

9340-4T SERIES

PRECISION 4-WIRE TERMINAL (4T) ULTRA-LOW VALUE RTD SIMULATOR AND DECADE RESISTANCE STANDARDS

Excellent as a Low Resistance Measurement Source and the Ultimate Standard for RTD Simulation!



GUILDLINE INSTRUMENTS 9340-4T SERIES of precision RTD Simulators and DC Resistance Standards are a complete family of easy to use, low to ultra-low, 4 Wire resistance standards offering the best combination of accuracy and resistance range that is commercially available.

THE 9340-4T SERIES ARE THE MOST VERSATILE AND ACCURATE DECADE RESISTANCE STANDARDS AVAILABLE FROM ANY MANUFACTURER!

This performance has been achieved based on over 63 years of Guildline experience in the construction and stabilization of resistors; and in the use of low thermal switching. Guildline is the world leader in low value resistance measurements and this expertise is built into the 9340-4T product.

FEATURES

- Resistance Ranges include Decades from 1 $\mu\Omega$ to 10 k Ω
- True RTD Simulation with High Decade Resolution
- Excellent for milli-Ohm and micro-Ohm Applications and Instruments
- True 4-Wire Terminal Design
- Accuracy Better than $\pm 0.01\%$
- Temperature Coefficient Less than 5 ppm/ $^{\circ}\text{C}$
- Switch and Wiring Resistance Effects of the Four Terminal Arrangement are Less than 10 $\mu\Omega$
- Direct Reading of Resistance Value at the 4 Terminals
- Long Life Rotary Switches with Solid Silver Contacts
- An Overlap '10' Position for Fine-Tuning
- No Other Decade Standard on the Market Today with these Uncertainties and Low Ohmic Range!

The 9340-4T Series is available in models from 3 dials to 7 dials and with an industry leading ultra-low 1 $\mu\Omega$ Step available in the 7 dial configuration. This unique 9340-4T Series provides resolution and accuracies never before provided in a decade standard by arranging Decade step values below 1 Ω in a Kelvin Varley configuration.

And unlike typical RTD simulators, you have much better resolution. In a 6 dial configuration (RTD typical range) you can go down to 10 $\mu\Omega$ per step or 1 $\mu\Omega$ per step with a 7 dial. This makes these four terminal devices also an excellent solution for milli-Ohm and micro-Ohm meter calibration.

The 9340-4T Series provides a modern compact design of high quality construction and high reliability for a resistance decade standard.

9340-4T Series of Precision 4-Wire RTD/Decade Resistance Standards

9340-4T Series of Precision 4-Wire Decade Resistance Standards

The panel is clearly marked adjacent to each dial with the resistance per step and the current rating of that dial. Each dial has an overlap '10' position for fine-tuning a value without the need to reset all dials when passing through a decade point. The current terminals are labeled as C_1 and C_2 and the potential terminals are labeled as P_1 and P_2 ; with all terminals placed on the top panel. A terminal is also provided on the top panel to allow connection of a ground or guard to the metallic enclosure.



Accuracy of the 9340-4T RTD and Decade Resistance Standards are better than $\pm 0.01\%$ from the range of $1\ \Omega$ to $100\ \text{k}\Omega$. As you go lower, the specifications increase, but there is no other commercially available product that is capable of meeting Guildline's 9340-4T specifications. For example, the 0.01 Decade at 1% absolute accuracy equates to only a $100\ \mu\Omega$ total error and is **20 times more accurate** than other decade boxes and RTD Simulators whose floor specification alone is $2\ \text{m}\Omega$. And forget about specifications or values below $1\ \text{m}\Omega$, other manufacturers just cannot provide these ultra-low outputs.

Not only are the accuracies much better, other important specifications such as current handling capabilities, long term stability, temperature and power coefficients are also typically 5X to 10X better than the nearest competition. The 9340-4T Series truly sets the highest standard for Decade Resistors and RTD Simulation. The long-term stability is maintained by using specialized techniques developed by Guildline, combined with the use of today's finest quality materials.

The individual decade switches have multiple contacts made of solid silver, which minimizes contact resistance. The design also minimizes leakage effects by careful shielding and the use of high quality insulation materials. The dials have a smooth rotation from position to position and the switches are stopped at position '10' to prevent the operator from accidentally switching directly from '10' to '0'. This is particularly critical when a decade box forms part of a circuit where there are devices present that cannot have current drawn from them.

The 9340-4T Series consists of 3, 4, 5, 6 or 7 decades of resistors switched in a four terminal configuration. The Models 9343-4T, 9344-4T, 9345-4T, 9346-4T and 9347-4T are identical except for the number of decades.

The model value designations of the resistances are related to the total resistance of the unit when all decades are set at maximum resistance. These values are listed under model specifications along with the resistance resolution available with the lowest value decade.

Unlike other RTD Simulators, the 9340-4T Series does not have a minimum resistance output (such as $10\ \Omega$). This means the 9340-4T series can also be used for values that are required for milli-Ohm and micro-Ohm measurement devices. Note that since the 9340-4T Series is a true 4-Wire standard, it will not provide correct values if utilized as a 2 terminal device below the $1\ \Omega$ step decade.

9340-4T Series of Precision 4-Wire RTD/Decade Resistance Standards

Model Specifications

Model	Minimum Step (Ω 's)	Maximum Value(Ω 's)
3 Decade Models		
9343-4T/10	10 m Ω	11.10 Ω
9343-4T/100	100 m Ω	111.0 Ω
9343-4T/1k	1 Ω	1.110 k Ω
9343-4T/10k	10 Ω	11.10 k Ω
9343-4T/100k	100 Ω	111.10 k Ω

Model	Minimum Step (Ω 's)	Maximum Value(Ω 's)
6 Decade Models		
9346-4T/10	0.01 m Ω	11.11110 Ω
9346-4T/100	0.1 m Ω	111.1110 Ω
9346-4T/1k	1 m Ω	1.111110 k Ω
9346-4T/10k	10 m Ω	11.11110 k Ω
9346-4T/100k	100 m Ω	111.1110 k Ω

4 Decade Models		
9344-4T/10	1 m Ω	11.110 Ω
9344-4T/100	10 m Ω	111.10 Ω
9344-4T/1k	100 m Ω	1.1110 k Ω
9344-4T/10k	1 Ω	11.110 k Ω
9344-4T/100k	10 Ω	111.10 k Ω

7 Decade Models		
9347-4T/10	0.001 m Ω	11.111110 Ω
9347-4T/100	0.01 m Ω	111.11110 Ω
9347-4T/1k	0.1 m Ω	1.1111110 k Ω
9347-4T/10k	1 m Ω	11.111110 k Ω
9347-4T/100k	10 m Ω	111.11110 k Ω

5 Decade Models		
9345-4T/10	0.1 m Ω	11.1110 Ω
9345-4T/100	1 m Ω	111.110 Ω
9345-4T/1k	10 m Ω	1.11110 k Ω
9345-4T/10k	100 m Ω	11.1110 k Ω
9345-4T/100k	1 Ω	111.110 k Ω

Size and Weight		
Model	Dimensions (H x L x W)	Weight
9343-4T	11.8 x 23.3 x 10.3 cm	2.7 kg
	4.6 x 9 x 4 inches	6.1 lbs
9344-4T	11.8 x 29 x 10.3 cm	3.25 kg
	4.6 x 11.5 x 4 inches	7.2 lbs
9345-4T	11.8 x 34.7 x 10.3 cm	3.9 kg
	4.6 x 13.5 x 4 inches	8.6 lbs
9346-4T	11.8 x 40.5 x 10.3 cm	4.4 kg
	4.6 x 16 x 4 inches	9.8 lbs
9347-4T	11.8 x 46.1 x 10.3 cm	5.1 kg
	4.6 x 18 x 4 inches	11.3 lbs

General:

Zero Resistance: Less than 10 $\mu\Omega$ with four terminal connections
Breakdown Voltage: 1000 V to case
Number of Decades: 3, 4, 5, 6 & 7

9340-4T Series of Precision 4-Wire RTD/Decade Resistance Standards

Resistance Specifications (12 Month)

Decade Resistance (Ohms)	Step Resistance (Ohms) ¹	Step Accuracy DC (± %) ²	Stability ² (± ppm/yr)	Temperature Coefficient (± ppm/C) ³	Power Coefficient ⁴ (± ppm/mW)	Maximum Power (W/step) ¹	Maximum Current (amperes)	Maximum Voltage ⁵ (volts/step)
0.01 mΩ	0.001 mΩ	± 15 %	150	25	0.3	-	1.2	0.7
0.1 mΩ	0.01 mΩ	± 10 %	100	20	0.3	-	1.2	0.7
1 mΩ	0.1 mΩ	± 3 %	35	10	0.3	-	1.2	0.7
10 mΩ	1 mΩ	± 1 %	35	10	0.3	-	1.2	0.7
0.1 Ω	10 mΩ	± 0.3 %	20	5	0.3	-	1.2	0.7
1 Ω	0.1 Ω	± 0.1 %	20	5	0.3	.5	1.2	0.7
10 Ω	1 Ω	± 0.01 %	20	5	0.2	.5	0.7	0.7
100 Ω	10 Ω	± 0.01 %	10	5	0.2	.5	0.2	2
1 kΩ	100 Ω	± 0.01 %	10	5	0.2	.5	0.07	7
10 kΩ	1 kΩ	± 0.01 %	10	5	0.2	.5	0.02	20
100 kΩ	10 kΩ	± 0.01 %	10	5	0.2	.5	0.007	70

1. Decade 0.1 Ω and below are arranged in a Kelvin Varley configuration and cannot be used for 2 terminal resistance. The minimum resistance across C₁ and C₂ Terminals is 2 Ω.
2. Step accuracy and stability is when used at 23 °C ± 1 °C. The Step accuracy is applicable to each Decade step value. For example, the 10 mΩ Step has an accuracy of 1 %. This equates to a 100 μΩ error with the dial set to 1 (output = 0.01 Ω). With the dial set to 10, the output would be 0.1 Ω and the step accuracy would be 1 mΩ. Using a 9343-4T/10 Ω with steps of 0.01, 0.1 and 1 Ω and assuming all 3 dials are set to x10, the output would be 11.1 Ω. Each Decade Step maximum error would be ± 1 mΩ (i.e. 0.1 Ω @ 1 %, 1 Ω @ 0.1 % and 10 Ω @ 0.01 %) and would mathematically add for a total maximum error of ± 3 mΩ's.
3. When used outside 23 °C ± 1 °C.
4. The apparent power coefficient is due to the voltage coefficient of the resistor.
5. The maximum voltage is 700 V.

A Note about Ordering: To Order, select the model # (e.g. 3, 4, 5, 6 or 7 dial) and enter in the Models "X" field, the value of the highest decade resistance value you require. For example, a 9343-4T/10 would be a 3-dial decade box with a 0.01, 0.1 and 1 Ω Decade (10 Ω highest output on the 1 Ω Decade).

ORDERING INFORMATION

9340-4T Model	DC Current Shunt (List Amperage Value For Model)
Model #	"X" Resistance Values Available for Each Model
9343-4T/X	10, 100, 1k, 10k, 100k
9344-4T/X	10, 100, 1k, 10k, 100k
9345-4T/X	10, 100, 1k, 10k, 100k
9346-4T/X	10, 100, 1k, 10k, 100k
9347-4T/X	10, 100, 1k, 10k, 100k
/CC	ISO/IEC 17025 Certificate of Calibration (Included)
/Report	Adds Report of Calibration
/OM934X	Operation Manual included at no charge.
Many Precision Leads Sets Are Available – Please Contact Guildline	

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