

Thank you for purchasing the Standard Resistor. This manual describes the specifications and operating precautions for the Standard Resistor. Before using this product, thoroughly read this manual to understand how to use it properly.

2092A01: 0.001 Ω	2092A05: 10 Ω
2092A02: 0.01 Ω	2092A06: 100 Ω
2092A03: 0.1 Ω	2092A07: 1 kΩ
2092A04: 1 Ω	2092A08: 10 kΩ

Contact information of Yokogawa offices worldwide is provided on the following sheet.
PIM 113-01Z2: Inquiries List of worldwide contacts

Store this manual in an easily accessible place for quick reference.

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Safety Precautions

This product is designed to be used by a person with specialized knowledge. When operating the instrument, be sure to observe the cautionary notes given below to ensure correct and safe use of the instrument. If you use the instrument in any way other than as instructed in this manual, the instrument's protective measures may be impaired. This manual is an essential part of the product; keep it a safe place for future reference. YOKOGAWA is by no means liable for any damage resulting from use of the instrument in contradiction to these cautionary notes.

The following safety symbols are used on the instrument and in this manual.

Danger! Handle with Care.
This symbol indicates that the operator must refer to an explanation in the User's Manual in order to avoid risk of injury or death of personnel or damage to the instrument.

WARNING
Indicates a hazard that may result in the loss of life or serious injury of the user unless the described instruction is abided by.

CAUTION
Indicates a hazard that may result in an injury to the user and/or physical damage to the product or other equipment unless the described instruction is abided by.

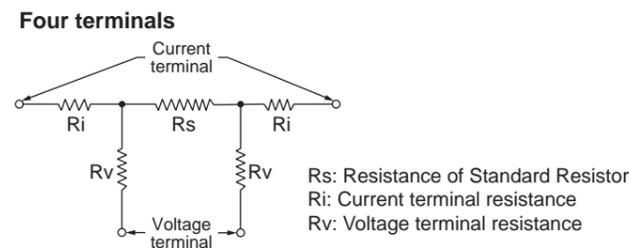
Strictly observe the following cautionary notes in order to avoid the risk of injury or death of personnel or damage to the instrument due to hazards such as electric shock.

WARNING

- **Measurement**
 - The maximum allowable power for the operation of the instrument is 3 W.
 - The rated circuit-to-earth voltage for safe use of the instrument is 250 V.
 - The terminal and internal circuitry may carry high voltages and become extremely hot depending on the instrument's condition of use. Do not touch these parts.
- **Protective Measures**
 - Should a crack appear in the casing of the instrument after it has been accidentally dropped or bumped, the protective insulation may be damaged. Do not use the instrument until it has been repaired by the manufacturer.
- **Operating Environment**
 - Do not operate the instrument where flammable or explosive gases are present. Do not operate the instrument if there is condensation on it.
- **Do Not Remove the Casing or Disassemble**
 - Removing the casing and disassembling or modifying the instrument is strictly prohibited. Do not attempt to repair/modify the product yourself, as doing so is extremely dangerous.

Terminal Construction

Models 2792A01 (0.001 Ω) to 2792A08 (10 kΩ) are of four-terminal construction, and have the equivalent circuit as shown below.



<Caution on Two-Terminal Measurement>

In two-terminal measurement using only current terminals, resistance of the terminals (Ri x 2) is added to the resistance of Standard Resistor (Rs), resulting in measurement error.

Especially for models 2792A01, 02, and 03 with small nominal values, resistance of the terminals are not negligible. Therefore, we recommend these models are used in four-terminal measurement.

Model	Nominal value	Terminal resistance	
		Ri (Current)	Rv (Voltage)
2792A	01	Less than 0.5 mΩ	Less than 5 mΩ
	02	Less than 2 mΩ	
	03	Less than 5 mΩ	
2792A	04	Less than 10 mΩ	Less than 30 mΩ
	05		
	06		
	07		
	08		

Example: When the model 2792A02 (0.01 Ω) is used in two-terminal measurement (resistance of the terminal is 2 mΩ each), the following result is obtained.
10 mΩ + (2 mΩ x 2) = 14 mΩ
As shown above, two-terminal measurement results in 40% margin of error to the actual value, i.e. 10 mΩ.

Handling Precautions

- **Temperature**
To maintain a high level of accuracy, the Standard Resistor must be used in rooms with a constant ambient temperature or placed in a thermostatic chamber. Measure the ambient temperature accurately and perform compensation according to the temperature coefficient. Ensure that the instrument is not subjected to rapid changes in temperature during storage as changes in resistance or deterioration of the insulator may result. (Instrument can be operated stably for over two hours.)
- **Temperature coefficient**
The resistance at temperature t is expressed by the following equation:
 $R_t = R_{23} \{ 1 + \alpha_{23}(t-23) + \beta(t-23)^2 \}$
Where
R_t ; Resistance value at t°C
R₂₃ ; Resistance value at 23°C
α₂₃ ; 1st temperature coefficient at 23°C
β ; 2nd temperature coefficient at 0 to 50°C
- **Operating Environment**
Use the Standard Resistor only in air. Do not use the Standard Resistor in an oil bath as the resistance value may be altered by the chemical properties of the oil.

- **Maximum Allowable Power and Current**
When electric current flows through the Standard Resistor, its resistance value changes due to the generated heat. To ensure accurate measurement, use the Standard Resistor below the standard power for testing*. When the applied current exceeds the maximum allowable current, the resistance could change, or the internal circuit could be broken.
- **Thermal emf and Contact Resistance**
To minimize the effects of thermal emf, connect the circuit with copper wire, and take the average of two readings obtained by reversing the direction of the current flowing through the current terminals. Incomplete contact between the lead wire and the terminals causes current change due to contact resistance, and temperature errors due to heat generation.
- **Mechanical Shock and Vibration**
Mechanical vibration and shock may cause distortion of the resistive element, which results in instability and changes in the resistance value.
- **Calibration**
To maintain a high level of accuracy, it is recommended that the Standard Resistor be calibrated annually.

Specifications

Model	Nominal value	Accuracy 23±2°C	Temperature coefficient		Drift per year (ppm/year)	Maximum allowable current (A)	
			α ₂₃ (ppm/°C)	β (ppm/°C ²)			
2792A	01	0.001 Ω	±100 ppm	-5 to +15	±100	54.7	
	02	0.01 Ω	±75 ppm	±10		±75	17.3
	03	0.1 Ω	±50 ppm	±5		±50	5.47
	04	1 Ω	±30 ppm	±2.5	-0.05 ≤ β ≤ +0.05	±30	1.73
	05	10 Ω					0.547
	06	100 Ω					0.173
	07	1 kΩ					0.055
	08	10 kΩ					0.017

ppm = x10⁻⁶

<Standard Test Conditions> At Direct Current

Temperature: 23±2°C
Power*: 2792A01: Less than 0.1 W
2792A02 to 2792A08: Less than 0.01 W
To maintain accuracy, the Standard Resistor must be used in rooms with a constant ambient temperature (Instrument can be operated stably for over two hours.)
Operating temperature and humidity ranges:
0 to 50°C, 20 to 80% RH (no condensation)
Storage temperature and humidity ranges:
-20 to 60°C, 20 to 80% RH (no condensation)

Maximum allowable power: 3 W
Test (calibrated) accuracy: ±5 ppm
Power characteristic: ±100 ppm/W
Insulation resistance: More than 10⁹ Ω at 500 V DC
Withstand voltage: 1500 V AC for one minute (between the terminal and case)
External dimensions: Approx. φ 104 x 150 mm (between the current terminals: approx. 174 mm)
Weight: Approx. 1.2 kg
Accessories: User's Manual, One Test Certificate