



# 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 commercially available.

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

This performance has been achieved based on over 60 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 this new 9340-4T product.

### FEATURES

- Resistance Ranges include Decades from  $1 \mu\Omega$  to  $10 \text{ k}\Omega$ !
- 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  $5 \text{ ppm}/^\circ\text{C}$ !
- 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!

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

And unlike typical RTD simulators, you have much better resolution. If you want to go down to  $1 \mu\Omega$  you can! This makes these four terminals 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

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 panel is clearly marked adjacent to each dial with the resistance per step and the current rating of that dial. 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  $100\ \text{k}\Omega$  Steps. 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 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 positions '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 wiring consists of 3, 4, 5, 6 or 7 decades of resistors switched in a four terminal series 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  $1\ \text{ohm}$  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/1m	0.001 mΩ	1.110 mΩ
9343-4T/10m	0.01 mΩ	11.10 mΩ
9343-4T/100m	0.1 mΩ	111.0 mΩ
9343-4T/1	1 mΩ	1.110 Ω
9343-4T/10	10 mΩ	11.10 Ω
9343-4T/100	100 mΩ	111.0 Ω
9343-4T/1k	1 Ω	1.110 kΩ
9343-4T/10k	10 Ω	11.10 kΩ

4 Decade Models		
9344-4T/10m	0.001 mΩ	11.10 mΩ
9344-4T/100m	0.01 mΩ	111.10 mΩ
9344-4T/1	0.1 mΩ	1.1110 Ω
9344-4T/10	1 mΩ	11.110 Ω
9344-4T/100	10 mΩ	111.10 Ω
9344-4T/1k	100 mΩ	1.1110 kΩ
9344-4T/10k	1 Ω	11.110 kΩ
9344-4T/100k	10 Ω	111.10 kΩ

5 Decade Models		
9345-4T/100m	0.001 mΩ	111.110 mΩ
9345-4T/1	0.01 mΩ	1.11110 Ω
9345-4T/10	0.1 mΩ	11.1110 Ω
9345-4T/100	1 mΩ	111.110 Ω
9345-4T/1k	10 mΩ	1.11110 kΩ
9345-4T/10k	100 mΩ	11.1110 kΩ
9345-4T/100k	1 Ω	111.110 kΩ

Model	Minimum Step (Ω's)	Maximum Value(Ω's)
6 Decade Models		
9346-4T/1	0.001 mΩ	1.111110 Ω
9345-4T/10	0.01 mΩ	11.11110 Ω
9346-4T/100	0.1 mΩ	111.1110 Ω
9346-4T/1k	1 mΩ	1.111110 kΩ
9346-4T/10k	10 mΩ	11.11110 kΩ
9346-4T/100k	100 mΩ	111.1110 kΩ

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

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 μΩ 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) <sup>1</sup>	Step Accuracy DC (± %) <sup>2</sup>	Stability <sup>2</sup> (± ppm/yr)	Temperature Coefficient (± ppm/C) <sup>3</sup>	Power Coefficient <sup>4</sup> (± ppm/mW)	Maximum Power (W/step) <sup>1</sup>	Maximum Current (amperes)	Maximum Voltage <sup>5</sup> (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

- 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 C<sub>1</sub> and C<sub>2</sub> Terminals is 2 Ω.
- 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.
- When used outside 23 °C ± 1 °C.
- The apparent power coefficient is due to the voltage coefficient of the resistor.
- The maximum voltage is 700 V.

*A Note about Ordering: To Order, select the model # (eg 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

9230A-Model	DC Current Shunt (List Amperage Value For Model)
<b>Model #</b>	<b>"X" Resistance Values Available for Each Model</b>
9343-4T/X	1m, 10m, 100m, 1, 10, 100, 1k, 10k, 100k
9344-4T/X	10m, 100m, 1, 10, 100, 1k, 10k, 100k
9345-4T/X	100m, 1, 10, 100, 1k, 10k, 100k
9346-4T/X	1, 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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