



Operation Manual

For The

Model 934X-4T

**Precision Four Terminal
Decade Resistance Boxes**

NOTICE

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**OM934X-4T-D-00
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RECEIPT AND INSPECTION

GENERAL

Remove the instrument from its shipping container. The instrument was thoroughly tested and inspected before shipment and should be free from any electrical or mechanical damage when received. Nevertheless, you should perform an inspection for physical damage, ensure all items on the packing list are present and test the instrument, electrically, as soon as possible after receipt. Refer to the warranty card at the front of the manual if any damage or deficiencies are found.

SHIPPING CONTAINER

We recommend that the shipping container be retained for future storage or transportation of this instrument.

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The Model 934X-4T is a four terminal variation of the Model 934X Series Precision Decade Resistance Boxes. It combines techniques established at Guildline in the construction and stabilizing of resistors, and low level switching techniques used in many of our instruments. Decade step values below the 1 ohm are arranged in a Kelvin Varley configuration. Note that the decade resistance box will not provide correct values if utilized as a 2 terminal device below the 1 ohm step decade.

The current terminals are labeled as C_1 and C_2 on the top panel and the potential terminals are labeled as P_1 and P_2 on the top panel. A terminal is provided on the top panel to allow connection of a ground or guard to the metallic enclosure. The minimum resistance between the C_1 and C_2 terminals is a nominal 2 ohm value.

The main features of the 934X-4T are:

- Resistance range from 0.001 m Ω to 111 k Ω
- 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
- Resolution available to 1 $\mu\Omega$
- Long life rotary switches

GENERAL THEORY

The 934X-4T series wiring consists of 3, 4, 5, 6 or 7 decades of resistors switched in a four terminal series configuration. Figure 1-1 illustrates schematically the wiring of the 9347-4T model. The Models 9343, 9344, 9345, 9346 and 9347 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 in Table 2-2 along with the resistance resolution available with the lowest value decade. Note that the minimum dial setting is 1 ohm except for those models which do not have an x1 decade. Models without an x1 decade will have the first step of the highest decade as the minimum dial setting.

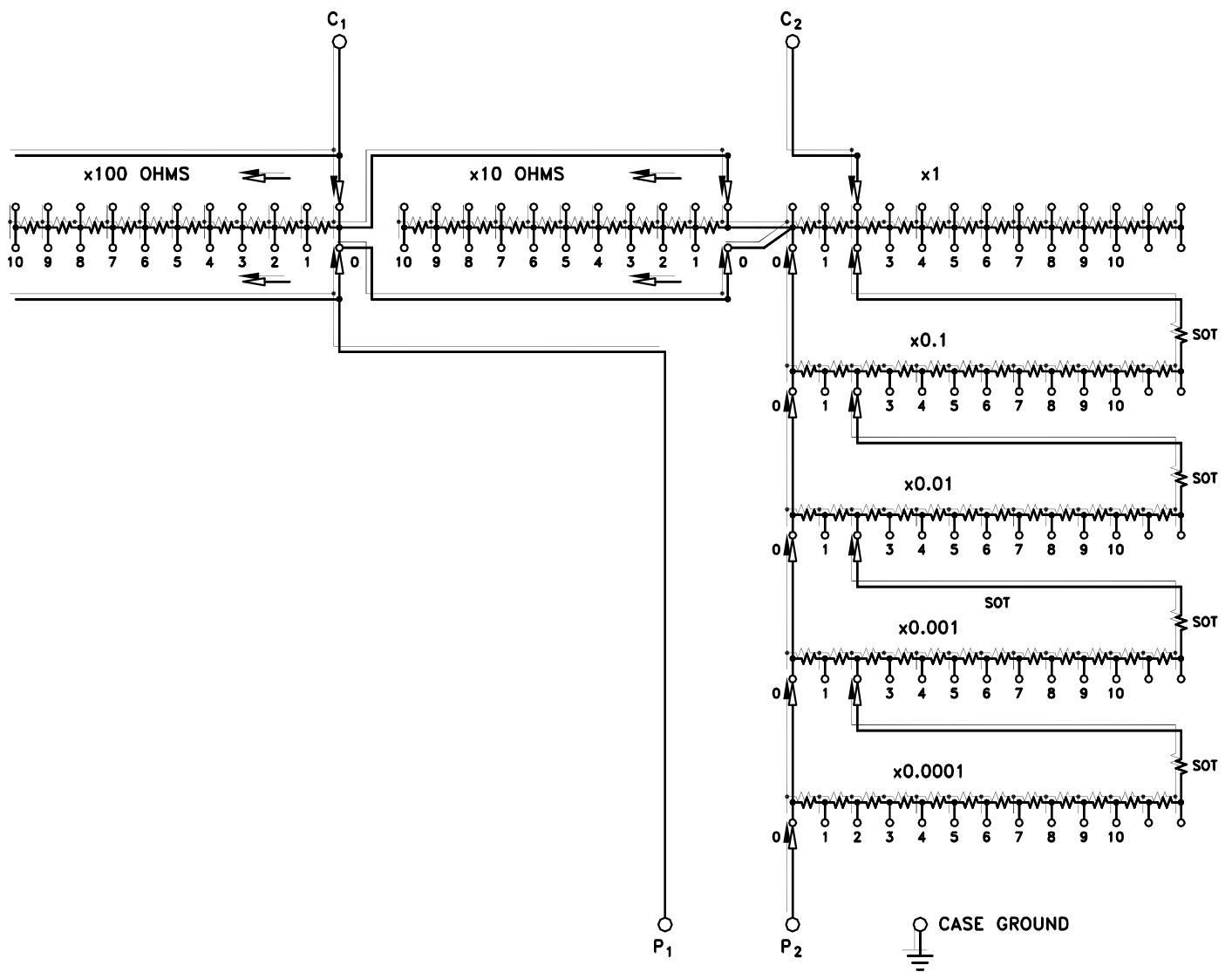


Figure 1-1 Decade Box Schematic Diagram



Section 2 – Specifications

General:

Long Term Stability: See Table 2-1

Zero Resistance: Less than 10 $\mu\Omega$ with four terminal connections

Breakdown Voltage: 1000 Volts to case

Dimensions:

9343	W 11.5 cm, L 24 cm, H 10 cm
9344	W 11.5 cm, L 29 cm, H 10 cm
9345	W 11.5 cm, L 37 cm, H 10 cm
9346	W 11.5 cm, L 40.5 cm, H 10 cm
9347	W 11.5 cm, L 43 cm, H 10 cm

Weight:

9343	2.6 kg
9344	3.25 kg
9345	3.75 kg
9346	4.3 kg
9347	4.5 kg

Electrical Specifications:

Decade Resistance	Step Resistance	DC Accuracy 23 +/- 1 °C	Long Term Stability ± ppm/year	Temperature Coefficient ± ppm/°C	Power Coefficient ± ppm/mW	Maximum Power W/Step	Maximum Current Ampere	Maximum V/ 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

- Notes:
1. The apparent power coefficient is due to the voltage coefficient of the resistor.
 2. The decades below 1 ohm are arranged in a Kelvin Varley configuration and cannot be used as a 2 terminal resistance. The minimum resistance across C₁ and C₂ is 2 ohm.
 3. Zero resistance residual offset is less than 10 uΩ in a 4 terminal configuration.

TABLE 2-1: Resistance Specifications

MODEL	TOTAL RESISTANCE	RESOLUTION
9343-4T-0.001Ω	1.110 mΩ	0.001 mΩ
9343-4T-0.01Ω	11.10 mΩ	0.01 mΩ
9343-4T-0.1Ω	111.0 mΩ	0.1 mΩ
9343-4T-1Ω	1.110 Ω	1 mΩ
9343-4T-10Ω	11.10 Ω	10 mΩ
9343-4T-100Ω	111.0 Ω	100 mΩ
9343-4T-1kΩ	1.110 kΩ	1 Ω
9343-4T-10kΩ	11.10 kΩ	10 Ω
9343-4T-100kΩ	111.0 kΩ	100 Ω
9344-4T-0.01Ω	11.110 mΩ	0.001 mΩ
9344-4T-0.1Ω	111.10 mΩ	0.01 mΩ
9344-4T-1Ω	1.1110 Ω	0.1 mΩ
9344-4T-10Ω	11.110 Ω	1 mΩ
9344-4T-100Ω	111.10 Ω	10 mΩ
9344-4T-1kΩ	1.1110 kΩ	100 mΩ
9344-4T-10kΩ	11.110 kΩ	1 Ω
9344-4T-100kΩ	111.10 kΩ	10 Ω
9345-4T-0.1Ω	111.110 mΩ	0.001 mΩ
9345-4T-1Ω	1.11110 Ω	0.01 mΩ
9345-4T-10Ω	11.1110 Ω	0.1 mΩ
9345-4T-100Ω	111.110 Ω	1 mΩ
9345-4T-1kΩ	1.11110 kΩ	10 mΩ
9345-4T-10kΩ	11.1110 kΩ	100 mΩ
9345-4T-100kΩ	111.110 kΩ	1 Ω
9346-4T-1Ω	1.111110 Ω	0.001 mΩ
9346-4T-10Ω	11.11110 Ω	0.01 mΩ
9346-4T-100Ω	111.1110 Ω	0.1 mΩ
9346-4T-1kΩ	1.111110 kΩ	1 mΩ
9346-4T-10kΩ	11.11110 kΩ	10 mΩ
9346-4T-100kΩ	111.1110 kΩ	100 mΩ
9347-4T-10Ω	11.111110 Ω	0.001 mΩ
9347-4T-100Ω	111.11110 Ω	0.01 mΩ
9347-4T-1kΩ	1.1111110 kΩ	0.1 mΩ
9347-4T-10kΩ	11.111110 kΩ	1 mΩ
9347-4T-100kΩ	111.11110 kΩ	10 mΩ

TABLE 2-2: Resistance Range and Resolution



Section 3 – Maintenance

Maintenance:

The model 934X-4T series of four terminal decade resistance boxes do not require any specific maintenance other than periodic verification of the resistance accuracy. The accuracy can be verified by measurement with a suitable long scale multi-meter of sufficient accuracy. The lower decade values below 1 ohm can be measured while setting the first step of the 1 ohm decade at the x1 position and calculating the differences in resistance value as the lower decades are switched through the 10 steps from 1 to 10.

For best verification accuracy it is recommended that a DC Comparator Resistance Bridge be used to make the measurements.