Time Electronics
Calibration, Test and Measurement

# User Manual

## 1048
## Voltage / Current / Loop Calibrator

Version 1.3
12-23

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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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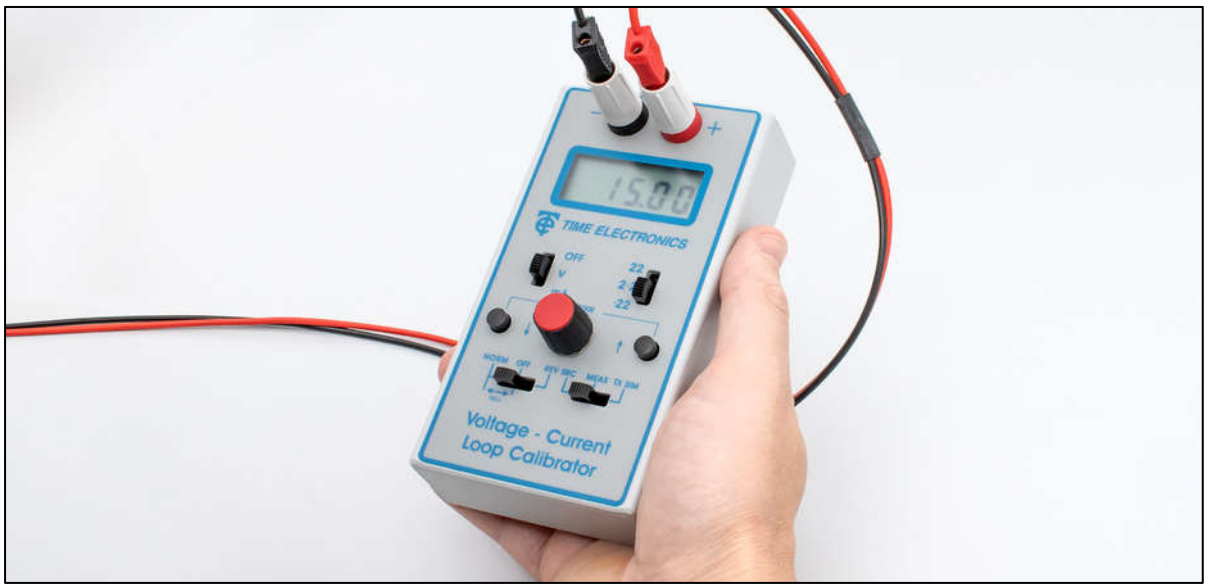
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# 1 Introduction




## 1.1 Description

A portable instrument that operates as a current and voltage source and a multi-purpose loop calibrator. High performance and simple operation make it suitable for R&D, service, process control engineers, and calibration technicians. As a versatile handheld calibrator, the source and measure capabilities with 0.02 % accuracy mean the 1048 is a compact solution for most simulation and test applications.

The large, easy to read 4.5-digit LCD display shows the actual output, even when the connected load exceeds the specifications. This important feature eliminates the risk of large errors when connecting to unknown loads. The display also indicates if the battery becomes critically low.

In the source mode, voltage up to 22 V and current up to 22 mA may be generated in three ranges. When in current source mode the 1048 has a high 24 V compliance voltage which is ideal for powering process loops. In the measurement mode, the range and function can be easily selected, with the measured input accurately shown on the display.

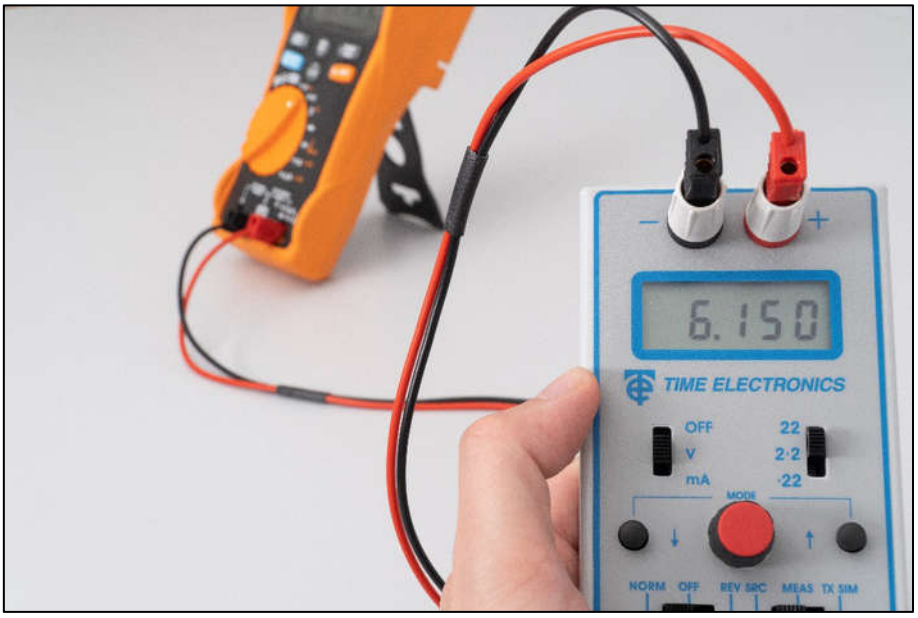
The step and ramp functions are simple operation, with no key press menus to learn, just switches and buttons. A multi-turn potentiometer controls the output, with up/down incrementing buttons for fine control. The output can be reversed (+/-) and zeroed at the flick of a switch. The automatic ramp function enables the user to choose either 5, 11, or 21 point calibration. Manual operation can be quickly restored by a single push of a button.

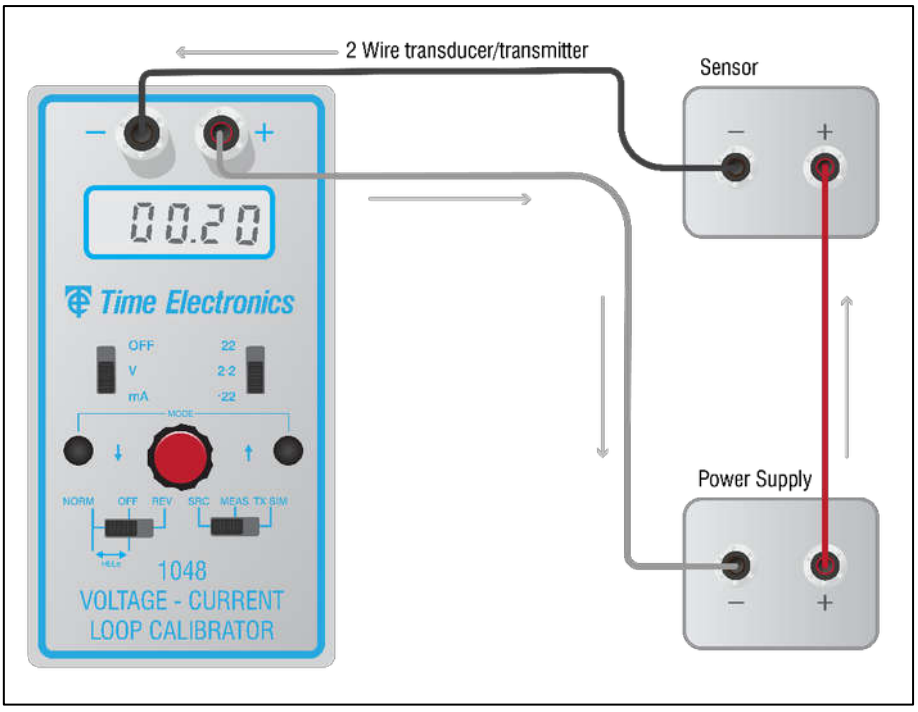
The 1048 is housed in a pocket-sized ABS case, with carry case supplied as standard. Connections are by standard 4 mm plugs or by clamping the wires under the terminals. A single 9 V battery powers the unit or an external 12 V DC power supply may be used which disconnects the internal battery. The unit is constructed in a rugged pocket size hard ABS case and supplied with leatherette carrying pouch. Leads can be stored in the pouch.

## 1.2 Applications

Common use of the 1048 is to simulate a transducer or measure the current flow in a transducer loop. The 1048 can be used to check a 4 to 20 mA system in either source or measure modes of operation, with the 24 V compliance voltage powering the loop when current source mode is selected.

In the source mode, the 1048 may be used to calibrate meters, thermocouple indicators, data loggers, for signal injection, semiconductor characterization, or as a backing off source. In the measure mode, the 1048 may be used in the same way as a digital multimeter, checking DC voltages and current over 3 ranges with excellent resolution and accuracy.



## 1.3 Features

- Measure voltage and current
- 3 source ranges: 0 to 22 mA and 0 to 22 V
- 3 measure ranges: 0 to 70 mA and 0 to 50 V
- Accuracy 0.02 %
- Transmitter simulator/sink loop control
- Output steps and ramps
- Coarse and fine adjustment
- 20 hours typical battery life
- Optional mains power supply (230 V and 110 V available)
- Supplied with carry case




## 1.4 Ordering Information and Options

| Order Code | Description |
|---|---|
| **1048** | Voltage/Current/Loop Calibrator |
| **7643** | Mains power supply (230 V) |
| **7652** | Mains power supply (110 V) |
| **C176** | Traceable Calibration Certificate (Factory) |
| **C138** | Accredited Calibration Certificate (ISO 17025) |

# 2 Specifications

## 2.1 Technical Specifications

### Voltage source

| Range | Resolution | Accuracy | Output current | Temp coefficient |
|---|---|---|---|---|
| 0 to 220 mV | 10 µV, 100 µV above 0.2 V | 0.05 % of FS | 20 mA | ± 6 ppm/°C |
| 0 to 2.2 V | 100 µV, 1 mV above 2 V | 0.02 % of FS | | |
| 0 to 22 V | 1 mV, 10m V above 20 V | 0.02 % of FS | | |

### Voltage measure

| Range | Resolution | Accuracy | Measure load | Temp coefficient |
|---|---|---|---|---|
| 0 to 220 mV | 10 µV, 100 µV above 0.2 V | 0.05 % of FS ± 1 digit | 1 MΩ | ± 3 ppm/°C |
| 0 to 2.2 V | 100 µV, 1 mV above 2 V | 0.02 % of FS ± 1 digit | 1 MΩ | |
| 0 to 22 V | 1 mV, 10 mV above 20 V | 0.02 % of FS ± 1 digit | 10 MΩ | |

### Current source

| Range | Resolution | Accuracy | Output voltage | Temp coefficient |
|---|---|---|---|---|
| 0 to 220 µA | 10 nA, 0.1 µA above 200 mA | 0.05 % of FS | 24 V Max | ± 12 ppm/°C |
| 0 to 2.2 mA | 0.1 µA, 1 µA above 2 mA | 0.02 % of FS | | |
| 0 to 22 mA | 1 µA, 10 µA above 20 mA | 0.02 % of FS | | |

### Current measure

| Range | Resolution | Accuracy | Input load | Temp coefficient |
|---|---|---|---|---|
| 0 to 220 µA | 10 nA, 0.1 µA above 200 mA | 0.05 % of FS ± 1 digit | 1 kΩ | ± 8 ppm/°C |
| 0 to 2.2 mA | 0.1 µA, 1 µA above 2 mA | 0.02 % of FS ± 1 digit | 110 Ω | |
| 0 to 22 mA | 1 µA, 10 µA above 20 mA | 0.02 % of FS ± 1 digit | 16 Ω | |

## 2.2 Settings and General Specifications

**Sink (Tx Simulation)** .....2 wire transmitter simulation: External excitation voltage, 3 V min, 50 V max.
*The current sink levels are adjustable, with accuracies as per the 3 source ranges shown on previous page.*
**Note:** Accuracies in all measure modes are ± 1 digit.

**Output steps**.....5 fixed 4 mA steps for current output 4, 8, 12, 16 and 20 mA.
11 fixed 1 V steps for voltage output 0,1,2. 10 V.
21 fixed steps 1 V/1 mA for V and I output 0,1,2. 20.
*Stepping can be done manually or automatically (Autostep). Stepping speed is adjustable (1 - 9 sec/step). Dwell time (top and bottom) is one step period. In step mode the accuracy is limited to 0.05 % of span ± 1 digit.*

**Output adjustment**.....A ten turn potentiometer for quick setting, with fine adjust using up/down increment buttons.

**Connections**.....Made by 4 mm connectors or clamped using the wire compression feature.

**Power**.....PP3 size, 9 V battery.
Approximately 20 hours of life depending on the current sourced.
Alternatively, an optional 12 V power supply can be plugged into the 2.5 mm socket on the top of the unit.

**Protection**.....The 1048 can withstand open circuits, short circuits and reverse polarity up to 25 V. Additional protection is by an internal fuse.

**Operating temperature**.....-10 to 50 °C.

**Storage temperature**.....-30 to 70 °C.

**Operating humidity**.....0 to 90 % non-condensing at 25 °C.

**Dimensions**.....H 142 x W 78 x D 50 mm.

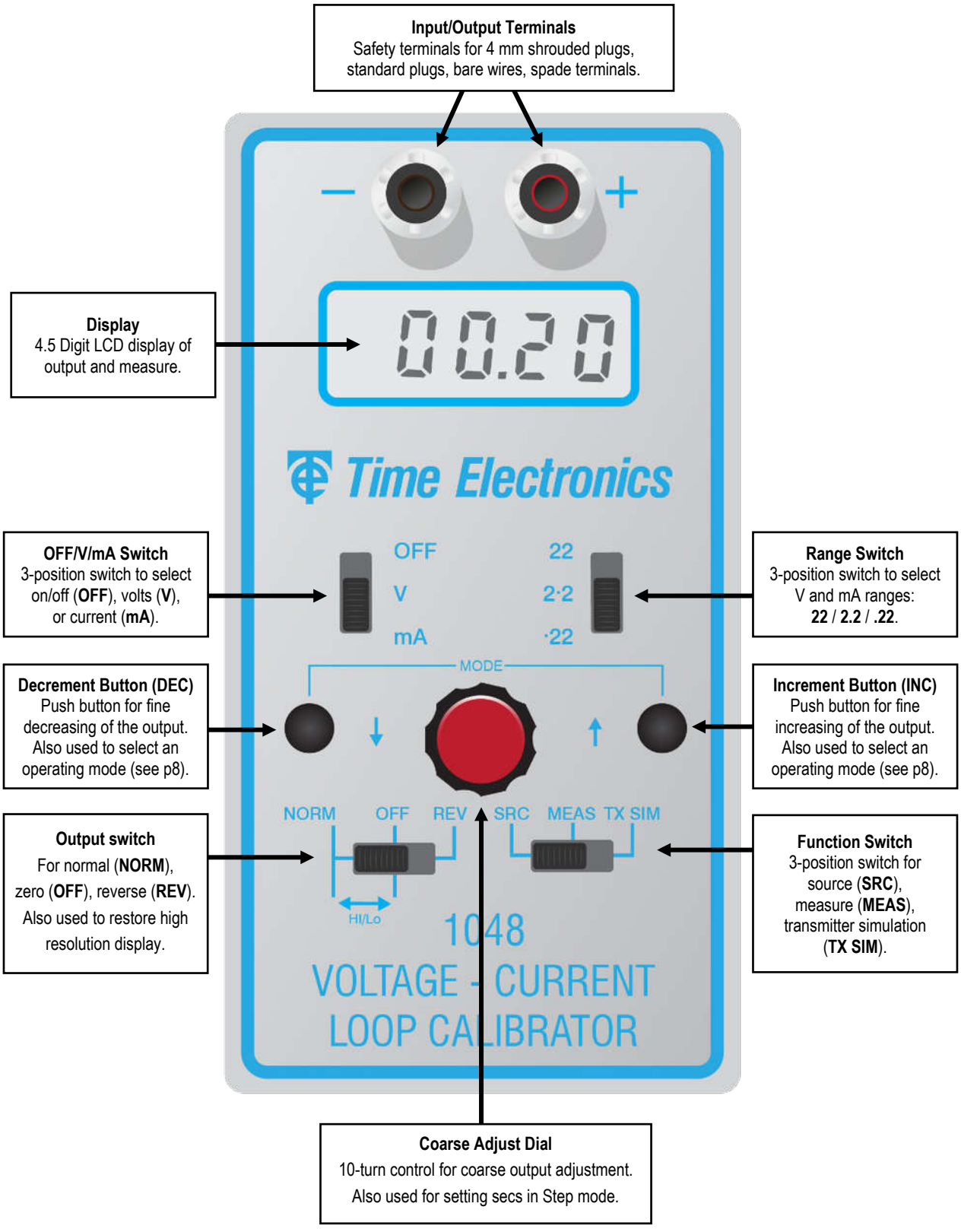
**Weight**.....0.30 kg.

**Optional extras**.....230 V or 110 V mains power supplies.
Calibration certificates:
Traceable (Factory) and Accredited (ISO 17025).

**Country of origin**.....UK.

# 3 Controls and Operating Modes

## 3.1 Front Panel Controls



## 3.2 Operating Modes

The 1048 has 3 operating modes; Normal, Step, and Ramp.

### 3.2.1 NORMAL Operating Mode

Provides manual operation of the standard measure and source functions for both voltage and current. A transmitter simulation/sink (TX SIM) function is also included for loop test and calibration. The internal power supply can also be used to provide the drive voltage to passive process control transmitters and sensors. This allows them to be calibrated without the need for the loop power to be connected.

### 3.2.2 STEP Operating Mode

Provides output steps of fixed value. Three options are available:

A. 5-point calibration: 4, 8 ,12, 16, 20 **mA**.
B. 11-point calibration: 1,2,3,4,5,6,7,8,9,10 **V**.
C. 21-point calibration: 1,2,3,4,5…18,19,20 **mA or V**.

The stepping between the calibration points can be done manually or can be set to proceed automatically at an adjustable rate (see Section 5).

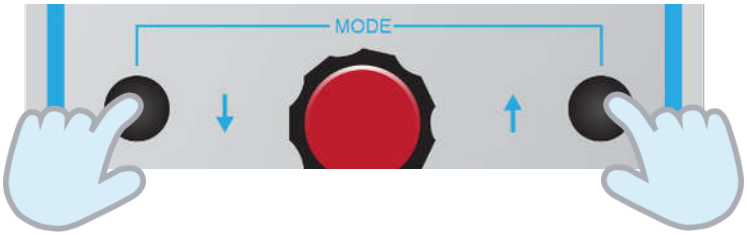
### 3.2.3 RAMP Operating Mode

Provides a continuous ramp up/down with dwell periods at the top and bottom. Both voltage and current are available for ramping (see Section 5).

### 3.2.4 Changing/Selecting the Operating Mode

The default mode at power up is **NORMAL**.

The above modes are selected by simultaneously pressing the **INC** and **DEC** buttons.




Every time they are pressed the next mode will be selected.

This is followed by **STEP**, which is indicated by the '**CONTINUITY**' legend appearing in the top right section of the display.

The final mode is **RAMP**, which is indicated by the '**CONTINUITY**' legend flashing.

# 4 Operating Notes

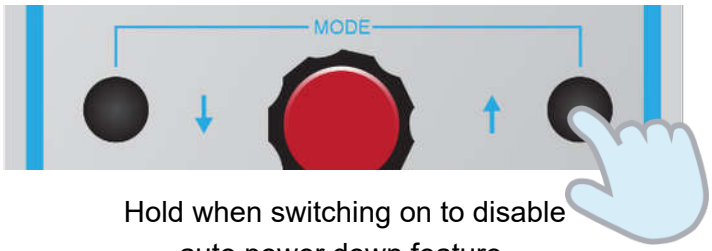
## 4.1 Power

The unit is powered by a PP3 (Alkaline) battery that lasts approximately 15 hours of normal operation. Continuous operation on current will shorten the battery life. The unit will indicate '**Low Battery**' when the battery needs changing. A short period of operation is possible when '**Low Battery**' is showing but no more than a few mA will be available at the output. See Maintenance Section for battery replacement instructions.

The unit can also be operated from an external 12 V DC (100 mA) mains power supply unit. This is available as an optional extra. Connection is via the small jack plug socket on the terminal end of the unit.

### 4.1.1 Automatic power down disable

If the unit is not operated for 15 minutes, it will automatically power down to conserve the battery life. This feature can be disabled by pressing the INC button when switching on the unit. It should be noted that the operation is indicated by flashing the decimal point at the switch on time.




Hold when switching on to disable auto power down feature.

## 4.2 Operating Precautions

### 4.2.1 Display

The LCD display should not be exposed to strong sunlight for prolonged periods.
It is recommended to store the unit inside the supplied carry case when not in use.

### 4.2.2 Usage and Storage Conditions

- Operating temperature: –10 to 50 °C.
- Storage temperature: –30 to 70 °C.
- Operating humidity: 0 to 90 % non-condensing at 25 °C.

## 4.3 Resolution Adjustment

### 4.3.1 Resolution high/low

The unit has a unique method of changing the display resolution when values greater than the conventional 19999 (4.5 digit) display are used. This feature allows the units ranges to be extended by 10% above the commonly used 0.2/2.0/20 full scales. Calibration of values just above these figures is now possible. This will be found particularly useful with 4 - 20mA transducers where they are slightly over scale but are still within specification.

For both measure and source functions, high resolution (4.5 digit, e.g. 1.9999) will apply for all values below:

- 0.20 on the 0.22 range
- 2.0 on the 2.2 range
- 20 on the 22 range

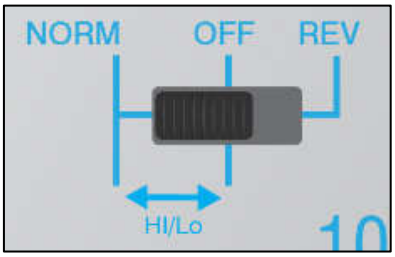
All values above those above will be displayed to 3.5 digit resolution e.g. 21.05.

The change-over from high to low resolution is automatic. However, if the value increases and the resolution changes from high to low, it will not return to high resolution until the value is reduced to:

- 0.1 on the 0.22 range
- 1.0 on the 2.2 range
- 10 on the 22 range

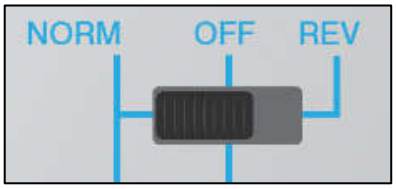
To force the display back into high resolution the output polarity switch should be moved from **Hi** to **Lo** to **Hi**.

There is a marking on the front panel below the switch to indicate this:



## 4.4 Polarity Setting

### 4.4.1 Output Polarity Switch




It is important for the user to understand the operation of the output polarity switch.
The switch has three positions, **NORM / OFF / REV**, and its function depends on the operating mode being used.

#### 4.4.1.1 Measure function (V & mA)

In the **NORM** position the unit will measure inputs connected in the same polarity as the terminals i.e. red is positive and black negative.

The **OFF** (centre) position, when measuring voltage, disconnects the signal internally and leaves the input terminals still providing 1 M Ω input resistance. The display should read zero but occasionally the last digit may show '1', this is normal and is within the specification.

The **OFF** position, when measuring current, disconnects the signal internally and leaves the input terminals still providing the current shunt input resistance. The display should read zero but occasionally the last digit may show '1', this is normal and is within the specification.

The **REV** position is not used since the unit's measuring capability is bi-polar i.e. it can accept both +ve and –ve input signals. The –ve inputs are displayed with a '-' sign in front of the value.

#### 4.4.1.2 Source function (V & mA)

The **NORM** position outputs signals in the polarity indicated by the terminals.

The **REV** position reverses the polarity.

When outputting voltage or current, the **OFF** position disconnects the output signal and places an open circuit on the output terminals. The display will read zero.

*NOTE: When the switch is in the **REV** position it should be noted that the display does not place a – (minus) annunciator before the value.*

#### 4.4.1.3 TX SIM function

The switch is not used for this function and has no effect at all.

#### 4.4.1.4 STEP and RAMP modes

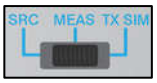
In both these modes the function switch is in source (**SRC**) position and the **NORM/OFF/REV** switch performs in the same way as in the NORMAL operating mode.

# 5 Normal Operation

## 5.1 Voltage Measurement

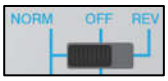
The unit measures dc voltage in three selectable ranges, 0 to 0.22 V (displayed in mV), 0 to 2.2 V and 0 to 22 V (plus over-range to 50 V).

**SPECIAL NOTE**: Although the top range is nominally 22 V it can be safely used to measure voltages up to 50 V.

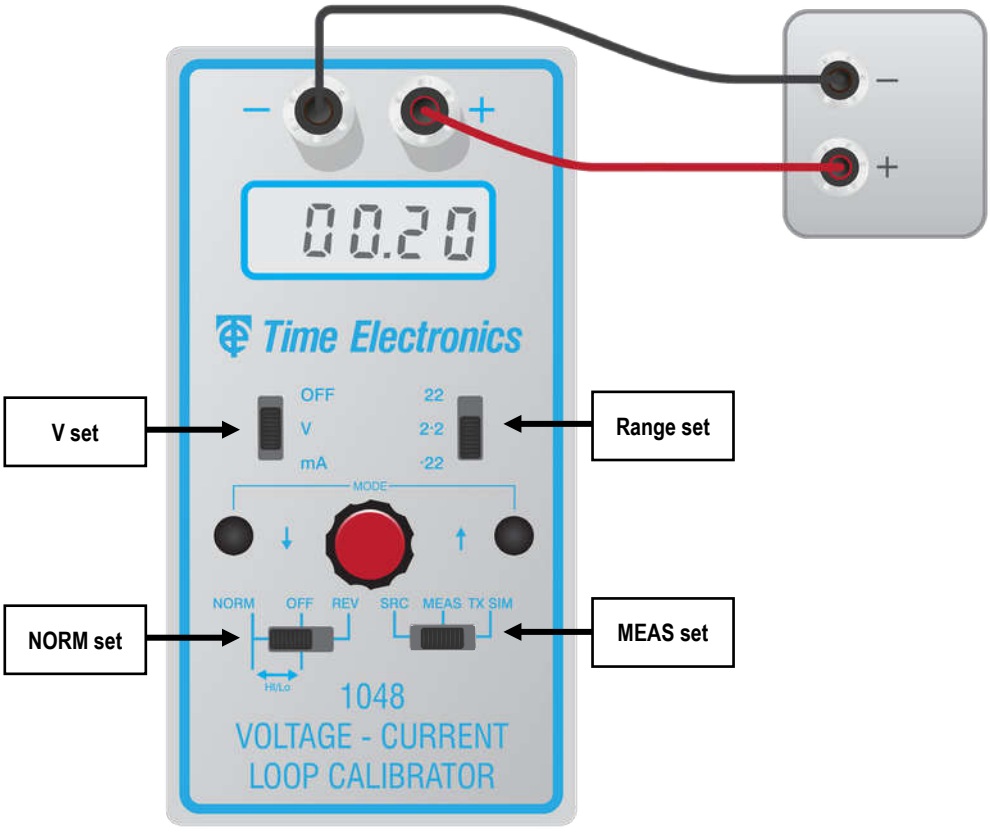
- Set Function switch to **MEAS** 

- Set OFF/V/I switch to **V** 

- Set Range switch to the desired range (**22 / 2.2 / .2**) 

- Set Output switch to **NORM** 

- Connect the unit to the signal source observing correct polarity, the voltage will be displayed with 3.5 or 4.5 resolution (see section 4.3 for resolution notes).

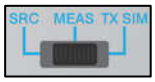



**Measure Mode**

## 5.2 Current Measurement (external loop power)

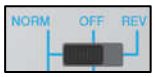
The unit measures current in three selectable ranges, 0 to 0.22 mA (displayed in µA), 0 to 2.2 mA and 0 to 22 mA (plus over-range to 70 mA).

**SPECIAL NOTE:** Although the top range is nominally 22 mA, it can be safely used to measure current to 70 mA.

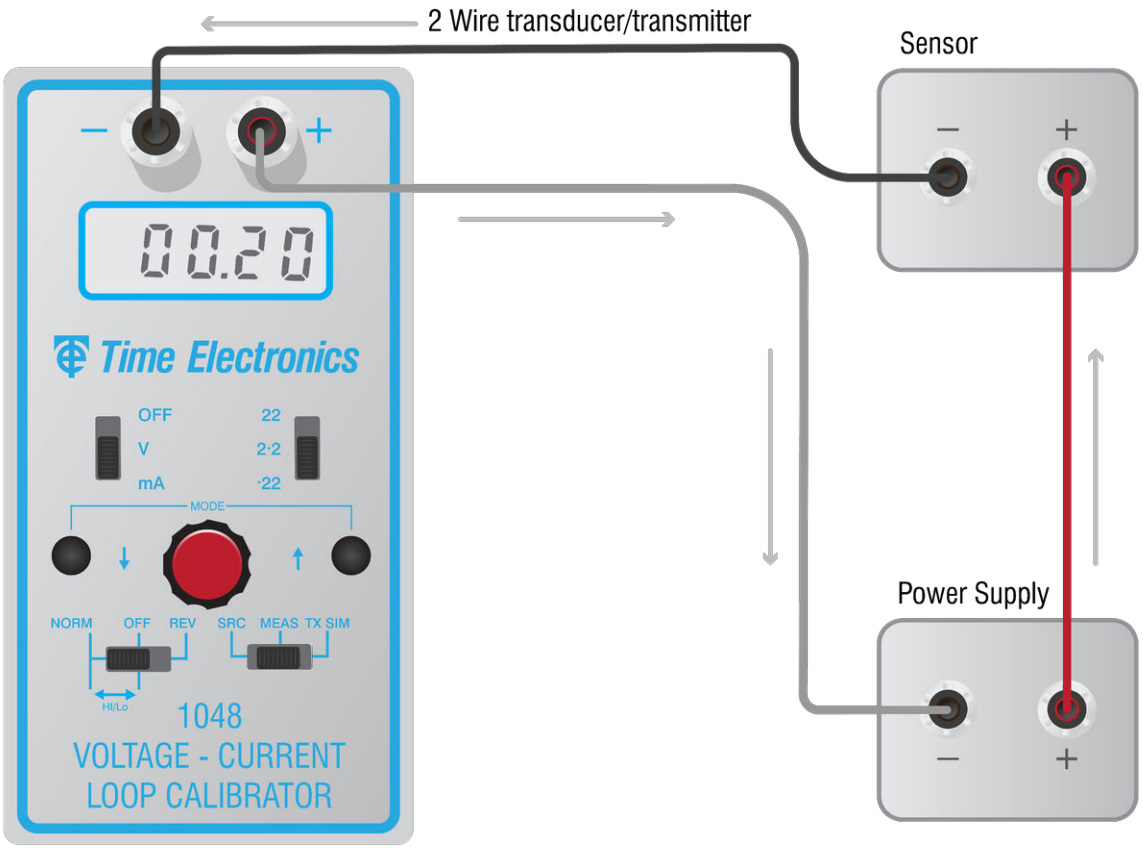
- Set Function switch to **MEAS** 

- Set OFF/V/I switch to **mA** 

- Set Range switch to the desired range (**22 / 2.2 / .2**) 

- Set Output switch to **NORM** 

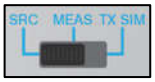
- Connect the unit to the signal source observing correct polarity, the current will be displayed with 3.5 or 4.5 resolution (see section 4.3 for resolution notes).

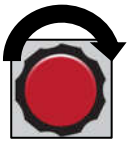
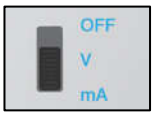



**Measure Mode**

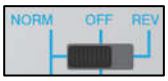
## 5.3 Power and Calibrate - transmitters/sensors

If the external loop power supply is not available, it is possible to use the unit's internal 22 V supply to power the loop. Set up the unit as described below.

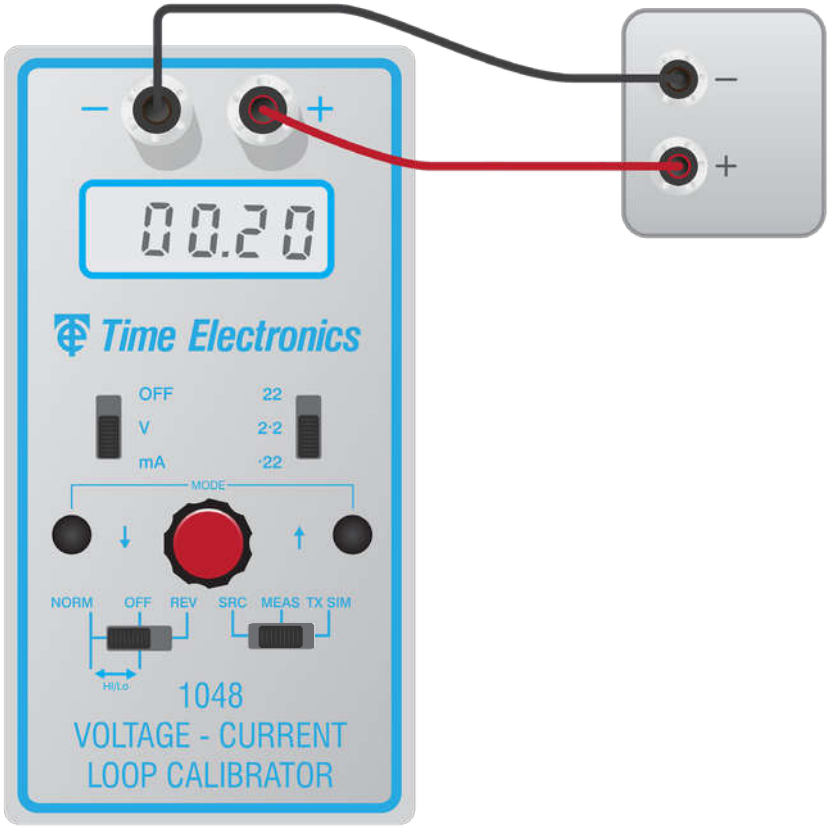
- Set Function switch to **SRC** 


- Set the multi-turn output control dial fully clockwise.
- Set OFF/V/mA Switch to **mA** 

- Set Range switch to the desired range (**22 / 2.2 / .2**) 

- Set Output switch to **NORM** 

- Connect the unit to the sensor or transmitter observing the correct polarity. The current drawn is displayed.




**Measure and Power Mode**

## 5.4 Voltage Source

The unit outputs voltage from 0 to 22 V in three ranges:

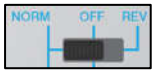
- 0 to 0.22 V (displayed in mV)
- 0 to 2.2 V
- 0 to 22 V

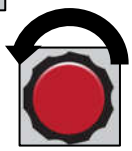
To source voltage follow the steps below:

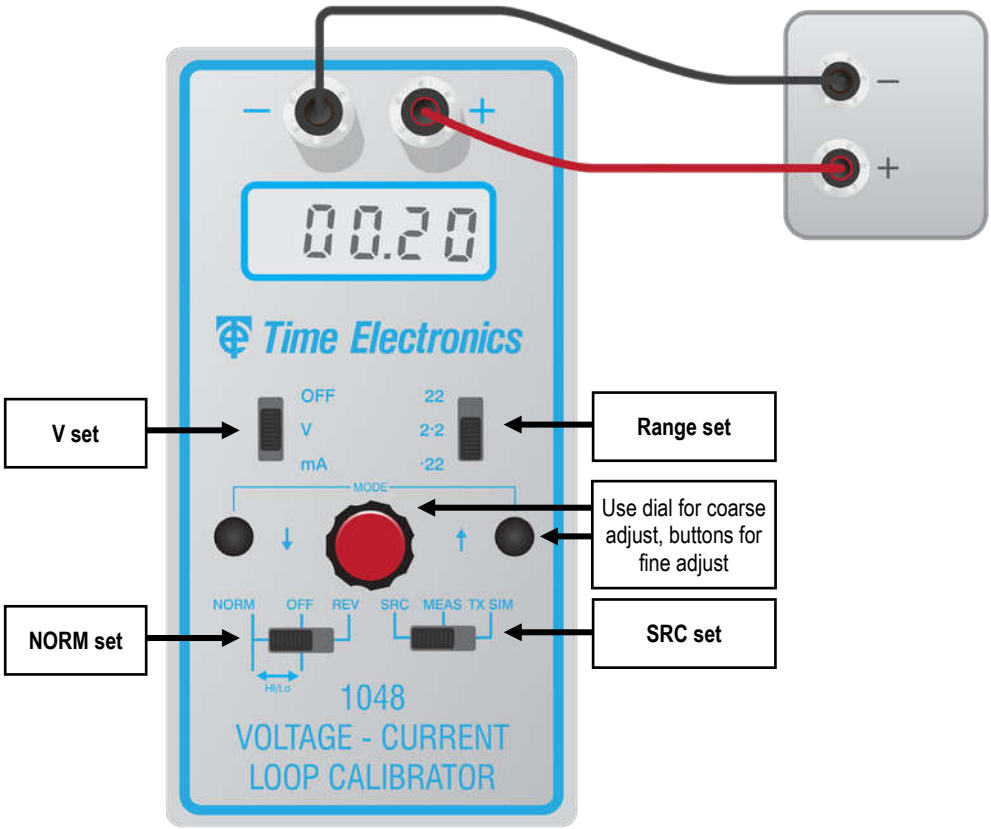
- Set Function switch to **SRC** 

- Set OFF/V/I switch to **V** 

- Set Range switch to the desired range (**22 / 2.2 / .2**) 

- Set Output switch to **NORM** 

- Set multi-turn output control dial to minimum (anticlockwise) 
- Connect the unit to the process instrument observing correct polarity and adjust the multi-turn output control dial for coarse control and INC / DEC buttons for fine control.




**Source Mode**

## 5.5 Current Source

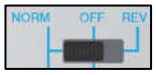
The unit outputs current from 0 to 22 mA in three ranges:

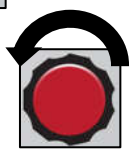
- 0 to 0.22 mA (displayed in µA)
- 0 to 2.2 A
- 0 to 22 A

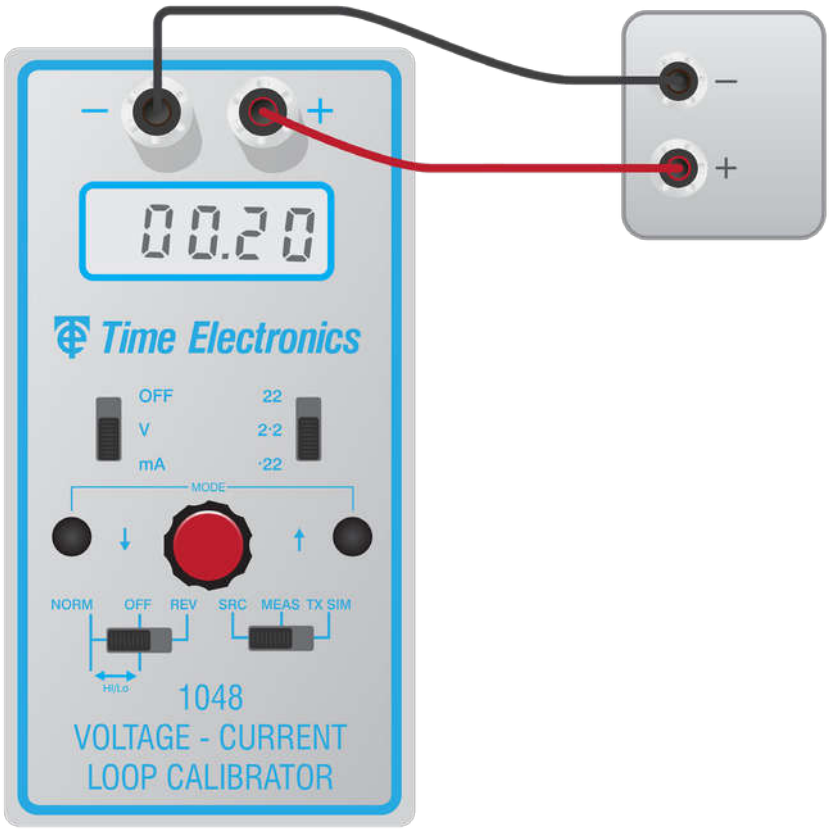
- Set Function switch to **SRC** 

- Set OFF/V/I switch to **mA** 

- Set Range switch to the desired range (**22 / 2.2 / .2**) 

- Set Output switch to **NORM** 

- Set multi-turn output control dial to minimum (anticlockwise) 
- Connect the unit to the process instrument observing correct polarity and adjust the multi-turn output control dial for coarse control and INC / DEC buttons for fine control.




**Source Mode**

## 5.1 Sink - transmitter simulator (TX SIM)

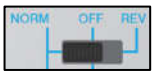
In the Sink function, the unit simulates a process field transmitter as part of a loop testing and calibration operation. The unit takes its excitation power from the loop and acts as a variable resistance to adjust the loop current to the value shown on the unit's display. The excitation voltage must be in the range 3 to 50 V DC.

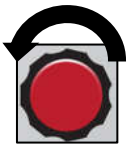
The NORM/OFF/REV switch is not functional in the SINK mode.

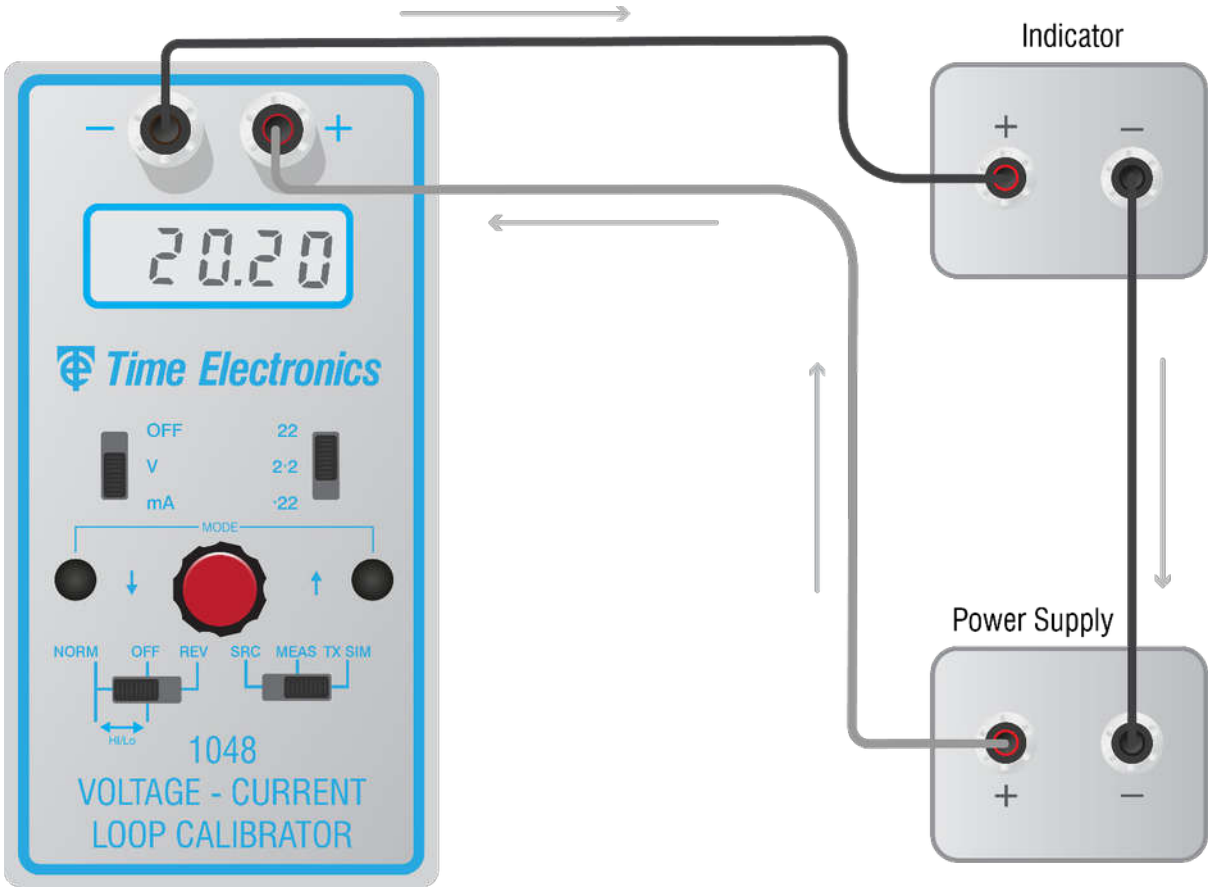
- Set function switch to **TX SIM** 

- Set OFF/V/mA switch to **mA** 

- Set range switch to the **22** position at the top 

- Set output switch to **NORM** 

- Set multi-turn output control dial to minimum (anticlockwise) 
- Connect the unit in the loop observing correct polarity. Set the current in the loop by adjusting the multi-turn control (coarse) and the INC/DEC buttons (fine).




**Sink Mode (transmitter simulator)**

# 6 Step and Ramp Operation

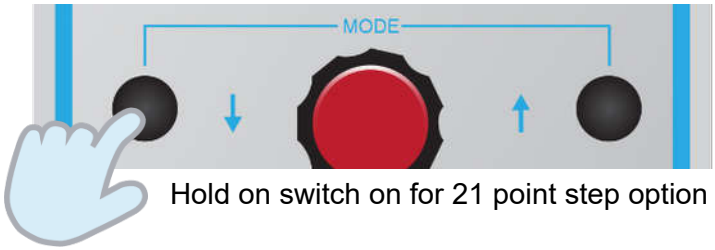
These modes are designed to automate and speed up the process of testing and calibration.

The **STEP** mode allows simplified calibration. It provides output steps of fixed value.

Three options are available:

A. 5-point calibration: 4, 8 ,12, 16, 20 **mA**.
B. 11-point calibration: 1,2,3,4,5,6,7,8,9,10 **V**.
C. 21-point calibration: 1,2,3,4,5…18,19,20 **mA or V**.

**A** and **B** are the default options, ie 4-20 mA for current source, 0-10 V for voltage source.
The **C** option is obtained by powering up the unit while pressing the **DEC** ↓ button.

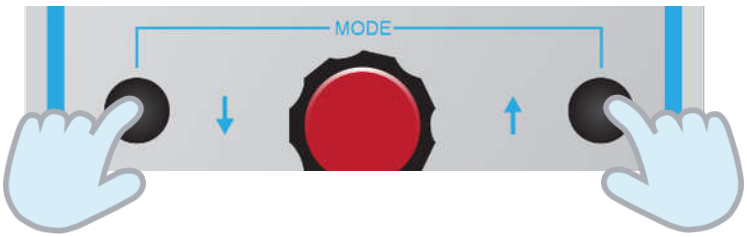


Hold on switch on for 21 point step option

The **RAMP** mode provides a continuous ramp up/down with dwell periods at the top and bottom. Both voltage and current are available for ramping and the ramp limits can be selected as shown above i.e. for 5, 11 or 21 point calibrations.

## Selecting the Operating Mode

The above modes are selected by simultaneously pressing the **INC** ↑ and **DEC** ↓ buttons.




Every time they are pressed the next mode will be selected.

The default mode at power up is **NORMAL**.

This is followed by **STEP**, which is indicated by the '**CONTINUITY**' legend appearing in the top right section of the display.

The final mode is **RAMP**, which is indicated by the '**CONTINUITY**' legend flashing.

## 6.1 Step Mode

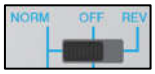
### 6.1.1 Manual STEP Operation

This mode considerably speeds up the calibration process as a simple push of a button enables the unit to manually step through standard calibration points, 5 points in 4 – 20 mA, 11 points in 0 – 10 V, or 21 points in 0 – 20 mA or V (see section 5 for 21-point setup).

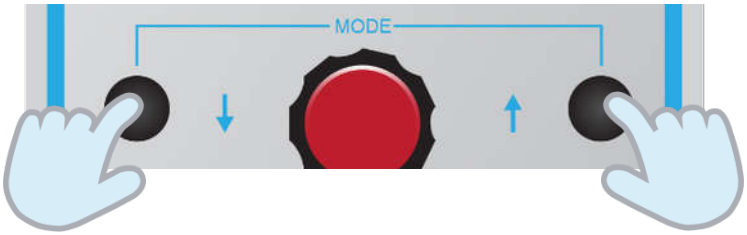
- Set function switch to **SRC** 

- Set OFF/V/mA switch to the desired units (**V** or **mA**) 

- Set range switch to the desired range (**22 / 2.2 / .2**) 

- Set output switch to **NORM** 

- Simultaneously press **INC** and **DEC** buttons and the word “CONTINUITY” will appear on the display and the reading will go to zero.




- The unit is now ready to manually step through the preset calibration points.
- Press the **INC** ↑ to step to the next output value 
- Press the **DEC** ↓ button to step back to the previous output value 

## Notes:

a) When choosing the 4 - 20 steps the initial value will be zero. It will move to 4 at the first press and subsequently cycle between 4 and 20 in the regular 5-point pattern.

b) The output switch will operate in the same way as for source (V & mA) function.

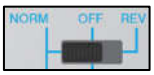
### 6.1.2 Automatic STEP Operation

This function provides a method of automatically stepping through the fixed output values.

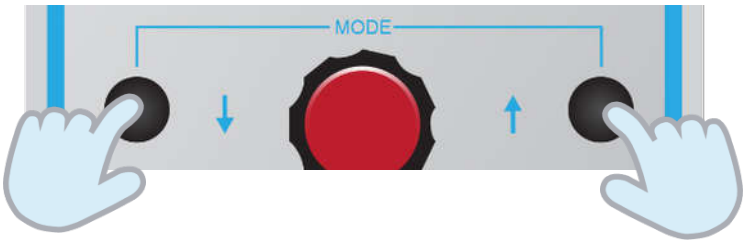
- Set function switch to **SRC** 

- Set OFF/V/mA switch to the desired units (**V** or **mA**) 

- Set range switch to the desired range (**22 / 2.2 / .2**) 

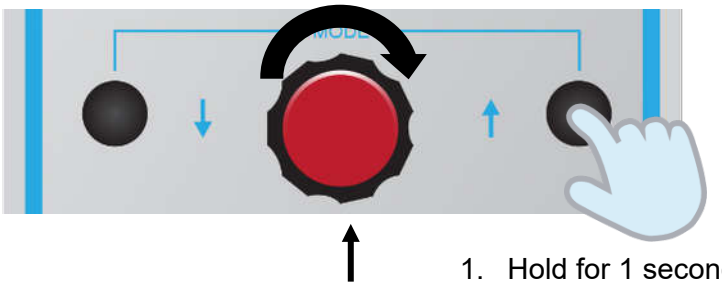
- Set output switch to **NORM** 

- Simultaneously press **INC** ↑ and **DEC** ↓ buttons. The word “CONTINUITY” will appear on the display and the reading will go to zero.




- The unit is now ready to enter the auto-step function and automatically output the preset calibration points.

- Press the **INC** ↑ button and hold for 1 second. The display decimal point will start to flash and the output will cycle up and down through the fixed values.
The time step on each value may be varied from 1 to 9 seconds by adjusting the multi-turn output control.

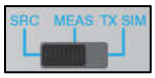


1. Hold for 1 second
2. Adjust from 1 to 9 seconds (shown on display)

- To return to the Manual Step Function press the **INC** ↑ button once more.
The decimal point will stop flashing.

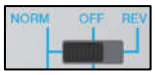
## 6.2 Ramp Mode

When using either the Source or Sink functions, RAMP provides a method of continuously increasing and then decreasing the output in a continuous fashion. The output ramps up from 0% (4 in the 4-20 selection) to the full scale where it stays (dwells) for a fixed period before ramping down again to its starting value. It dwells here again for a fixed period before restarting the cycle. The ramp times are approx 7 secs and the dwell times approx 5 secs. Ramp operation is available for both voltage and mA output.

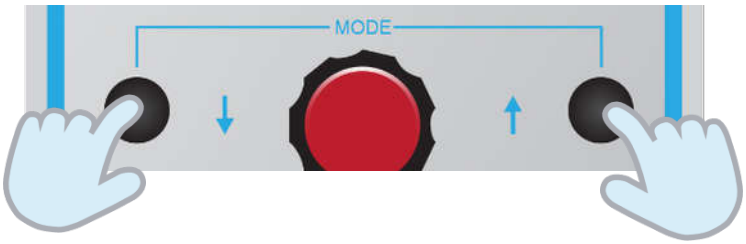
- Set function switch to **SRC** or **TX SIM** 

- Set OFF/V/mA switch to the desired units (**V** or **mA**) 

- Set range switch to the desired range (**22 / 2.2 / .2**) 

- Set output switch to **NORM** 

- Simultaneously press INC and DEC buttons twice. The CONTINUITY legend will appear flashing on the display.




- The unit will now ramp up and down automatically between the range limits as determined by the range and V/mA selected. The alternative limits can also be used and are as determined by the switch-on conditions as stated at the start of section 6.

## Notes

a) When the unit first enters **RAMP** mode the first dwell period will be shorter than 5 secs.

b) To reverse the direction of the ramp at any time press the **INC** button once.

c) To restart the ramp immediately when it is waiting in the dwell period, press the **INC** button once.

# 7 Maintenance and Calibration

## 7.1 Power Supplies

### 7.1.1 Auto-power down

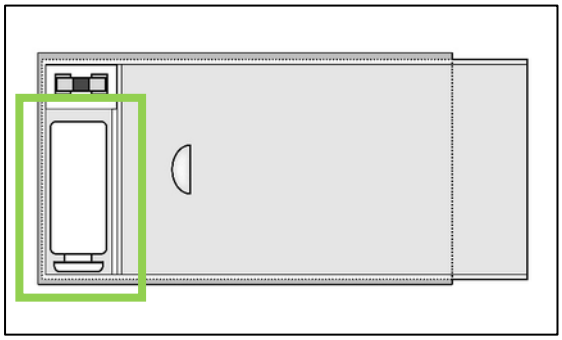
If the unit is not used for 15 minutes, it will automatically power down to conserve the battery life. This feature can be disabled by holding down the INC button whilst switching on the unit.

### 7.1.2 Battery Life

The unit is powered by a PP3 (Alkaline) battery that lasts approximately 15 hours of normal operation. Continuous operation on current will shorten the battery life. The unit will indicate 'Low Battery' when the battery needs changing. A short period of operation is possible when 'Low Battery' is showing but no more than a few mA will be available at the output.

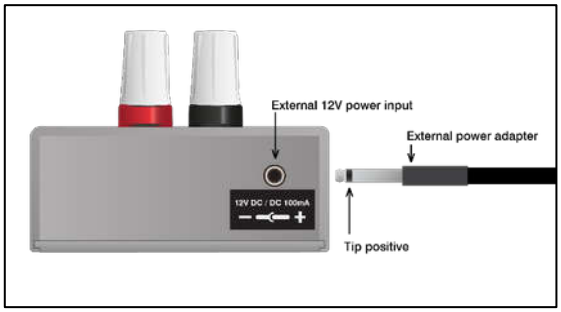
### 7.1.3 Battery Replacement

Slide off the back cover of the case and remove the battery from its compartment. Unclip the battery and replace it with a new PP3 (Alkaline). The NiCad / NiMH rechargeable version of this battery may be used. However, it should be noted that if the optional mains power supply adapter (see below) is used to power the unit, the battery will not be recharged. It is necessary to remove the battery and re-charge it externally.



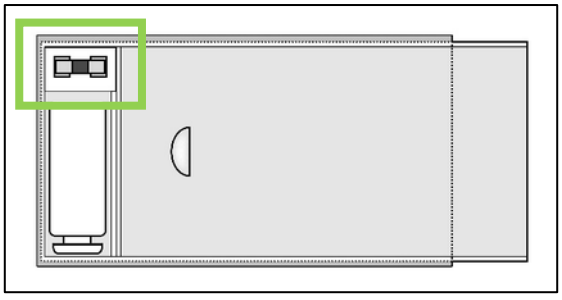
### 7.1.4 Mains Power Supply Adapter

The unit can be operated from an external 12 V DC (100 mA) mains power supply unit. This is available as an optional extra. Connection is via the small jack plug socket on the terminal end of the unit.




### 7.1.5 Fuse Replacement

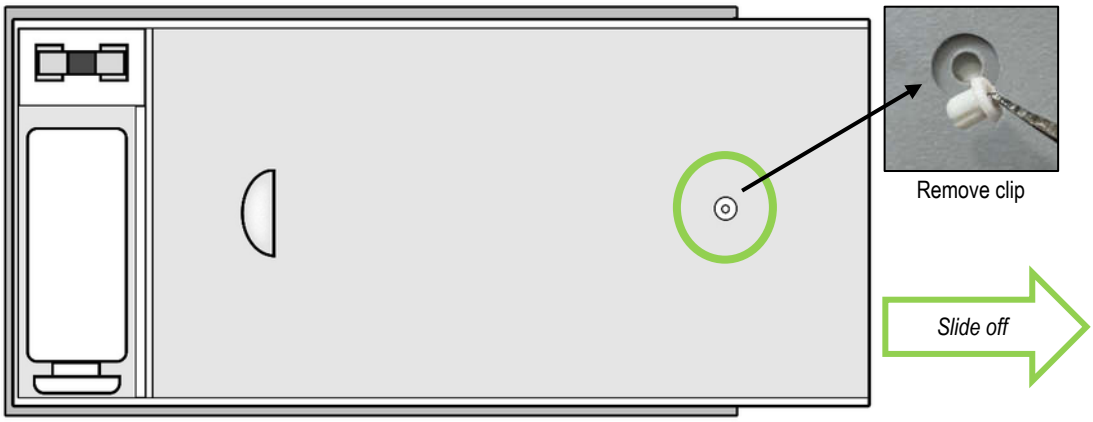
The unit is fitted with an F100 mA fuse. Switch off the unit and disconnect the battery. Slide off the back cover to access the fuse. The fuse is located next to the battery.
Fuse length 20 mm x 5 mm (TE part # 6107).



## 7.2 Disassembling the unit

For disassembly follow the steps below. Note that the 1048 and 1044 have the same method.

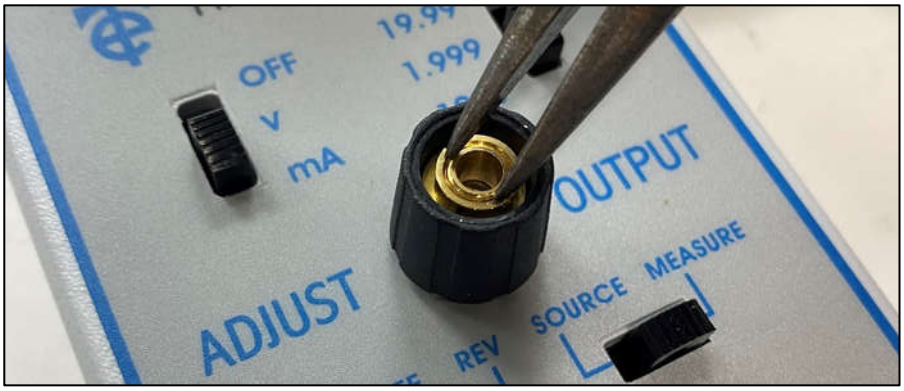
1. Ensure that the unit is switched off before removing the rear panel which slides out. Note: The plastic cover retaining clip will need to be removed prior to sliding cover off. Keep it to refit when reassembled. There may be a sticker over the clip hole.




2. Remove the cap on the multi-turn control knob by levering it off with a fine bladed screwdriver or similar tool.




3. Remove the collet nut (inside the knob). Use a suitable split head screwdriver or small long nosed pliers.



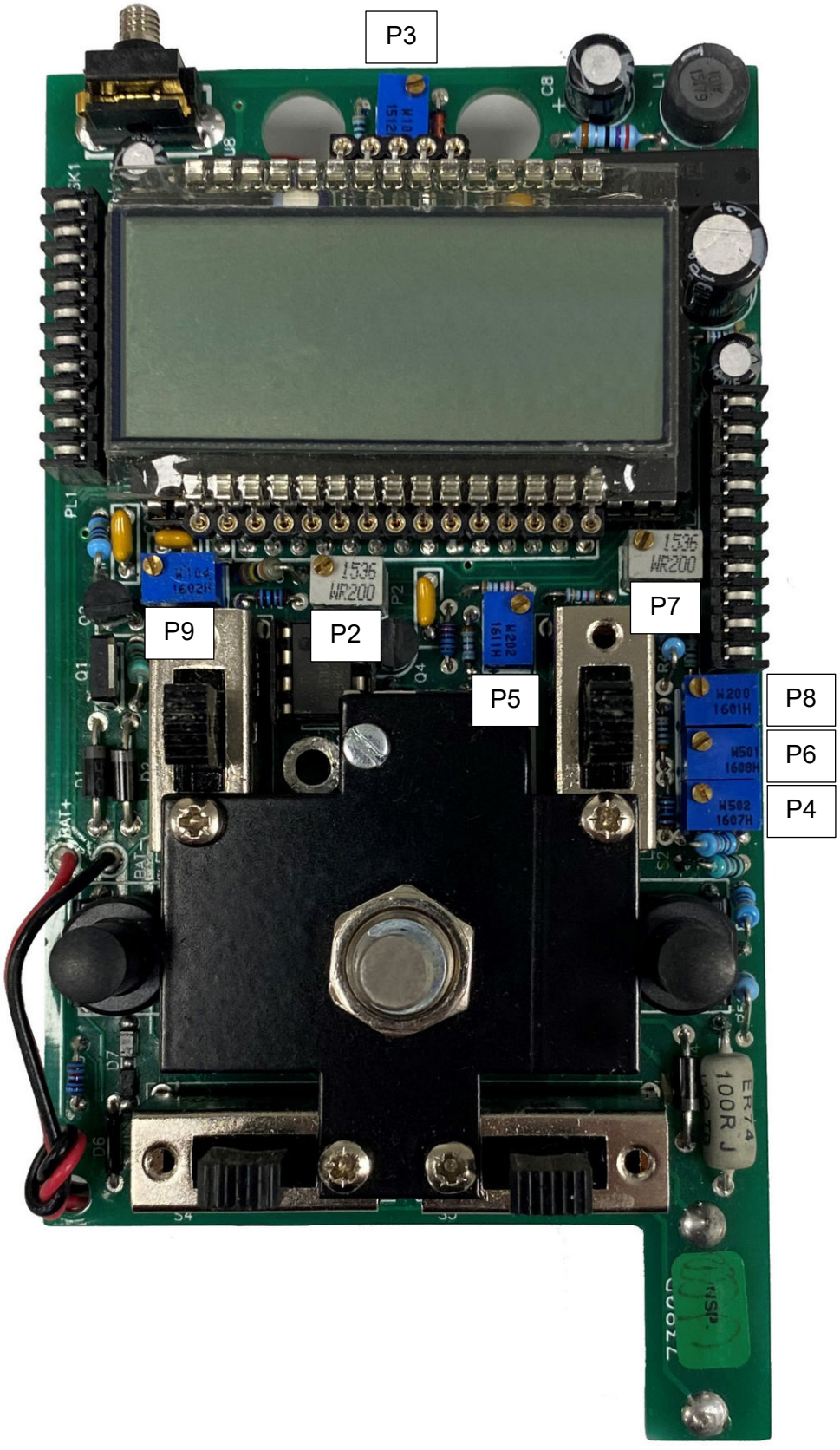
4. Remove the knob and then the hexagon nut below it, use the correct sized spanner or pliers. Take care not to damage the front panel label.




5. Gently press on the shaft of the multi-turn control to release the printed circuit assembly and battery from the case. Do not attempt to remove it completely - leave the case sitting vertical and the assembly flat horizontal.



## 7.3 Trimmer Locations



## 7.4 Re-Calibration

### 7.4.1 Calibration equipment required:

- A precision DC voltage calibrator with an accuracy of 0.01% or better.
- A multimeter with accuracy of 0.01% or better.

**Note:** It is advisable to use leads with low thermal emf connections. This will ensure that stray thermal emfs do not cause errors when calibrating the low voltage range (.22 V) which has a setting resolution of 10 µ V.

### 7.4.2 Measure Function Calibration

1) a) Switch on the unit while holding down the 'Decrement-DEC' button (left side). Select the 'V' position.

   b) Select 'MEAS' on the Function switch.

   c) Select '0.22' on the Range switch.

   d) Select 'NORM' on the Output switch.

   **Note:** It may be necessary to check the required switch positions by looking at the markings on the front panel.

2) Connect the precision DC voltage calibrator to the unit's terminals and select zero output. Check that the unit is displaying 00.00. Note that it may take a short while for the connection leads to stabilize thermally and settle down.

3) Inject 190.00 mV from the calibrator and adjust P3 for the correct reading on the display.

4) Select '2.2' on the Range switch and inject 1.9000 V from the calibrator. Adjust P5 for the correct reading on the display.

5) Select '22' on the Range switch and inject 19.000 V from the calibrator and adjust P7 for the correct reading on the display.

6) Reduce the output from the calibrator to 1.9000 V and reading on the display. Return to test above and re-check the 22 V range. There is a small amount of interaction of P5 and P7.

7) Finally re-check the 2.2 V range to ensure that it has not changed.

8) Over-Range check: The unit allows measurement up to 50 V on the 22 V range. This can be checked by injecting 30, 40, 50 V.

This completes the calibration of the measure function and the precision DC calibrator can be disconnected.

### 7.4.3 Step Mode Calibration

1) a) Select ‘SRC’ on the Mode select switch.

   b) Select 0.22 on range switch.

   c) Select ‘Norm’ on output switch.

2) Enter the step mode by pressing the ‘Inc’ and ‘Dec’ buttons simultaneously. The ‘CONTINUITY’ legend will then show on the top of the right side of the display. Press the ‘DEC’ button twice. **Note:** Make sure that the unit was switched on with the ‘DEC’ button held down.

3) Adjust P9 for 100.0 on the display.

4) Press ‘Inc’ 20 times until the display shows approximately 200.
   Adjust P2 for 200.0 on the display.

   This completes the ‘Step Mode’ calibration.

### 7.4.4 Current Shunt Calibration

1) a) Select normal mode operation by pressing the ‘Increment’ and ‘Decrement’ buttons simultaneously. The ‘CONTINUITY’ legend will then show on the top of the right side of the display.

   b) Select ‘SRC’ on the Mode select switch.

   c) Select .22 on range switch.

   d) Select ‘Norm’ on output switch.

   e) Select ‘mA’ on the OFF/V/I switch.

2) Connect a precision multimeter to the output terminal and set it to 30 or 100 mA DC current range.

3) Adjust the multi-turn control until the display shows 19.000 (use the INC/DEC buttons for fine adjustment). Make sure the unit is in high resolution mode, i.e. 5-digit display. If it has dropped back to low resolution (4 digit), move output switch to ‘Lo’ position and then back to ‘Hi’.

4) Adjust P8 until DMM reads exactly 19.000 mA.

5) Select ‘2.2’ on the range switch, select 3 or 10 mA range on multimeter.

6) Use similar procedure to 3) and 4) to calibrate at 1.9000 mA (P6)

7) Select ‘.22’ on the range switch. Select 0.3 or 1 mA on DMM and use similar procedure to 3) & 4) to calibrate at 190.00 µA. (P4)

   This completes the calibration of the ‘current shunts’.

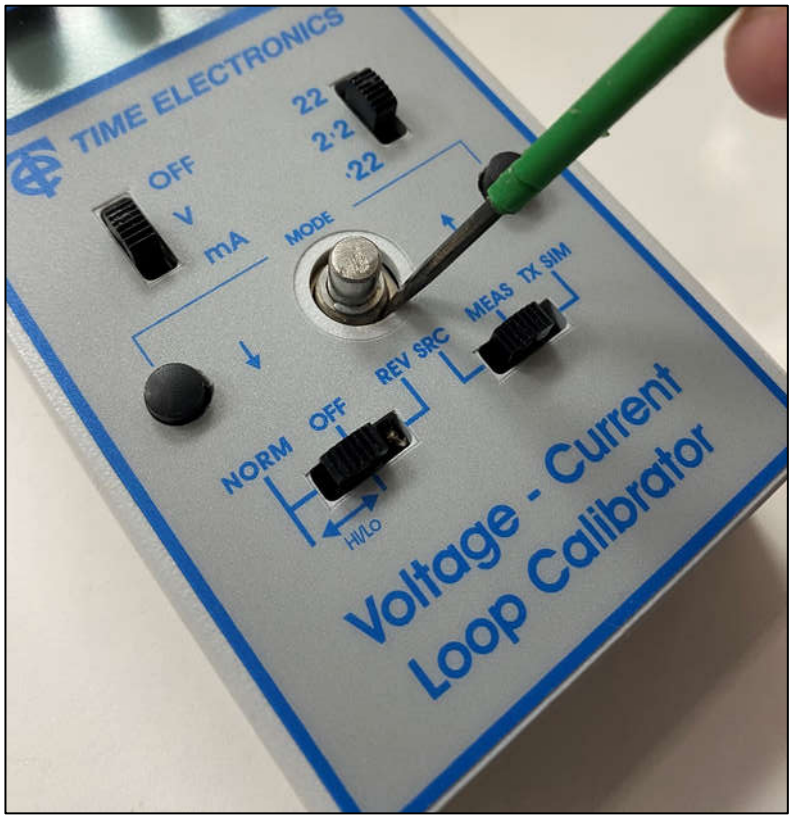
## 7.5 Reassembling the Unit

Reassemble the unit in the reverse order as in 5) through to 1) in section 7.2.

Note that care must be taken when returning the printed circuit board assembly to its correct position in the case. It is important to initially position it so that the external supply socket (the terminal end) is adjacent to its hole in the case.

The whole assembly should then be lowered into position as far as it will go - it is important to have the ‘OFF/V/mA’ and range switches to the ‘OFF’ and ‘22’ positions and the ‘OUTPUT’ and ‘MODE’ switches in ‘OFF’ and ‘MEAS’ positions.

It is then necessary to lever the multi-turn shaft (with a small screwdriver) towards the terminals. This will ease the output and mode switches forward enough to allow them to spring into their slots. At the same time the ‘INC/DEC’ buttons may need to be re-positioned slightly to allow them to go back into their holes.



# 8 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:**
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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:

**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.