Time Electronics
Calibration, Test and Measurement

User Manual

1041
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 low ohm resistance box designed for general laboratory work including platinum resistance thermometry. The 1041 is compact and durable, housed in a robust metal case with removable protective rubber cover. Excellent accuracy is achieved by using high stability metal film resistors.

The 5-digit thumbwheel switch makes selecting and reading the resistance setting easy. The 1041 incorporates colour-coded digits: ohms - white, milliohms - yellow.

Special attention has been given to maximize the reliability of operation. A special multiple gold contact switch arrangement ensures that a back-up contact is always available to take over should a failure occur.

For connections the unit features safety terminals that are compatible with 4 mm shrouded plugs, as well as standard plugs, bare wires, and spade terminals.

The 1041 comes fitted with an ergonomic rubber cover providing increased protection and durability. It has a textured grip for comfortable handling, and side openings to place labels. It is easy to remove if you prefer a stand-alone unit or to use the optional 9026 carry case.

Features

- 0.01 Ω to 1 kΩ
- High accuracy
- Clear visual indication
- High stability
- Low temperature coefficient
- Safety terminals
- Removable protective cover
- Suitable for industry or education

2 Specifications

Resistance range ..... 0.01 Ω to 1 kΩ in 0.01 Ω steps.

Decade (9 steps each)	0.01 Ω	0.1 Ω	1 Ω	10 Ω	100 Ω
Accuracy	± 10 %	± 5 %	± 1 %	± 0.5 %	± 0.1 %
Max current	1.0 A	1.0 A	1.0 A	0.3 A	0.1 A
Max voltage	90 mV	900 mV	9 V	27 V	90 V
Voltage DC per step	10 mV	100 mV	1 V	3 V	10 V

NOTE: On all ranges 0.01 Ω up to 100 Ω, the maximum applied voltage is proportional to the set point, keeping the current at or below the maximum specified.

Residual resistance ..... Less than 60 mΩ (< 12 mΩ / decade).

Residual resistance stability ..... Less than 3 mΩ.

Power rating ..... 1 watt per resistor. Metal film resistors are used throughout.

Voltage rating ..... Maximum 90 V DC, 63.64 V AC RMS.

Current rating ..... Maximum 1 A DC, 0.7 A AC RMS.

Temperature coefficient ..... 50 ppm/°C.

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.

Dimensions ..... W200 x H75 x D110 mm
(215 x 100 x 120 mm including supplied protective cover).

Weight ..... 0.6 kg (1.0 kg including protective cover)

Options ..... Calibration certificates, carry case.

Country of origin ..... United Kingdom.

Ordering Information

1041 ..... **Resistance Decade Box**

9026 ..... Carry case (replaces protective cover)

C161 ..... Traceable calibration certificate (Factory)

C114 ..... Accredited calibration certificate (ISO 17025)

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 Switches:** Used for selecting the required resistance by setting the thumbwheel digit switches to the value of the decade range. Each decade can be set from 0 to 9.

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



Before use it is recommended that all the thumbwheels are rotated completely 2 times. This will ensure the contacts are self-cleaned, maximizing their low contact resistance. This is particularly beneficial if the decade box has not been used for a long time.

The 1041 features colour-coded digits to help provide a clear indication of the set values.

- Ohms (100 Ω , 10 Ω, 1 Ω decades) = White.
- Milliohms (0.1 Ω, 0.01 Ω decades) = Yellow.

To set resistance, use the thumbwheel digit switches to set the required values according to the decade ranges.

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

- Set the 100 Ω decade to 1.
- Set the 10 Ω decade to 3.
- Set the 1 Ω decade to 8.
- Set the 0.1 Ω decade to 5.
- Set the 0.01 Ω decade to 1.

For a quick reference to the setting values of the 1041, 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 switches.

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

4 Applications

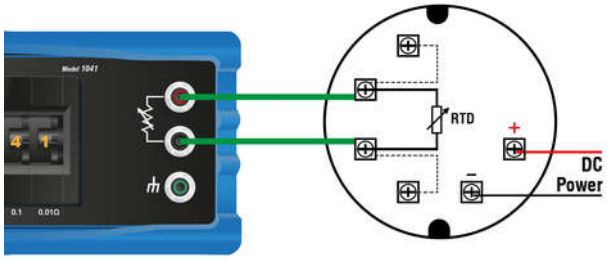
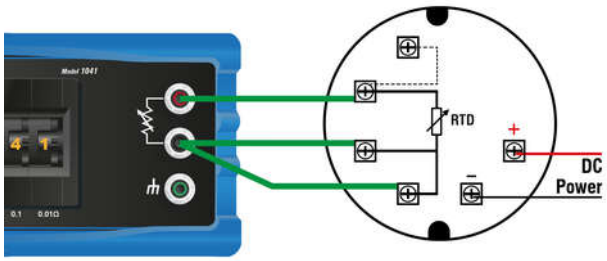
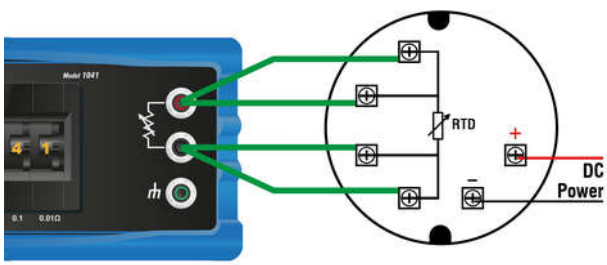
Pt100 Resistance Simulation

Accurate simulation of low ohm values, such as PRT, can be performed by using the 1041.

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** The connecting lead/wire resistance must be factored. Residual resistance is factored to calculate best setting accuracy, if required.
	**3-wire Pt100 Connection** Leads/wires must be of the same length, gauge, and resistance, meaning the connection is compensated. Residual resistance is factored to calculate best setting accuracy, if required.
	**4-wire Pt100 Connection** 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 Maintenance and Repair

Overload Considerations

To avoid overload, power dissipation in the resistive elements must be kept below 1 W. To achieve this the maximum current must not exceed those shown for each decade in the specifications table. Current will be proportional to the applied voltage. The maximum allowed working voltage that can be applied at the maximum setting for each decade is also shown in the specifications.
If multiple decades are being used, the current must not exceed that of the lowest rated decade. For example, if you set 107.79 Ω, the 100 Ω decade has the lowest current rating at 100 mA. Therefore the current flowing through the decade box must not exceed 100 mA.

Repair

NOTE: No repair work should be undertaken by the customer while the instrument is under warranty, as such work may render the warranty invalid.

Certain precision components used in this instrument are not readily available and make repairs by the customer difficult if these components are damaged. You should only use Time Electronics original parts to ensure the unit meets the stated specifications.

Dismantling the Instrument
Remove the protective rubber cover. Then removal of four case screws enables the metal cover to be taken off, enabling access to all parts of the instrument.

Spare Parts List

Part #	Description
017-1900	1 Ω resistor
017-1913	10 Ω resistor
017-1914	100 Ω resistor
062-0060	4 mm red terminal
062-0061	4mm black terminal
062-0062	4 mm green terminal
063-6323	Pair of tolec bank ends & fixing clips
090-9015	Case metal cover

Part #	Description
094-9553	0.01 Ω decade assembly
094-9554	0.1 Ω decade assembly
094-9555	1 Ω decade assembly
094-9556	10 Ω decade assembly
094-9557	100 Ω decade assembly
9026	Carry case
9028	Protective rubber cover

6 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:

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Tel: +44(0)1732 355993
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Email: mail@timeelectronics.co.uk
Web Site: www.timeelectronics.com

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.