Time Electronics
Calibration, Test and Measurement

User Manual

7006 Loop-Mate 1
Loop/Current/Voltage Simulator

Version 1.1
March 2021

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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 Features

- Simple operation, pocket sized loop diagnostic tool
- Simulate process loop signals for current and voltage
- 4 - 20 mA or 0 - 10 V loops
- 7 calibration set-points
- Transmitter simulation and receiver test
- Auto-Step output - adjustable rate
- Battery powered PP3
- Internal loop drive supply
- Supplied with carry case and test leads

1.2 Description

The 7006 Loop-Mate1 provides both 4 - 20 mA and 0 - 10V process loop compatible signals. It simulates a transmitter and allows testing and calibration of process signal indicators and controllers.

To assist the operator it emits an audible beep for every change in output. This increases in frequency as the signal level increases.

For hands-free operation, the Auto Step mode can be selected and this automatically steps the signal through the span. The operator can then leave the Loop-Mate 1 connected while moving to another location to check the signal is arriving correctly.

In addition to TxSim (transmitter simulation) and 10vSim, the Loop-Mate 1 can also provide the loop drive supply that allows an RxTest function (indicator/controller test) without the need for the external excitation power supply.

The instrument is powered by a single PP3 battery. An Auto-power down feature, which can be disabled, ensures fewer battery changes. Rechargeable batteries can be used if required.

The 7006 is a useful and practical tool for process, service and maintenance engineers.
It provides a compact and simple operation solution with 0.1% accuracy, making it suitable for most process loop calibration and diagnostics applications.

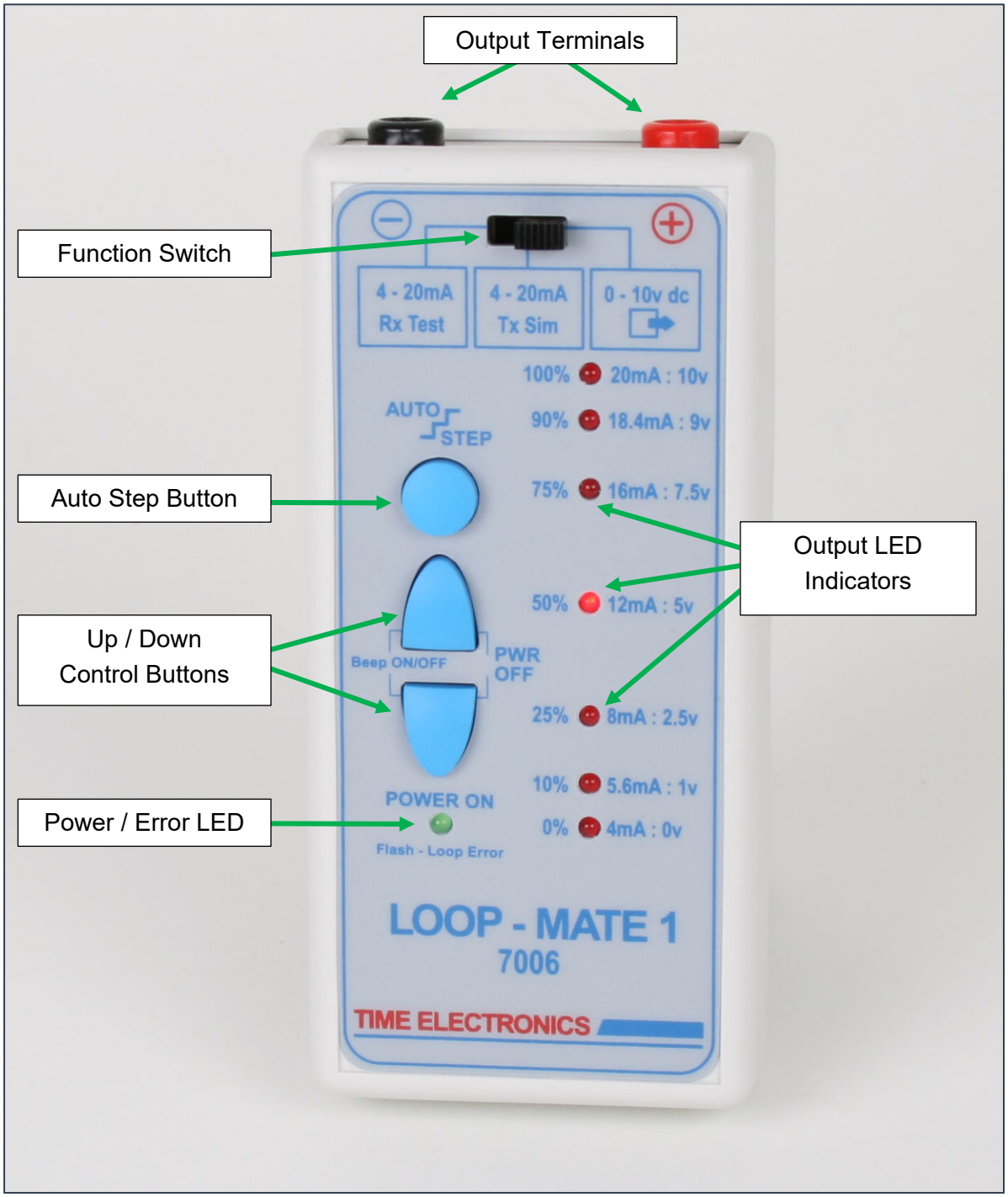
It comes complete with carrying pouch, leads, clips and user manual.



1.3 Specifications

Functions	RxTest, TxSim, 10vSim.
Ranges	4 - 20mA, 0 - 10V DC (Max current 20mA).
Set Points	7 Points: 0% (4mA or 0V), 10% (5.6mA or 1V), 25% (8mA or 2.5V), 50% (12mA or 5V), 75% (16mA or 7.5V), 90% (18.4mA or 9V), 100% (20mA or 10V).
Accuracy	0.1% of span.
Indication	High brightness LEDs.
Control	UP/DOWN buttons, function select switch, auto-step select button.
Auto Step	Automatic Up/Down step through the set points.
Step Rates	Selectable 0.5, 1, 2, 4 or 8 steps per second.
Dwell Time	At top (100%) and bottom (0%), twice the step time.
Beeping	A beep is sounded with increasing frequency for each step. This feature can be disabled if required.
Error Indicator for faulty loop conditions	TxSim: Loop open circuit or loop resistance too high. RxTest: Inadequate loop excitation supply. 10vSim: Loop short or loop resistance too low.
Connections	Two 4mm recessed sockets.
Power	PP3 battery. Note that an auto power down feature can be disabled if required.
Carrying Pouch	Leatherette material. Includes compartment for leads and spare battery.
Leads	4mm gold plated connectors with crocodile clips.
Temperature Co-efficient	The unit stays in specification over operating temperature range.
Operating Temperature	-5 to 50 °C.
Storage Temperature	-30 to 70 °C.
Operating Humidity	10 to 90% non-condensing, 25 °C.
Dimensions	H 140 x W 65 x D 27 mm (6.0 × 2.5 × 1.0 in).
Weight	280 grams (10 oz).
Options	C145: Traceable calibration certificate (Factory). C144: Accredited calibration certificate (ISO 17025). 7007: Loop-Mate 2: Loop Signal Indicator (separate product).

2 Front panel controls



3 Operation

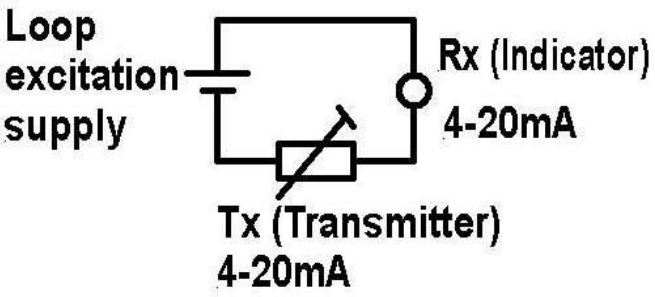
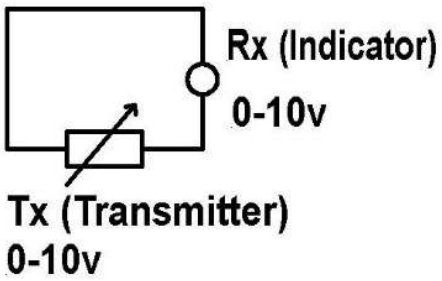
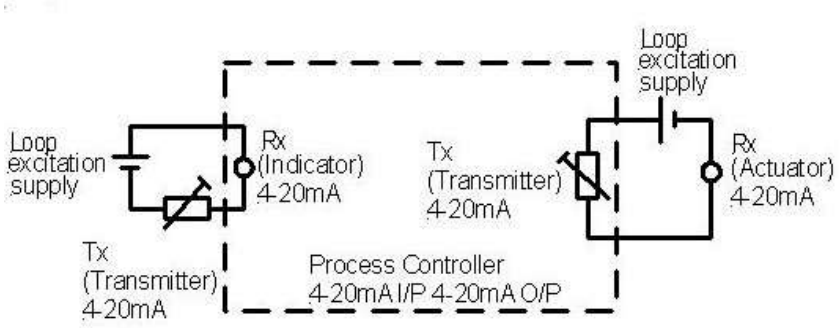
3.1 Function Select

The Loop-Mate 1 has 3 functions:

1. **Function 1** .....Rx TEST (4-20 mA)
2. **Function 2** .....Tx SIM (4-20 mA)
3. **Function 3** .....0-10 v dc SIM

These are selected using the function select switch. Function 2 acts as a current sink only when an external loop excitation supply is connected.

3.2 Description of typical process loop components

	4 - 20 mA process loop
	0 - 10 V process loop
	4-20 mA Process loop and 4 - 20 mA Control loop. *This can be used for closed loop control.*

Tx (transmitter):

This component converts physical signals such as pressure, temperature, flow, and level etc, into the loop signals (4 - 20 mA or 0 - 10 V).

Rx (receiver):

This component measures the loop signal and either displays it (indicator) or converts it to another form e.g. digital output for control purposes, (controller).

Process Controllers:

This device usually contains both Rx (signal loop) and Tx (control loop) components, which operate in separate loops. The Rx and Tx can be either 4 - 20 mA or 0 - 10 V.

Loop excitation supply:

A DC power supply (nominally 24 V) that drives the loop.

3.3 RxTest function 4 - 20 mA

The unit can provide current output from 4-20 mA with an internally generated loop excitation drive capability. There are seven output set-points over the span. They are indicated on the front panel in both 'percentage of the span' and actual mA. An illuminated LED indicates which point is selected. The **UP/DOWN** buttons can be used to change the set-point.

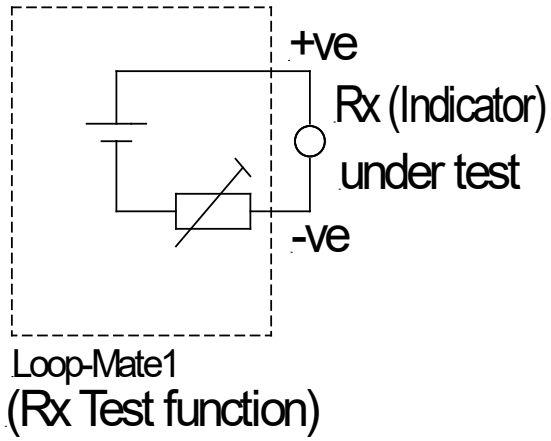
The set-points are:

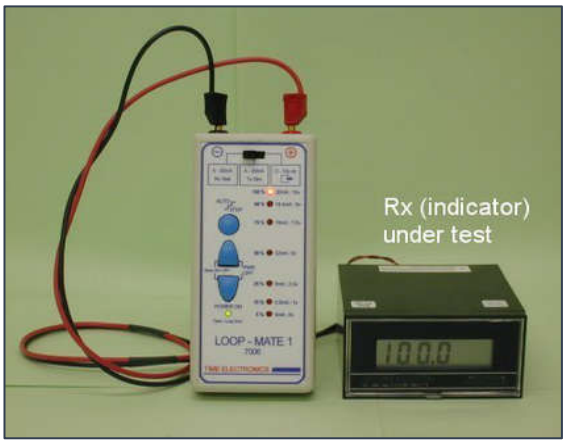
Percentage of Span	Current
0 %	4 mA
10 %	5.6 mA
25 %	8 mA
50 %	12 mA
75 %	16 mA
90 %	18.4 mA
100 %	20 mA

3.3.1 Operation

1. Set the function switch to **RxTest**.
2. Connect the unit to the process indicator or controller (Rx) observing correct polarity.
3. Turn on the unit by pressing the **Down** arrow button.
4. Set the required set-point by repeatedly pressing the **Arrow** keys. The indicator LED will show which set-point is selected.

3.3.2 Connection





Note: The total loop resistance of the Rx indicator plus lead connector should not exceed 600 Ω

3.4 TxSim function 4 - 20 mA (Current Sink)

Using the TxSim function the unit takes its excitation power from the loop and acts as a current sink. The excitation supply voltage must be in the range 5 to 50 volts DC.

Warning: Do not attach the excitation supply to the terminals of the Loop-Mate1 when TxSim is not selected.

The user can set the loop current to one of seven set-points. They are indicated on the front panel in both 'percentage of span' and actual mA. The **Up/Down** buttons can be used to change the set-point.

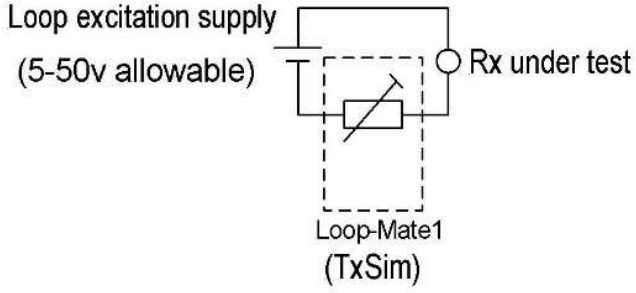
The set-points are:

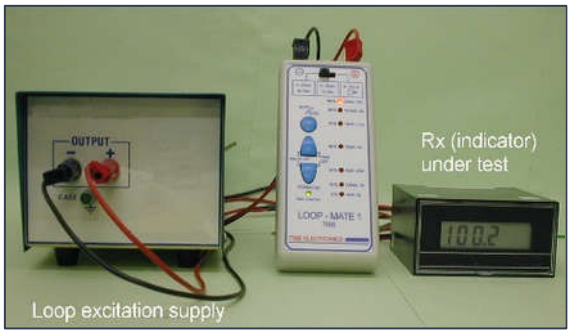
Percentage of Span	Current
0 %	4 mA
10 %	5.6 mA
25 %	8 mA
50 %	12 mA
75 %	16 mA
90 %	18.4 mA
100 %	20 mA

3.4.1 Operation

1. Set the function switch to **TxSim**.
2. Connect the unit to the loop excitation supply and process indicator or controller (Rx) observing correct polarity.
3. Turn on the unit by pressing the **Down** arrow button.
4. Set the required set-point by pressing the **Arrow** keys. The indicator LED will show which set-point is selected.

3.4.2 Connection





Note: The total loop resistance including connections should not exceed 600 Ω

3.5 10vSim function 0 - 10V

The unit outputs voltage in the range of 0 to 10 V. There are seven set-points. The selected set-point is indicated on the front panel in both 'percentage of span' and actual volts.
The **UP/DOWN** buttons can be used to change the set-point.

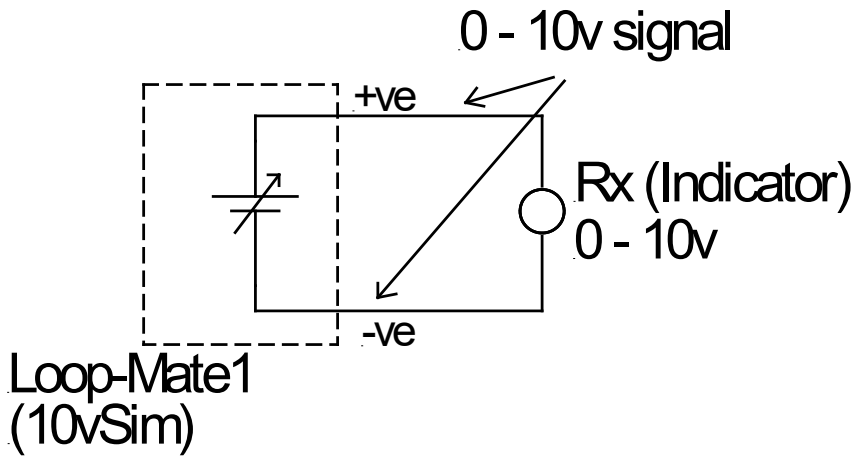
The set-points are:

Percentage of Span	Voltage output
0 %	0 V
10 %	1 V
25 %	2.5 V
50 %	5 V
75 %	7.5 V
90 %	9 V
100 %	10 V

3.5.1 Operation:

- Set function switch to **10vSim** (0 - 10 V).
- Connect the unit to the process indicator (or controller) observing correct polarity.
- Turn on the unit by pressing the **Down** arrow button.
- Select the required set-point by pressing the **Arrow** keys.
  The LED indicator will show which set point is selected.

3.5.2 Connection



4 Additional Features

4.1 Auto Step

The Loop-Mate 1 has the ability to automatically step through the set-points, both up and down. This feature is available for any of the 3 functions (RxTest, TxSim, 10vSim).

Auto Step is enabled by pressing the **Auto Step** button. To disable it press the button again. The length of time the output stays on each level can be altered by pressing the **UP** or **DOWN** arrow buttons. The **UP** shortens the period and the **DOWN** button increases the period. The different periods are 0.5, 1, 2, 4 or 8 seconds. When the output reaches the 100 % or 0 % levels, it will dwell (stay) for twice the step period before continuing in the opposite direction. The unit will continue indefinitely in Auto Step mode until the **Auto Step** button is pressed or the unit is turned off.

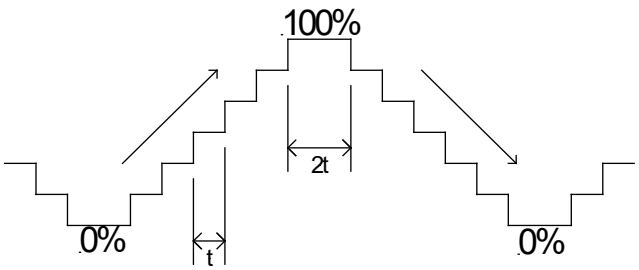


Diagram of Auto Step feature
(t = step period)

In Auto Step mode the indicator LED's blink at four times the step rate. The stepping direction can be reversed at any time by pressing the **Auto Step** button twice.
Audio beeps (if enabled) occur on each step change.

4.2 Audio (Beeping)

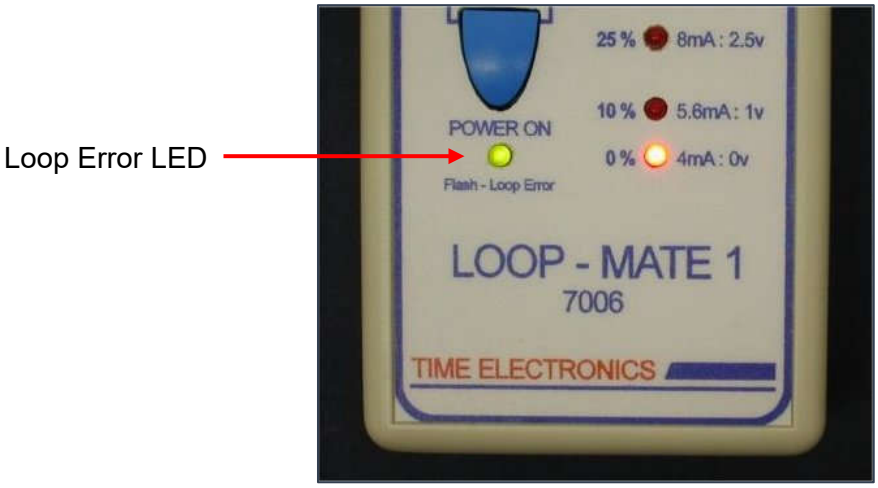
The audio beep feature can be toggled on or off by pressing the **UP/DOWN** arrow keys simultaneously when powering on the unit. This will power up the unit and change the beep setting. Switching on the unit normally will not change the beep setting.

4.3 Automatic power down

Auto power down is the default setting. The auto power down feature is incorporated to prevent the Loop-Mate 1 from being inadvertently left switched on after use and draining the battery. The unit will automatically power down if no button is pressed for 15 minutes. Auto power down does not operate when using the auto step mode. The auto power down feature can be disabled when powering up the unit if required. Instead of momentarily pressing the **DOWN** arrow button, hold it down until the 0 % LED comes on (approx 2 seconds).

5 Loop Error Indication

5.1 Error display on the Loop-Mate1



With the RxTest function selected

If the loop is open circuit or resistance too high, the error LED will start flashing. However, short circuit on the loop is not indicated.

With the TxSim function selected

If the external loop excitation supply voltage is too low, the polarity is not correct, or the loop open circuit or resistance too high, the error LED will start flashing. However, short circuit on the loop is not indicated.

With the 10 vSim function selected

If the loop is short circuit, or resistance too low, the error LED and the output LED will both flash. There is also a warning bleep emitted with every flash of the LED's. This error is caused when Loop-Mate1's current drive capability (20 mA) is exceeded.

6 Power supply

6.1 Battery life

The unit is powered by a single PP3 battery. Types that can be used are Zinc Carbon (250 mAh), Alkaline (450 mAh), Lithium (1200 mAh) and rechargeable (150 mAh). For best performance Lithium batteries are recommended. Under typical usage an Alkaline (450 mA) battery will last for approximately 15 - 20 hours of continuous operation. Assuming the Loop-Mate 1 is used for approximately 3 hours per day the batteries will last for a week or more. Continuous operation on the RxTest function will shorten the battery life. The unit will automatically power down when the battery voltage is too low. The performance of the unit will remain within specification until power down occurs. Replacement of the battery is then necessary. It is recommended that a spare battery be always carried in the compartment provided in the carrying pouch.

6.2 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 as shown below. Then slide the battery cover back into place.









7 Maintenance

7.1 Calibration

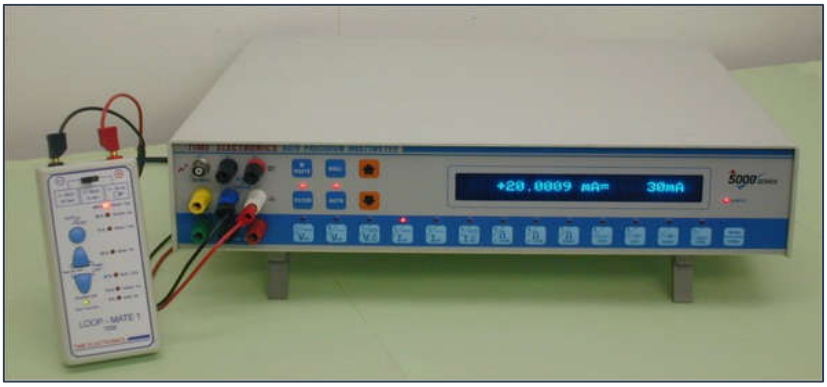
7.1.1 Calibration equipment required

A bench multimeter with accuracy of 0.02 % or better. Examples of suitable instruments are Time Electronics' 5075 or HP 34401A. Calibration should be done at 20 °C ± 10 °C.

7.1.2 Calibration (RxTest - Current source)

1. Connect the multimeter to the output terminals of the Loop-Mate 1.
2. Set the function switch to RxTest.
3. Select the most suitable range on the multimeter to measure 20 mA DC.
4. Turn on the Loop-Mate 1.
5. For each set point, check that the output is within specification (see table below).

If a set-point is out of specification then adjustment of the calibration will be required (see later in this section).



Allowed error specification:

Set-point (mA)	Min value (mA)	Max value (mA)
4	3.984	4.016
5.6	5.584	5.616
8	7.984	8.016
12	11.984	12.016
16	15.984	16.016
18.4	18.384	18.016
20	19.984	20.016

7.1.3 Calibration (Voltage)

1. Connect the multimeter to the output terminals of the Loop-Mate 1.
2. Set the function switch to 0 - 10 V DC.
3. Select the most suitable range on the multimeter to measure 10 V DC.
4. Turn on the Loop-Mate 1.
5. For each set-point check if the reading is within specification.

If a set-point is out of specification then adjustment of the calibration is needed (see later in this section).



Allowed error specification:

Set-point (V)	Min value (V)	Max value (V)
0	0	0
1	0.99	1.01
2.5	2.49	2.51
5	4.99	5.01
7.5	7.49	7.51
9	8.99	9.01
10	9.99	10.01

7.2 Adjustment of Calibration

When Loop-Mate1 is found to be out of specification the procedures described in the following sections can be followed to adjust and calibrate instrument.

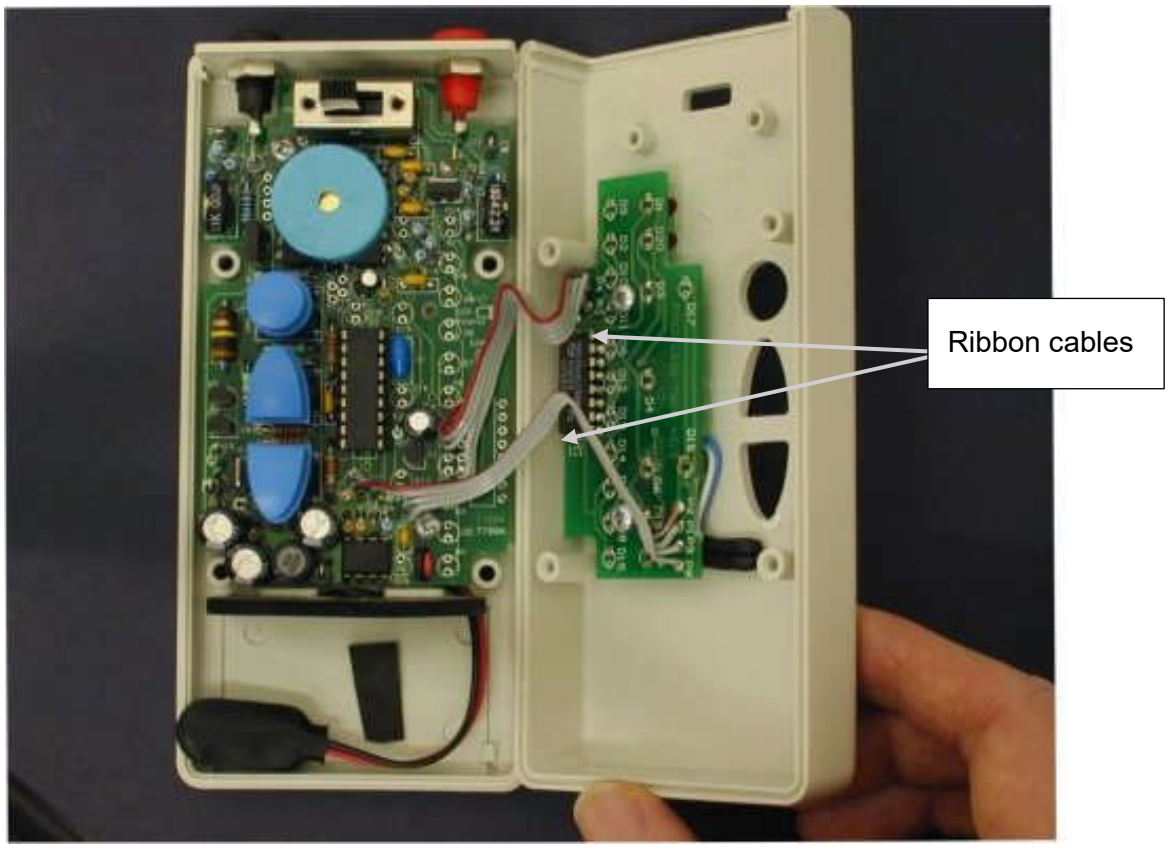
7.2.1 Disassembling Loop-Mate1

1. First remove the battery compartment cover and disconnect the battery, as shown in section 6.2 of this manual.

2. Remove the 4 screws from the back of the case.

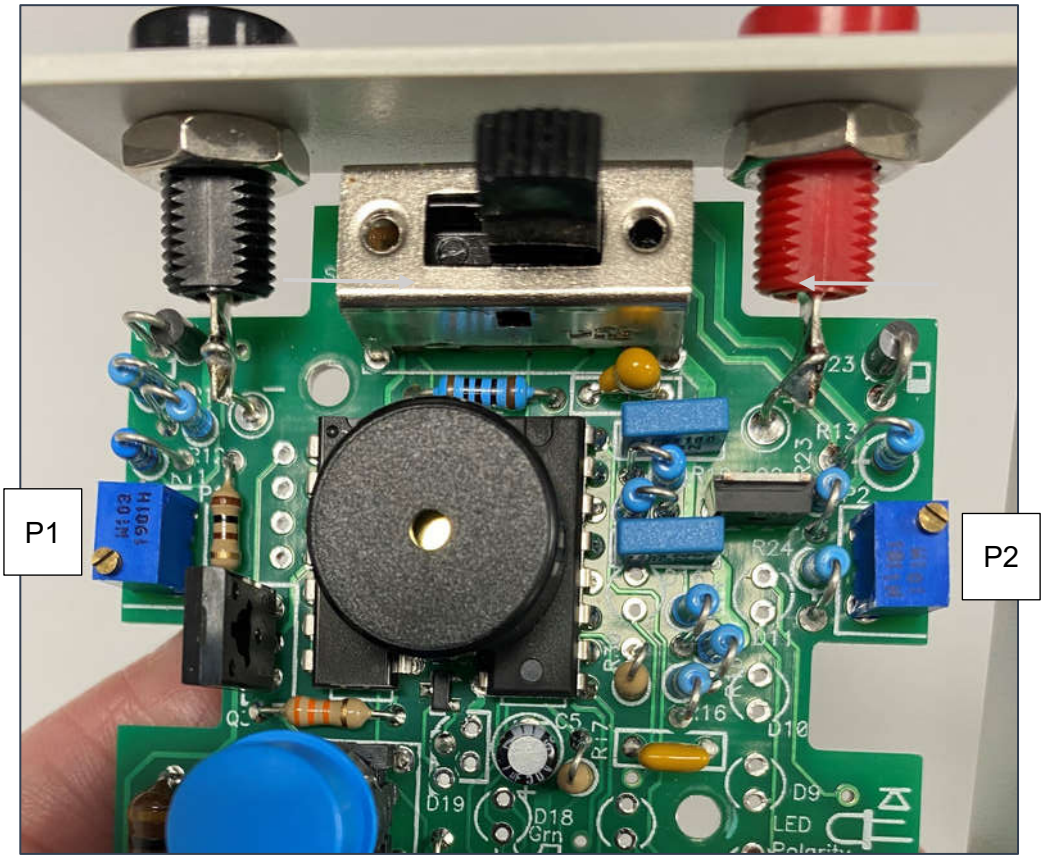
3. Position the Loop-Mate 1 so that the front panel is facing upwards.

4. Carefully lift the case lid and turn it towards the right, take care not to stress the ribbon cables.



5. Then reconnect the battery.

7.2.2 Trimmer Locations (used for adjusting the calibration)



7.2.3 RxTest (Current source) Adjustment Calibration

- Connect the multimeter to the output terminals of the Loop-Mate 1.
- Set the function switch to RxTest.
- Select the most suitable range on the multimeter to measure 20 mA DC.
- Turn on the Loop-Mate 1.
- Press the UP arrow until 20 mA output is selected.
- Adjust P2 until the multimeter display reads exactly 20.000 mA
  Note: if the full scale of the multimeter being used is 19.999 mA, then use set-point 18.4 mA and adjust P2 until the multimeter reads 18.400 mA.
- Then re-check all the other set-points.

7.2.4 10vSim (Voltage) calibration

- Connect the multimeter to the output terminals of the Loop-Mate1.
- Set the function switch to 0 – 10 V DC Sim.
- Select the most suitable range on the multimeter to measure 10 V DC.
- Turn on the Loop-Mate1.
- Press the UP arrow until 10 V output is selected.
- Adjust P1 until the multimeter display reads 10.000 V.

7.2.5 Re-assembly

- Disconnect the battery after re-calibration.
- Refit the lid. Care must be taken to ensure that the ribbon cable linking the two PCB's is folded in such a way it won't get trapped when the lid is screwed into place.
- Replace the lid and screw the four case screws into place.
- Replace the battery and battery compartment cover. See section 6.2.

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.

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 Support Request 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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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

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.