Time Electronics
Calibration, Test and Measurement

User Manual

1006 DC Millivolt Source

and

1007 DC Millivolt Potentiometer/Source

Version 1.2
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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

1.1 1006 DC Millivolt Source

Features

- 3 ranges:
  0 to 999.9mV (0.1 mV steps)
  0 to 99.99mV (10 µV steps)
  0 to 9.999mV (1 µV steps)
- Accuracy 0.02 %
- 20 mA output current
- Short circuit and overload protected
- Safety terminals
- Removable protective cover
- Powered by 6 x AA batteries
- 100 hours typical battery life
- Optional carry case



Description

The 1006 is an accurate millivolt source suitable for voltage injection applications.

Three output ranges are provided to give adjustable output values from 1 µV to 1 V with a basic 0.02 % accuracy. For signal injection, the operator needs to switch on, check the battery condition, select the range, and set the required voltage using the thumbwheel switches. The 1006 uses a precision bandgap reference device, with low temperature coefficient resistors to give a highly stable output.

Power is provided by 6 AA batteries. Battery life is several months, depending on usage. The battery condition is monitored by an indicator situated on the top of the unit.

The 1006 has up to 20 mA drive current and is short circuit and overload protected.
An off/normal/reverse output polarity switch is provided.

Connection is via safety terminals that are compatible with 4 mm shrouded plugs, as well as standard plugs, bare wires, and spade terminals.

The unit comes fitted with an ergonomic rubber cover providing increased protection and durability. It has a textured grip for comfortable handling and top/bottom openings to place labels. It is easy to remove if the user prefers a stand-alone unit or to house the instrument in the optional carry case.

The unit is simple to operate and does not require standardisation or calibration prior to use.

1.2 1007 DC Millivolt Potentiometer and Source

Features



- 3 ranges:
  0 to 999.9mV (0.1 mV steps)
  0 to 99.99mV (10 µV steps)
  0 to 9.999mV (1 µV steps)
- Accuracy 0.02 %
- 1 µV resolution null
- 20 mA output current
- Short circuit and overload protected
- Safety terminals
- Removable protective cover
- Powered by 6 x AA batteries
- 100 hours typical battery life
- Optional carry case

Description

The 1007 includes all the features of the 1006 with the addition of a microvolt null balance display. This enables it to be used for potentiometric voltage measurement in addition to its function as a calibrator. The null zero and sensitivity are adjustable via front panel controls - maximum sensitivity enables null balance to resolve 1 µV.

Applications are essentially those of conventional potentiometers with the following significant advantages:

- No standardisation is required.
- 20 mA output current.
- Output remains stable without re-adjustment.
- Electronic null with microvolt sensitivity.

Connection is via safety terminals that are compatible with 4 mm shrouded plugs, as well as standard plugs, bare wires, and spade terminals.

The unit comes fitted with an ergonomic rubber cover providing increased protection and durability. It has a textured grip for comfortable handling and top/bottom openings to place labels. It is easy to remove if the user prefers a stand-alone unit or to house the instrument in the optional carry case.

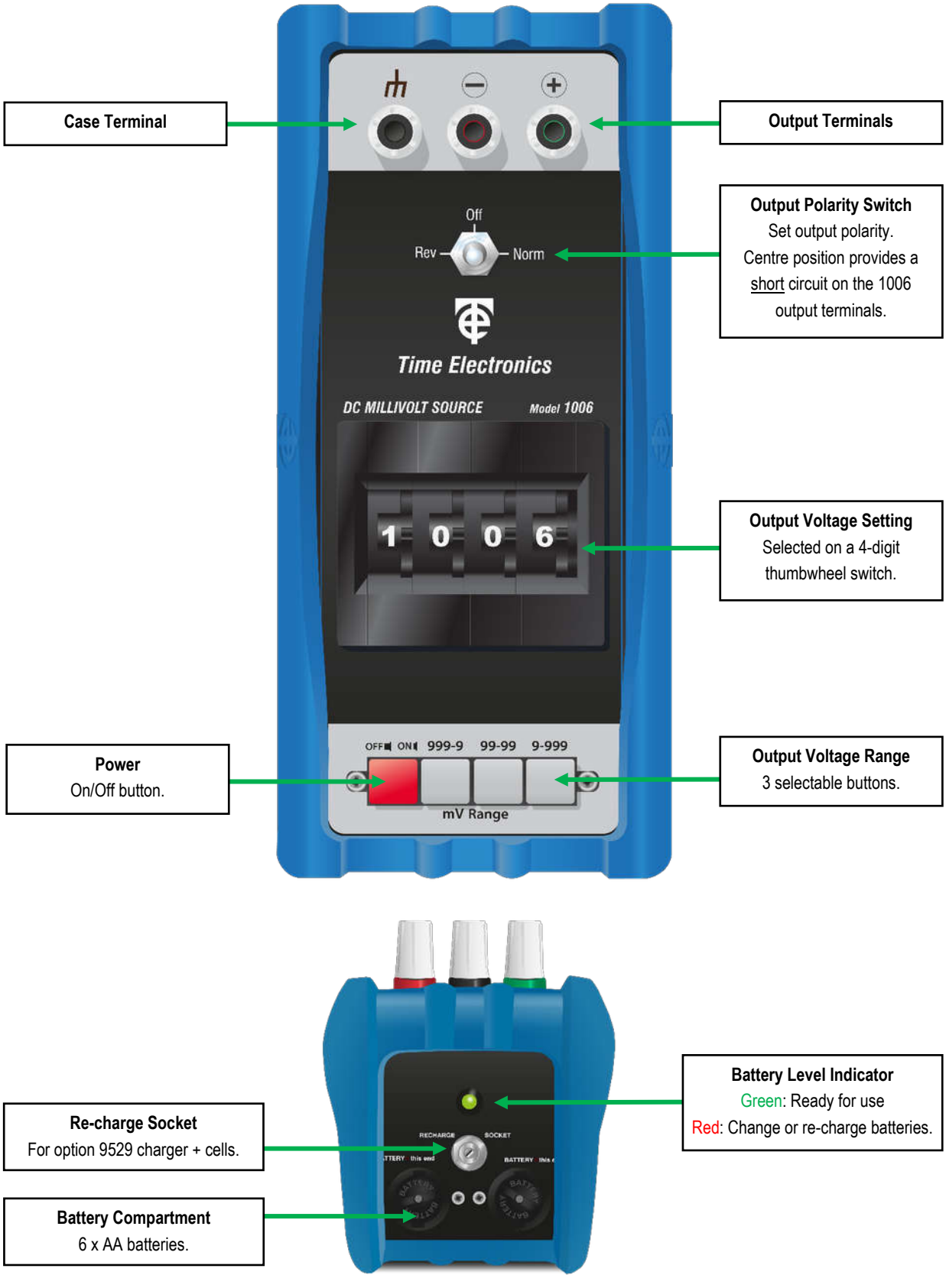
The 1007 is simple to operate and does not require standardisation or calibration before use. It is only necessary to zero the null amplifier prior to making a measurement.

1.3 Specifications

Output:	**0 to 999.9 mV in 3 ranges:** 0 to 999.9 mV in 0.1 mV steps 0 to 99.99 mV in 10 µV steps 0 to 9.999 mV in 1 µV steps
Accuracy:	± (0.02 % of setting + 0.02 % of range + 1 µV)
Output Resistance:	Less than 0.2 Ω on 1 V and 100 mV ranges. 1 Ω on 10 mV range.
Maximum Output Current:	999.9mV and 99.99mV ranges: 20 mA. 9.999mV range: Up to short circuit value although it should be noted that loads of less than 1 kΩ will give greater than 0.1 % error.
Output Voltage Stability:	Less than 60 ppm/°C. Less than 100 ppm per 3 month. (non cumulative)
Operating Temperature:	-10 °C to + 60 °C.
Output Polarity:	Positive or negative switch selected. A centre 'off' position is also provided.
Output Noise Level:	Less than 30 ppm of full scale.
Reference Source:	A precision bandgap reference diode is used to provide stability with a low temperature coefficient.
Maximum Overload:	The instrument can withstand continuous short circuit on the output for all ranges.
Power Supply:	6 AA batteries. A battery condition monitor indicates when the batteries should be replaced. An alternative power source is 6 NiMH cells of the same dimensions - these can be recharged via the charge socket located on the top of the unit. The 6 rechargeable batteries and mains re-charger unit are available as an optional extra.
Null Balance Display: (1007 only)	The null function is displayed on a front panel twin coloured LED bar graph, zero and sensitivity controls are provided. • Maximum sensitivity: ± 20 µV fsd • Minimum sensitivity: ± 200 mV fsd • Input resistance: Greater than 1 MΩ at balance.
Dimensions:	200 x 75 x 110 mm (215 x 100 x 120 mm incl. protective cover).
Weight:	0.75 kg (1.2 kg incl. protective cover).
Options:	9027 carry case (user must remove protective cover). 9529 rechargeable battery pack (6 cells and mains charger).

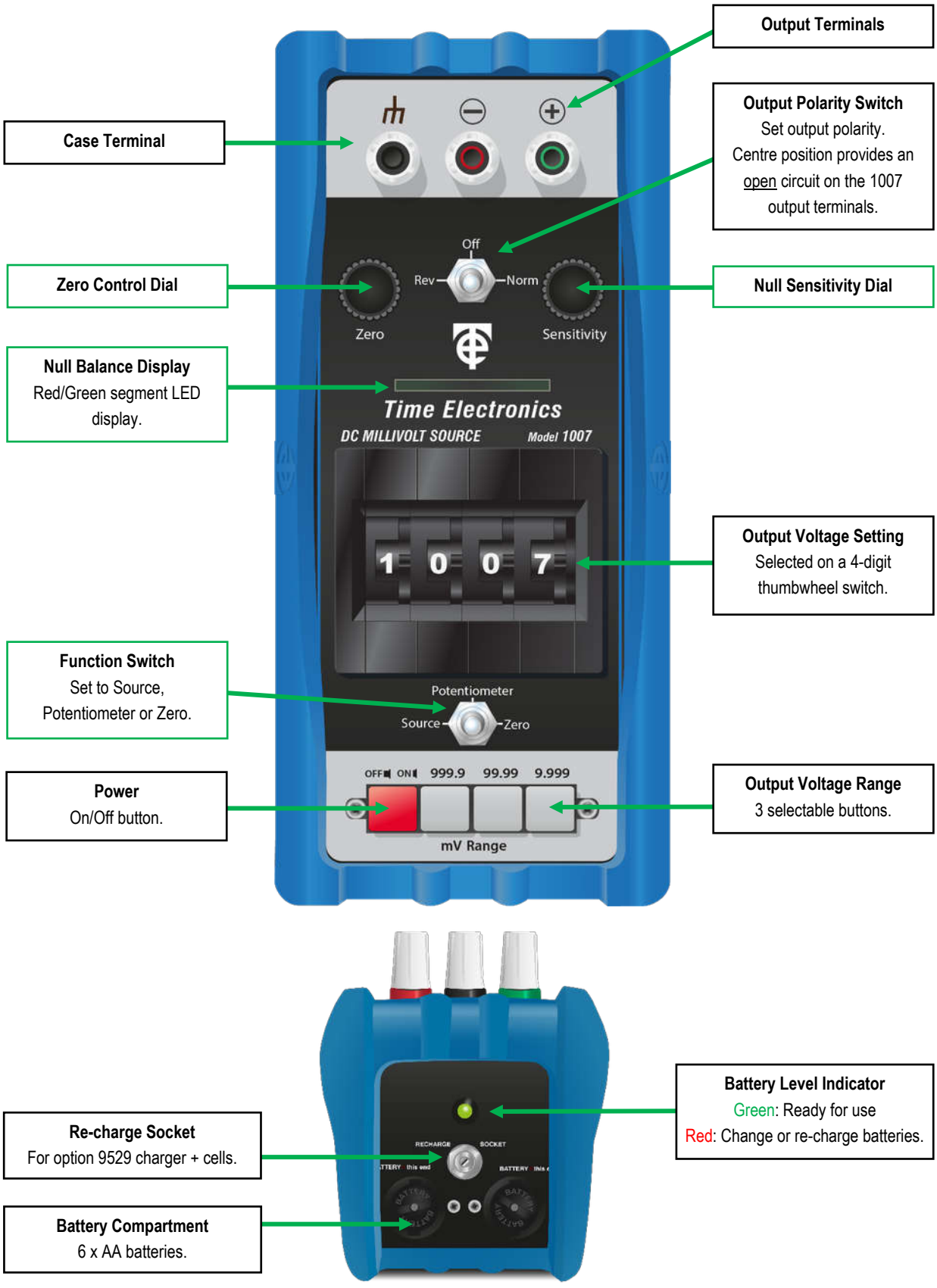
2 Controls

2.1 1006 Controls



2.2 1007 Controls

The 1007 incorporates a 1006 with the addition of a microvolt null detector and enables the unit to be used for potentiometric measurements. The additional components are highlighted with green boxes below.



3 Operating Instructions

3.1 Battery Insertion

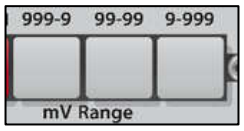
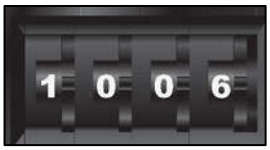


To insert batteries, remove two black covers on top of the instrument by pressing in and turning 90° anti-clockwise. Three size AA batteries should be inserted in each tube with the positive (tip) terminal upmost.

Note that if the optional battery charger is to be used, then nickel metal hydride (NiMH) rechargeable batteries must be used in the instrument.

3.2 1006/1007 mV Source Operation

To operate both models as a mV source, follow the steps below:

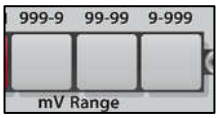
1. Power on the unit.	
2. Check the battery level indicator on the top of the unit: Green: Ready for use. Red: Change or recharge batteries.	
3. Select required range with push button. *On the 1007 select "source" on the function switch.*	
4. Dial required output voltage.	
5. The output voltage polarity can be selected on the front panel switch	

POLARITY SWITCH NOTE:
On the **1006**, the "off" polarity position disconnects the output & provides a short circuit on the output terminals. On the **1007**, the "off" polarity position provides an open circuit on the output terminals. This is to prevent accidental shorting of the voltage under test when the unit is being used as a potentiometer. It is desirable to keep the Null "SENSITIVITY" control set to minimum (fully anti-clockwise) when the 1007 is used as a source.

3.3 1007 mV Potentiometric Null Operation

Due to the extreme sensitivity of the electronic null detector (3 µV/div.) it is important to ensure that it is correctly zeroed before attempting accurate measurements.

3.3.1 Zero Setting Procedure

1. Set function switch to “Zero”.	
2. Select the range consistent with the voltage to be measured.	
3. Set Sensitivity dial to maximum (fully clockwise).	
4. Adjust Zero control dial for zero reading on null display (green segment lit).	

3.3.2 Measuring Procedure

1. Set function switch to Potentiometer.	
2. Set Output Polarity switch to “Norm”.	
3. Set the Sensitivity dial to minimum (fully counter clockwise).	
4. Connect unknown voltage (999.9 mV max) to output terminals (in the same polarity).	
5. Adjust range, output digits, and sensitivity for a null balance as required.	
6. Read off unknown applied voltage from rotary thumbwheel digit switches.	

4 Servicing and Calibration

4.1 Internal Preset Controls

IMPORTANT NOTE:
These controls are set in the factory before shipment and normally will not require readjustment.

If readjustment is considered necessary, it is important to check that the amount of adjustment required is within the range of the trimmer concerned. If it is greater than the trimmer range, there is no point in attempting to readjust and a fault condition will exist in the unit. The range of adjustment of the trimmers is given below.

Access to the 1006 or 1007 is by removing the blue case cover which is located by 8 screws.

1006 DC mV Source

The 1006 contains 4 (3 on instruments with serial number earlier than 1320) internal preset trimmers. They are located on the range switch selector module.

Zero Trimmer
The 'ZERO' trimmer adjusts the circuit zero and is set to bring the output voltage (with all digits set to zero) within the specified limits.

Calibration Trimmers
The 1 V, 100 mV, and 10 mV 'CAL' trimmers adjust the full-scale calibration (i.e. 9999) on all 3 ranges respectively to within the specified limits.

It is important to set the ZERO before attempting calibration.

4.2 Calibration and Adjustment

Test Equipment Required

1) A microvoltmeter with a resolution of better than 5 microvolts.
2) An accurate DC voltage source with a range 0 to 1 V, accuracy better than 0.02 %.

Zero Setting Procedure

Switch unit on and check battery condition is good.
1) Select 99.99 mV range and set all digits to zero.
2) Select 'NORMAL' output polarity.
3) Connect microvoltmeter to output and adjust ZERO trimmer for less than 10 µV reading.
   The maximum amount of adjustment available on this trimmer is approximately ± 100 µV.
5) Check the zero reading for all three ranges. The readings should be as follows:

   9.999 mV range less than ± 2 µV
   99.99 mV range less than ± 10 µV
   999.9 mV range less than ± 100 µV

FS Calibration/Adjustment Procedure

1) Check zero output is correct as described earlier.

2) Select 999.9 mV range and ‘normal’ output polarity.

3) Set output digits to 9999.

4) Connect the accurate voltage source and microvolt null meter to the 1006 output in a potentiometric mode.

5) Set the voltage source to 999.9 mV output and adjust the ‘1V CAL’ trimmer on the module to bring the 1006 output within specification. The maximum amount of adjustment available on this trimmer is 0.8 %.

6) Select 99.99 mV range on the 1006 and set the voltage source to 99.99 mV. Adjust the ‘100mV CAL’ trimmer to bring the output within specification. The maximum amount of adjustment available on this trimmer is 0.8 %.

7) Select the 9.999mV range on the 1006, and set the voltage source to 9.999 mV. Adjust the ‘10mV CAL’ trimmer bring the output to within specification. The maximum amount of adjustment available using this trimmer is 0.8%.

8) The specified FS allowable errors for these three ranges are:

999.9mV range less than ± 550uV at full scale output.
99.99mV range less than ± 55uV at full scale output.
9.999mV range less than ± 6uV at full scale output.

Note: All instruments with serial numbers earlier than 1320 do not have the additional trimmer fitted to adjust the 9.999mV full scale calibration of the 10mV range. See item 9 below.

9) The 9.999mV range is obtained by resistive attenuation of the 999.9mV range. A 100:1 attenuation ratio is used and adjustment is by preselected resistor values. Unless overload damage to the attenuator resistors has occurred, the calibration of the 1-volt range will automatically ensure the full scale calibration of the 9.999mV range.

1007 Millivolt Source and Potentiometer

The 1007 incorporates a 1006 with the addition of a microvolt null detector. With the front panel function switch in the ‘SOURCE’ position, the unit operates as a 1006 and the ZERO and CALIBRATION setting procedures are identical to those for the 1006.

The potentiometer position of the function switch connects a high performance null balance system in series with the output. The null zero and sensitivity are adjustable by front panel controls. Maximum sens. = ± 20 µV. Min. sens. = ± 200 mV and zero adjust range is approximately ± 100 µV.

The null amplifier circuitry is located on a small pcb which is fixed to the underside of the output terminals. The circuitry incorporates two preset trimmers for adjustment of the null amplifier input voltage and current offsets.

Important Note: It is important to check that the 1007 is operating correctly as a millivolt source and that the source zero setting is within specification before considering readjustment of the null amplifier trimmers.

Null Amplifier trimmer adjustment procedure

Voltage Offset (10k trimmer):

1) Select ’ZERO’ position on the function switch.

2) Set all digits to zero. Select 9.999 mV range.

3) Adjust trimmer for equal swing (about zero) of the front panel zero control.

Current Offset (500k trimmer):

1) Select ’ZERO’ function, all digits zero, 9.999 mV range.

2) Select potentiometer operation.

3) Connect a 47 kilohm resistor across output terminals.

4) Set the null sensitivity control to minimum.

5) Adjust trimmer for zero reading on the null display - the null sensitivity can be increased gradually to maximum during adjustment.

Note: A low offset current is important when measurements are to be made in high resistance circuits, but will not affect accuracy of measurements in low resistance circuits.

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.

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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:
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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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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.