks is not required. With our exacting specifications and adherence not just to specifications, but to the dimensions of the older ESI models – customers who already own SB103 Shorting Bars, PC101 Parallel Compensation Network and SPC102 Series Parallel Compensation Networks can use these older adapters on the new GL 1010 Series of Transfer Standards.

These adapters are shown to the right on the older ESI SR 1010. A special Model of the GL 1010 Series is available for the US Navy (GL 1010N) as is a unique SR 1010 Adapter for the US Air Force (shown below) and other customers. A front view of the GL 1010N-10 Ohm model is shown to the left. You can see that currently developed SR 1010 procedures and adapters will work perfectly with all models in the GL 1010 Series of Transfer Standards.



Like the old ESI SR 1010's, you will find the same performance, models, design and functionality. This means that no oil baths are required to maintain specifications. Unlike the old ESI models however, you will find that ONLY Guildline Instruments has developed the techniques and standards that allow full automation for the calibration of these models.



Guildline Designed SR 1010 Adapter

The Guildline Model 6625A Resistance Measurement System, when combined with Guildline's Bridgeworks Transfer Standard Utility software and the highly innovative SR 1010 (optional) adapter, can now fully automate the calibration of GL 1010's and the original ESI SR 1010's. The Guildline software also provides the user with an easy to use, and complete Calibration Report.

# GL 1010 Series of Resistance Transfer Standards

## GL 1010 Series Specifications

Value (Model)	Temperature Coefficient	Power Coefficient	Accuracy		
			Transfer <sup>1</sup>	Initial	Long Term
1 Ω /step	±15 ppm/°C matched within 5 ppm/°C	±0.3 ppm/ mW	±(1 ppm + 0.1 μΩ) at parallel value for 100:1 transfer	±20 ppm of nominal matched within 10 ppm	±10 ppm/year
10 Ω /step <sup>2</sup>	±1 ppm/°C	±0.02 ppm/ mW			
100 Ω /step	±5 ppm/°C matched within 3 ppm/°C	±0.1 ppm/ mW	±(1 ppm + 1 μΩ) at series/parallel value for 10:1 transfer		
1 kΩ /step					
10 kΩ /step					
100 kΩ /step					

- Notes:
- 1 - When used with shorting bars, Series Parallel Compensation Network or Parallel Compensation Network and at 23 °C ± 1 °C - No oil baths are required to meet specifications. Compatible with ESI SB103 Shorting Bars, PC101 PC Parallel Compensation and SPC102 Series Parallel Compensation Networks
  - 2 - Also known as model GL 1010/LTC
  - 3 - Calibration uncertainty for all model values is ± 10 ppm

R Value	(Per Step)	1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ
1 Resistor	Max mA	1000	320	100	32	10	3.2
	Max V	1	3.2	10	32	100	321
10 Resistors Parallel (R/10)	Max mA	7100	2300	710	230	71	23
	Max V	.71	2.3	7.1	23	71	230
10 Resistors Series (10R)	Max mA	710	230	71	23	7.1	2.3
	Max V	7.1	23	71	230	710	2300 <sup>1</sup>

1 - Do not exceed 1500 volts to case

**Maximum Power Rating:** 1 W/step or 5 W distributed over 10 resistors

**Leakage Resistance:** Greater than 10<sup>12</sup> Ω from terminal to case

**Calibration Data:** Initial Calibration readings are listed on calibration certificate (ISO 17025) and instrument

**Warranty Accuracy:** Specifications are guaranteed for 2 years from date of shipment.

**Environmental Conditions:** Operating: 10 °C to 40 °C; Storage: -40 °C to 70 °C

**Maximum Applied Voltage:** Equal to or less than 1500 Vdc between terminals and case

### ORDERING INFORMATION

GL-1010-Model	Resistance Transfer Standard (List Ohmic Value/Step For Model)
/TM	GL 1010 Technical Manual included at no charge.
/Report	Certificate and Report of Calibration (with data) included
<b>Optional Accessories</b>	
/BAR	Shorting Bar (SB103 Equivalent)
/SPCN	Series Parallel Compensation Network (SPC102 Equivalent)
/PCN	Parallel Compensation Network (PC101 Equivalent)
Precision Low Thermal Leads Are Available	

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