Time Electronics
Calibration, Test and Measurement

# User Manual

## 1067
## Precision Resistance Decade Box

Version 1.2
11-22

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This also applies to any schematics, drawings and diagrams contained herein.

This manual provides operating and safety instructions for the Time Electronics product. To ensure correct operation and safety, please follow the instructions in this manual.

Time Electronics reserves the right to change the contents, specifications and other information contained in this manual without notice.

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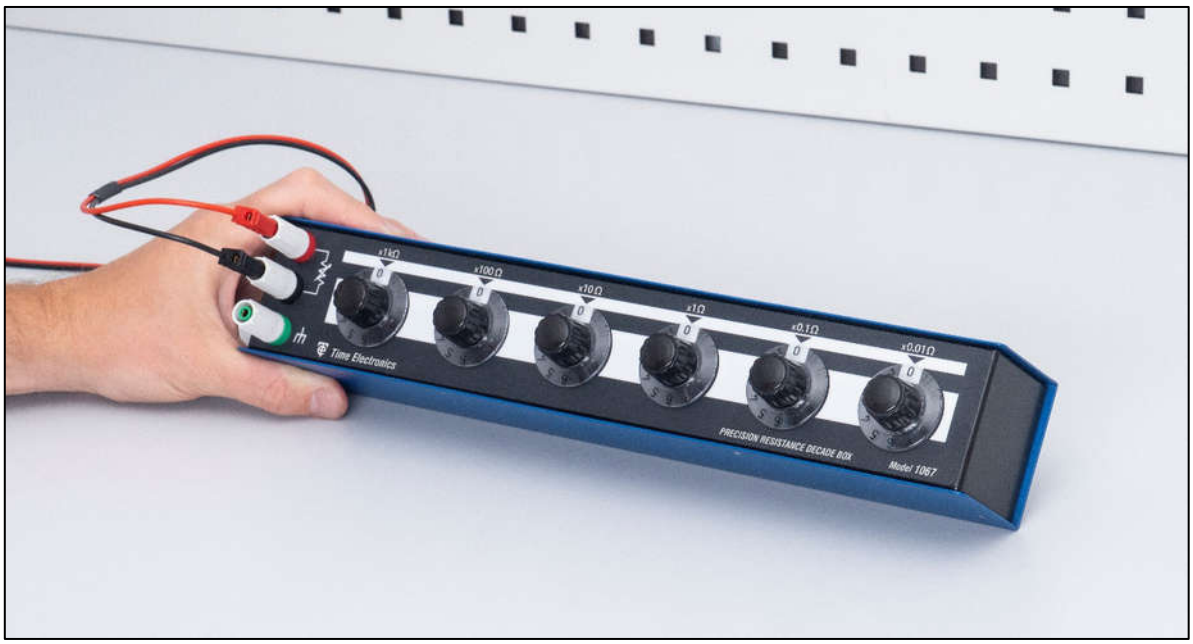
# 1 Introduction




A precision resistance decade box suitable for a wide range of simulation work. High accuracy, long term stability, and low temperature coefficient make the 1067 ideal for simulating and calibrating precision Pt100 sensors and temperature indicators/meters that use resistive sensors.

Special care has been taken in the construction of this precision decade box to ensure that the residual end resistance is as low and as stable as possible. Multiple self-cleaning silver alloy contacts are used for each position to ensure outstanding performance and long life.

Housed in a robust metal case the 1067 is fully screened and low thermal EMF terminals are used. The slimline design means it takes up minimum bench space and is easily transportable.

Resistance is selected by dialling the value required using the rotary switches. This enables precise setting with a clear indication. Each decade is scaled from 0 to 11 and therefore allows convenient overlap of the set values. The maximum value settable is 12,222.21 ohms.

## Features

- 10 mΩ to 12 kΩ
- 0.01 % accuracy
- Precision Pt100 simulation
- 6-digit resolution
- Better than 20 ppm/year stability
- Residual resistance < 10 mΩ
- Fully screened

# 2 Specifications

**Range / Resolution** .....0 to 12 kΩ / 10 mΩ steps.

**Number of decades**.....6. Each settable from 1 to 11.

**Accuracy**.....± 0.01 % of setting ± 2 mΩ, after deduction of residual end resistance ± 1 mΩ for residual variation.
*(At calibration temperature of 22°C)*

**Current rating .....**10 mΩ range: 3 A.
100 mΩ range: 2 A.
1 Ω range: 600 mA.
10 Ω range: 200 mA.
100 Ω range: 60 mA.
1 kΩ range: 20 mA.

**Residual resistance** .....Less than 10 mΩ.

**Residual resistance stability**.....Less than 1 mΩ.

**Voltage rating** .....200 V DC at maximum resistance setting.

**Temperature coefficient** .....Less than 10 ppm per °C (> 1 Ω).
Less than 20 ppm per °C (< 1 Ω).

**Stability** .....Better than 20 ppm per year (> 1 Ω).
Better than 100 ppm per year (< 1 Ω).

**Insulation** .....Case to resistance terminals 2 kV DC maximum.

**Connections .....**2 x 4 mm active safety terminals. A third safety terminal is to enable the case to be earthed or connected to either output.

**Contacts**.....Make before break - silver alloy.

**Operating torque**.....Less than 0.1 Nm.

**Dimensions**.....W 355 x H 63 x D 82 mm.

**Weight**.....1.1 kg.

**Options** .....Calibration certificates:
Traceable (factory) and accredited (ISO 17025).

**Country of origin**.....United Kingdom.

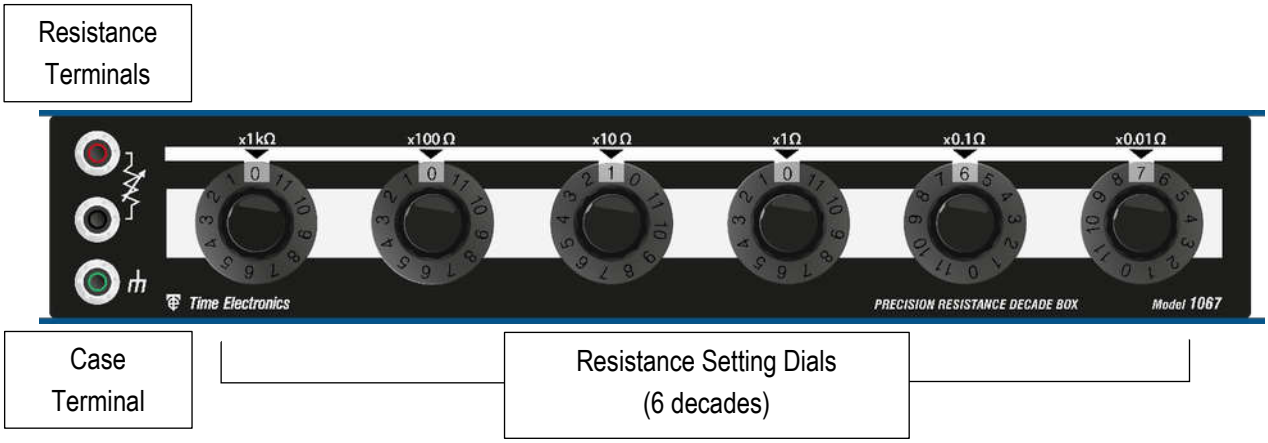
# 3 Operation

## 3.1 Safety Precautions



Observe proper safety operational guidelines when working with high voltages. To minimize shock hazard connect the case terminal to an electrical ground. Always take precautions to avoid and prevent contact with live components. Handle the unit with care and use as per the instructions in this manual.

## 3.2 Front Panel Controls and Connections



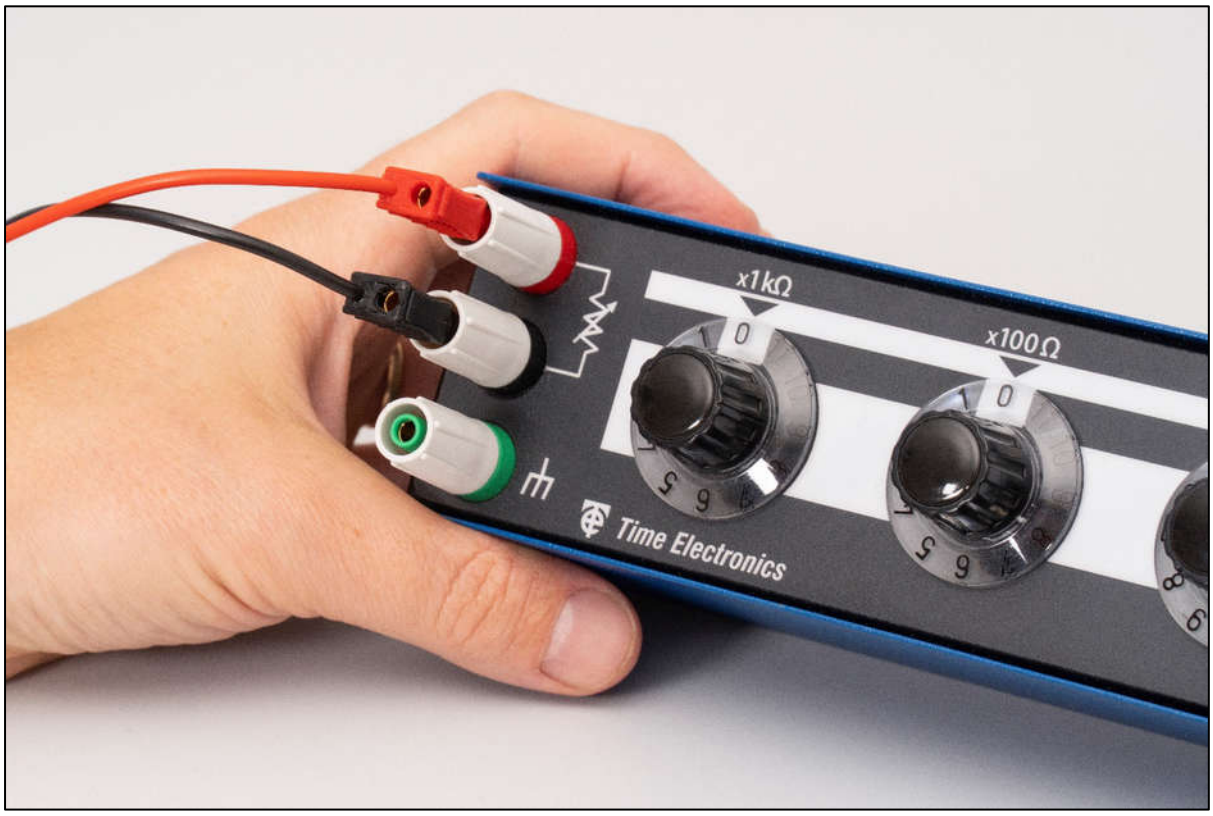

- **Resistance Terminals:** Resistance is connected via the safety terminal binding posts that are suitable for twisted stripped wire compression connection, spade terminals, or by 4 mm shrouded or normal plug insertion.

- **Case Terminal:** The case terminal is isolated from the two active resistance terminals. When connected to ground/earth, it may be used as a guard or shield connection, this can help to reduce unwanted electrical noise pickup, and help maintain the case at a safe voltage in certain modes of use.

- **Resistance Setting Dials:** Used for selecting the required resistance by setting the dial to the value of the decade range. Each dial can be set from 0 to 11.
  The value is clearly displayed in the white setting window below the decade range.

## 3.3 Operating Instructions

### 3.3.1 Connections




Connection to the decade box is via 4 mm safety terminal posts, using 4 mm shrouded or standard plugs. Alternatively, crocodile clips or stripped wire connections can be used.

Whatever method is used, the connection must be tight to the terminal posts to avoid introducing unwanted additional resistance.

The red and black active terminals connect to the resistance elements, and the green terminal is connected to the case for screening purposes.



For certain applications, the user may want to connect the case terminal to either of the active terminals. This can be done, but the case would then be at the same potential as the active terminals. The user should be aware that this could be hazardous and safety precautions must be taken to prevent electric shock.

### 3.3.2 Setting Resistance




Use the front panel dials to set the required values according to the decade ranges. The selected value shown in the white setting window under the range arrow. This enables precise setting with a clear unambiguous indication.

For example, to set 138.51 Ω equivalent to 100 °C Pt100 (ITS-90):

- Set the 1 kΩ dial to 0.
- Set the 100 Ω dial to 1.
- Set the 10 Ω dial to 3.
- Set the 1 Ω dial to 8.
- Set the 0.1 Ω dial to 5.
- Set the 0.01 Ω dial to 1.

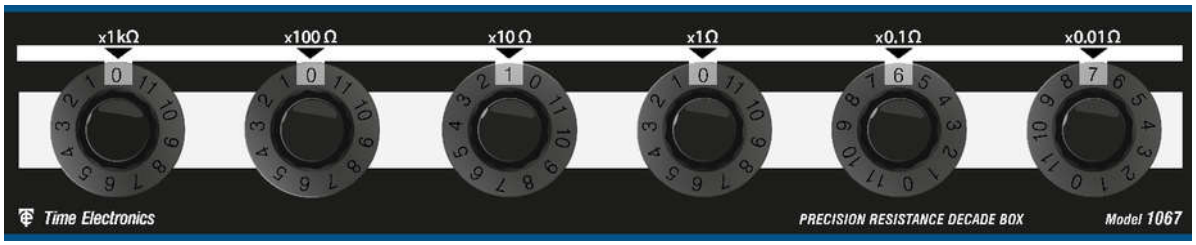
For a quick reference to the setting values of the 1067, please see the Resistance Setting Table on the following page.

**Note:** All resistance boxes have a residual resistance, meaning that when the dials are set to zero a small resistance remains. If you are making precision measurements or recalibrating the instrument, this residual value must be subtracted from all measurements.

Typical values of residual resistance are shown in the specifications.
For precise values relating to your specific unit, refer to calibration certificate (if ordered).

## 3.4 Resistance Setting Table

The below table shows the settings of each resistance decade using the dials.




| 1 kΩ Decade | | 100 Ω Decade | | 10 Ω Decade | | 1 Ω Decade | | 0.1 Ω Decade | | 0.01 Ω Decade | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dial** | **Ω** | **Dial** | **Ω** | **Dial** | **Ω** | **Dial** | **Ω** | **Dial** | **Ω** | **Dial** | **Ω** |
| 0 | 0 Ω | 0 | 0 Ω | 0 | 0 Ω | 0 | 0 Ω | 0 | 0 Ω | 0 | 0 Ω |
| 1 | 1 kΩ | 1 | 100 Ω | 1 | 10 Ω | 1 | 1 Ω | 1 | 0.1 Ω | 1 | 0.01 Ω |
| 2 | 2 kΩ | 2 | 200 Ω | 2 | 20 Ω | 2 | 2 Ω | 2 | 0.2 Ω | 2 | 0.02 Ω |
| 3 | 3 kΩ | 3 | 300 Ω | 3 | 30 Ω | 3 | 3 Ω | 3 | 0.3 Ω | 3 | 0.03 Ω |
| 4 | 4 kΩ | 4 | 400 Ω | 4 | 40 Ω | 4 | 4 Ω | 4 | 0.4 Ω | 4 | 0.04 Ω |
| 5 | 5 kΩ | 5 | 500 Ω | 5 | 50 Ω | 5 | 5 Ω | 5 | 0.5 Ω | 5 | 0.05 Ω |
| 6 | 6 kΩ | 6 | 600 Ω | 6 | 60 Ω | 6 | 6 Ω | 6 | 0.6 Ω | 6 | 0.06 Ω |
| 7 | 7 kΩ | 7 | 700 Ω | 7 | 70 Ω | 7 | 7 Ω | 7 | 0.7 Ω | 7 | 0.07 Ω |
| 8 | 8 kΩ | 8 | 800 Ω | 8 | 80 Ω | 8 | 8 Ω | 8 | 0.8 Ω | 8 | 0.08 Ω |
| 9 | 9 kΩ | 9 | 900 Ω | 9 | 90 Ω | 9 | 9 Ω | 9 | 0.9 Ω | 9 | 0.09 Ω |
| 10 | 10 kΩ | 10 | 1 kΩ | 10 | 100 Ω | 10 | 10 Ω | 10 | 1.0 Ω | 10 | 0.10 Ω |
| 11 | 11 kΩ | 11 | 1.1 kΩ | 11 | 110 Ω | 11 | 11 Ω | 11 | 1.1 Ω | 11 | 0.11 Ω |

# 4 Applications

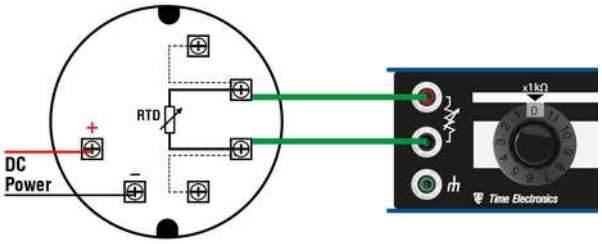
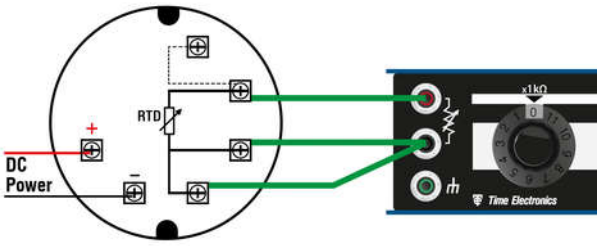
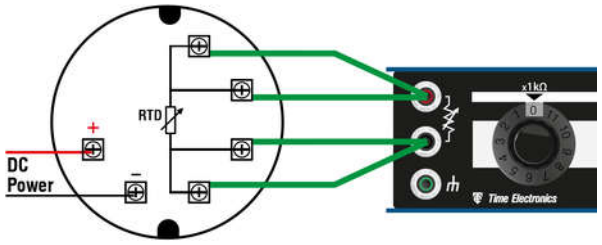
## Pt100 Resistance Simulation

Accurate simulation of low ohm values, such as PRT, can be performed by using the 1067.

**Resistance vs Temperature Relationship for Platinum Resistance Thermometer Detector Element (ITS-90)**

| °C | Ω | °C | Ω | °C | Ω | °C | Ω |
|---|---|---|---|---|---|---|---|
| -200 | 18.52 | 60 | 123.24 | 320 | 219.15 | 580 | 307.25 |
| -180 | 27.10 | 80 | 130.90 | 340 | 226.21 | 600 | 313.71 |
| -160 | 35.54 | 100 | 138.51 | 360 | 233.21 | 620 | 320.12 |
| -140 | 43.88 | 120 | 146.07 | 380 | 240.18 | 640 | 326.48 |
| -120 | 52.11 | 140 | 153.58 | 400 | 247.09 | 660 | 332.79 |
| -100 | 60.26 | 160 | 161.05 | 420 | 253.96 | 680 | 339.06 |
| -80 | 68.33 | 180 | 168.48 | 440 | 260.78 | 700 | 345.28 |
| -60 | 76.33 | 200 | 175.86 | 460 | 267.56 | 720 | 351.46 |
| -40 | 84.27 | 220 | 183.19 | 480 | 274.29 | 740 | 357.59 |
| -20 | 92.16 | 240 | 190.47 | 500 | 280.98 | 760 | 363.67 |
| 0 | 100.00 | 260 | 197.71 | 520 | 287.62 | 780 | 369.71 |
| 20 | 107.79 | 280 | 204.90 | 540 | 294.21 | 800 | 375.70 |
| 40 | 115.54 | 300 | 212.05 | 560 | 300.75 | 820 | 381.65 |

**Typical connections for 2, 3 and 4 wire resistance thermometers**

| Connection Diagram | Notes |
|---|---|
|  | **2-wire Pt100 Connection**<br>The connecting lead/wire resistance must be factored.<br>Residual resistance is factored to calculate best setting accuracy, if required. |
|  | **3-wire Pt100 Connection**<br>Leads/wires must be of the same length, gauge, and resistance, meaning the connection is compensated.<br>Residual resistance is factored to calculate best setting accuracy, if required. |
|  | **4-wire Pt100 Connection**<br>Provides the most accurate measurement, not being affected by any differences in the wires/leads used. Residual resistance is factored to calculate best setting accuracy, if required. |

# 5 Warranty and Servicing

## Warranty

Time Electronics products carry a one-year manufacturer's warranty as standard.

Time Electronics products are designed and manufactured to the highest standards and specifications to assure the quality and performance required by all sectors of industry. Time Electronics products are fully guaranteed against faulty materials and workmanship.

Should this product be found to be defective, please contact us using the below details. Inform us of the product type, serial number, and details of any fault and/or the service required. Please retain the supplier invoice as proof of purchase.

This warranty does not apply to defects resulting from action of the user such as misuse, operation outside of specification, improper maintenance or repair, or unauthorized modification. Time Electronics' total liability is limited to repair or replacement of the product. Note that if Time Electronics determine that the fault on a returned product has been caused by the user, we will contact the customer before proceeding with any repair.

## Product Registration

You can register your product at: www.timeelectronics.com/contact/product-registration. Registering your product will enable us to maintain a record of purchase for your warranty. You can also use the web form to provide feedback about our products and services.

## Calibration and Repair Services

Time Electronics offers repair and calibration services for all the products we make and sell. Routine maintenance by the manufacturer ensures optimal performance and condition of the product. Periodic traceable or accredited calibration is available.

## Contacting Time Electronics

**Online:**
Please visit www.timeelectronics.com and select Technical Support from the Contact links. From this page you will be able to send information to the Time Electronics service team who will help and support you.

**By phone:**
+44 (0) 1732 355993

**By email:**
mail@timeelectronics.co.uk

## Returning Instruments

Prior to returning your product please contact Time Electronics. We will issue a return merchandise authorization (RMA) number that is to accompany the goods returning. Further instructions will also be issued prior to shipment. When returning instruments, please ensure that they have been adequately packed, preferably in the original packing supplied. **Time Electronics Ltd will not accept responsibility for units returned damaged.** Please ensure that all units have details of the service required and all relevant paperwork.

Send the instrument, shipping charges paid to:

**Time Electronics Ltd**
Unit 5, TON Business Park, 2-8 Morley Road,
Tonbridge, Kent, TN9 1RA.
United Kingdom.

Tel: +44(0)1732 355993
Fax: +44(0)1732 350198

Email: mail@timeelectronics.co.uk
Web Site: www.timeelectronics.com

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### Disposal of your old equipment



1. When this crossed-out wheeled bin symbol is attached to a product it means the product is covered by the European Directive 2002/96/EC.
2. All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.
3. The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health.
4. For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or return to Time Electronics.