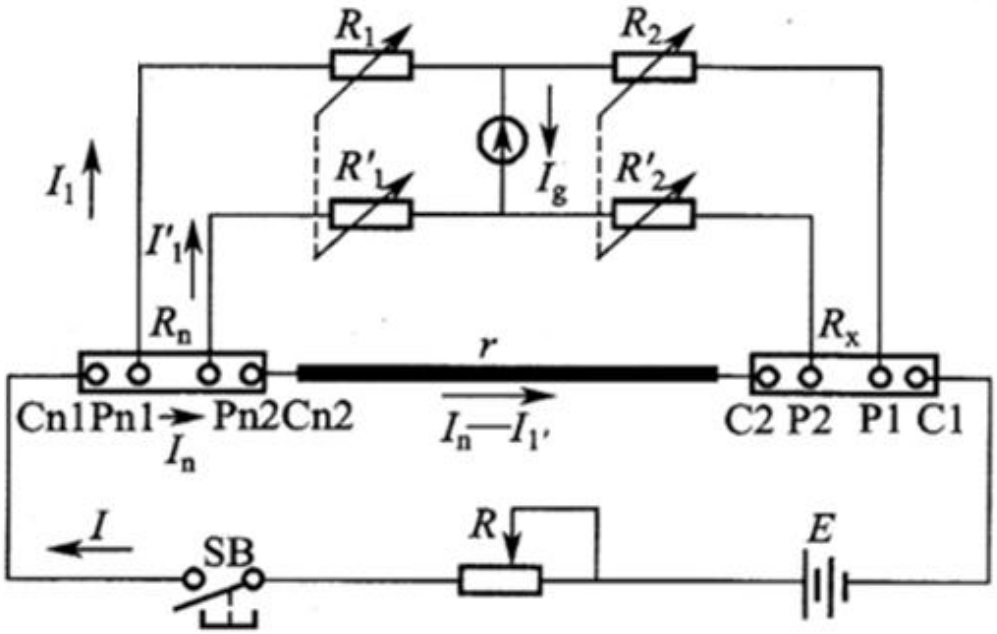
Explanation of Precise Measurement of LR Series Resistors (Product Technical Guidelines)

§ 0. Abstract

LR resistor is an ultra-low resistance resistor of alloy body, and the resistance value distribution is 0.5m Ω~300m Ω. The accuracy of the resistance measurement system in use is particularly important. The current resistance measurement methods are mainly 4-wire measurement, of which the general measurement methods are Wheatstone bridge measurement and Kelvin bridge measurement. The accuracy of Wheatstone bridge measurement can be guaranteed when measuring high resistance, but when measuring ultra-low resistance, the measurement error is relatively large due to the influence of electrode contact resistance error. The Kelvin bridge measurement uses a series circuit to connect the electrodes, reducing the impact of contact resistance at the electrode connection point, and the measured value is closer to the actual value. In addition, when measuring metal strip chip resistors LR alloy series with low resistance value, standardized and unified measurement needle spacing, instruments, etc. are implemented to ensure consistent measurement methods to guarantee accurate measurement resistance values.

§ 1. The Principle of Precise Measurement of LR Resistors

1.1 Kelvin bridge was invented by British physicist William Thomson in 1862. The Kelvin bridge measurement method can eliminate the impact of contact resistance and wire resistance. The equivalent circuit diagram of Kelvin bridge circuit is as follows:



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Remarks：① Rx is the to-be-measured resistance value, and the measurement accuracy is improved by reducing the influence of contact resistance and wire resistance through two series connections of "larger" resistors.

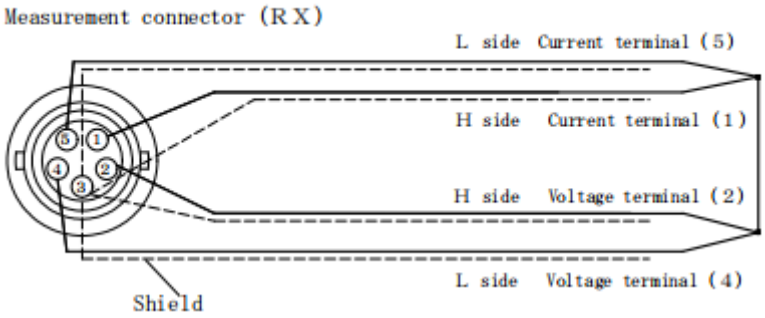
② The measurement wiring is a 4-wire connection, as shown in the figure, C2 and C1 are the measurement current input terminals, and P2 and P1 are the measurement voltage input terminals

§ 2. Accurate Measurement System for LR Resistors

2.1 The measurement system mainly consists of three parts: measuring instrument, measuring fixture and connecting wire, as shown in the following figures：

High precision measuring instrument

Measuring fixture



Measuring instrument wiring

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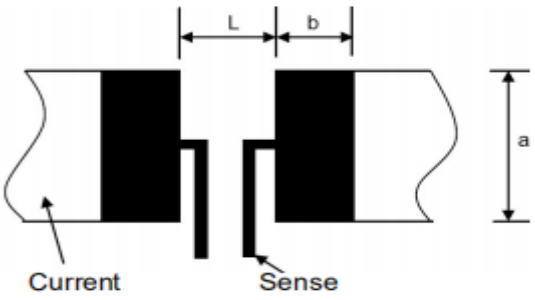
§ 3 . Precautions for LR resistor customers:

3.1 To ensure that the resistance value of the products can be accurately reflected during actual use by customers, the sizes of the bonding pads need to be designed according to different resistance values during application. Details are as follows:

Reference Pad Dimensions (mm)

Size	a	b	L
1206 <R002	1.8	2.3	1.0
1206 ≥R002	1.8	1.7	1.6
2512 ≤R003	4.0	3.1	1.3
2512 >R003	4.0	2.1	4.1



3.2 When measuring, customers need to ensure a stable measurement environment, with a measurement temperature range of 24 ℃± 2 ℃ and a humidity range of 35%~70%RH. The measuring instrument should be effectively grounded, and shielded wire should be used for measuring connecting wire.

§ 4 Summary

Before measuring LR products, the measurement system should be stable and meet the requirements of low resistance measurement, with measurement system MSA R&R%<10%.