Time Electronics
Calibration, Test and Measurement

User Manual

1030 MicroCal
Voltage and Current 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.

Contents

1 Introduction

The 1030 MicroCal is a portable voltage and current calibrator for general purpose signal injection. It is suitable for voltage and current loop signal simulation as well as thermocouple simulation. Being both cost-effective and simple operation, it is a popular instrument used in various applications across industries.

The compact (115 x 62 x 55 mm) and durable design makes it ideal for use in both the lab and field, with carry case supplied as standard. Typically, alkaline battery life is 60 hours. An optional rechargeable NiMH battery pack is available, complete with external mains charger, Useable time between charges typically 18 hours.

The MicroCal is designed for traditional and quick analogue control. The precision 10-turn dial provides a conventional feel to selecting the required output with a setting resolution of 1 part in a 1000 (0.1 %).

Three voltage ranges give an adjustable output from 10 µV to 1 V and two current ranges for 10 µA to 100 mA. An additional 0 to 8V output can be obtained by using a precision 1 kΩ resistor that is supplied with the unit. The resistor is connected across the output terminals and the 10 mA current range selected. This allows the output to be set between 0 and ± 8 V with a 10 mV resolution and an accuracy of 0.3% of full scale.

The 1030 is simple to operate and does not require any standardisation prior to use. The operator needs only to switch on, check the battery condition, and set the required range and output value. The unit is a pocket-sized, practical test tool for engineers and technicians requiring a precision compact solution for low range V/I sourcing.

Features

- 10 mV, 100 mV, 1 V ranges
- 10 mA, 100 mA ranges
- Accuracy 0.1 %
- Linearity 0.15 %
- Up to 8 V output (using 1 kΩ resistor)
- Precision 10-turn dial
- 60 hours typical battery life
- Battery level indicator
- Supplied with carry case

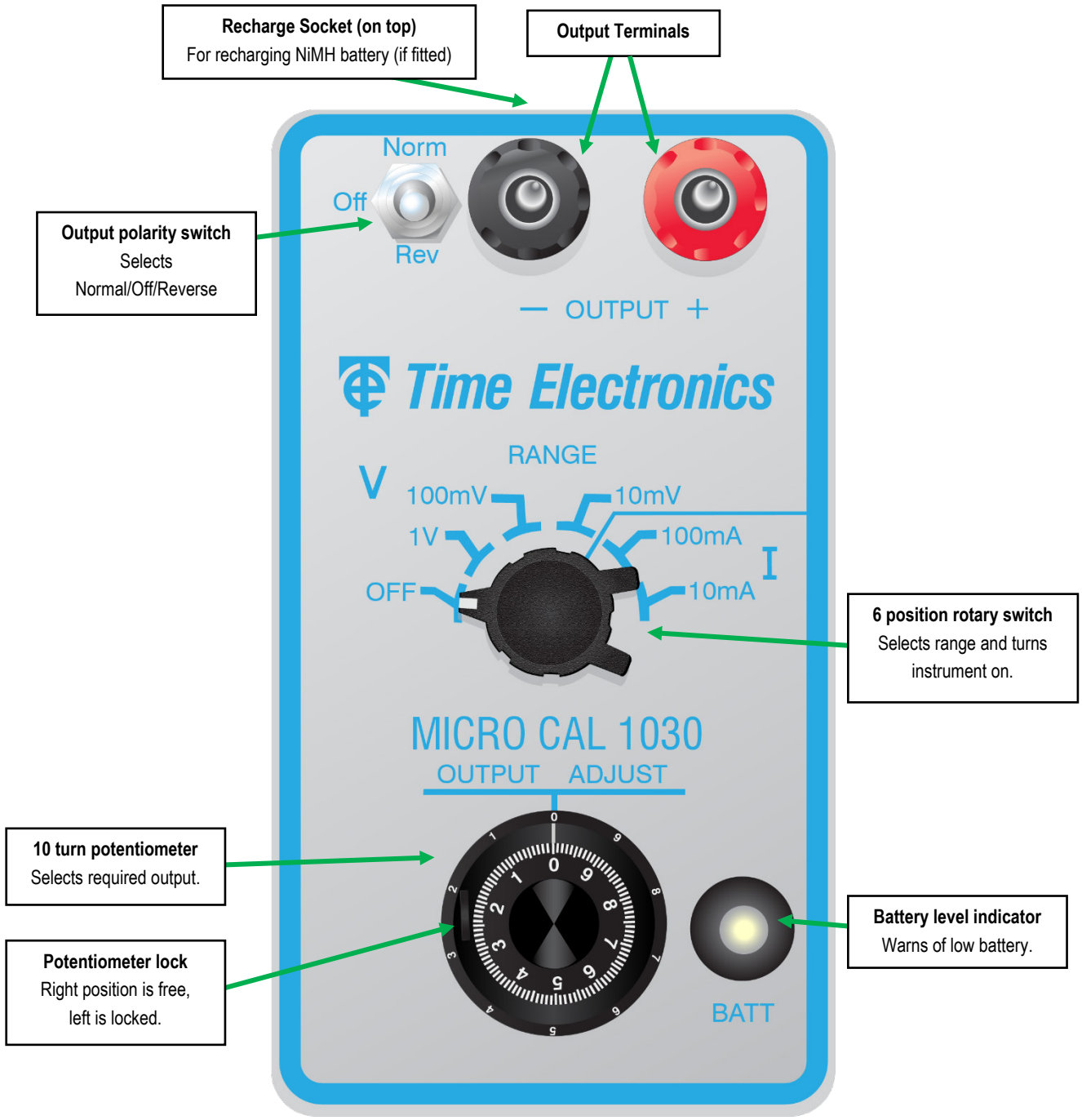
Ordering Information and Options

Order Code	Description
1030	MicroCal Voltage and Current Source
1031	Rechargeable Battery Pack (NiMH Battery and 240V Mains Charger)
1032	Rechargeable Battery Pack (NiMH Battery and 110V Mains Charger)
C155	Traceable Calibration Certificate (Factory)
C110	Accredited Calibration Certificate (ISO 17025)

2 Specifications

Voltage Ranges:	0 to 1 V (1 mV resolution). 0 to 100 mV (100 µV resolution). 0 to 10 mV (10 µV resolution). 8 Volts (10 mV resolution) using external precision 1KΩ resistor supplied.
Current Ranges:	0 to 100 mA (100 µA resolution). 0 to 10 mA (10 µA resolution).
Accuracy:	
1 Volt range:	± 0.1 % of FS ± 30 µV.
100mV range:	± 0.1 % of FS ± 3 µV.
10mV range:	± 0.2 % of FS ± 0.3 µV.
100mA range:	± 0.2 % of FS ± 3 µA.
10mA range:	± 0.2 % of FS ± 0.3 µA.
8 Volt range:	± 0.3 % of FS.
Linearity:	0.15 % of setting.
Temperature Coefficient:	150 ppm of FS/ºC (Outside 18 to 28 ºC).
Noise:	30 ppm of full scale.
Battery:	9 V Alkaline PP3 type. Approx. 60 hours life depending on output current. NiMH rechargeable available as an optional extra.
Battery Condition:	Continuously monitored by front panel Led indicator. Green = good battery, Red = change battery.
Output Polarity:	Positive or Negative (Norm – Rev), switch selectable. A centre Off position is also provided, which shorts the output terminals together.
Maximum Output Current:	
1V, 100mV Ranges:	Typically 20 mA.
10mV Range:	Up to short circuit value. Note that loads of less than 1 kΩ will give > 0.1% error.
Maximum Output Voltage:	
(Current Ranges):	8 V.
Output Protection:	The 1030 can withstand continuous short circuit or open circuit on all ranges.
Output Resistance:	0.2 Ω on 1 V and 100 mV ranges. 10 Ω on 10 mV range. 1 kΩ when using the current shunt resistor.
Dimensions:	115 x 62 x 55 mm.
Carry Case:	A black carry case is supplied.

3 Controls



Note: Models built before March 2020 feature a different type of battery level indicator.

3.1 Description of Controls

Output Terminals
Output Voltage and Current is available on two front panel terminals which are suitable for either wire compression or 4mm standard plug insertion.

Polarity Switch
Normal or reverse polarity is selected by a toggle switch. The centre position is OFF which provides an open circuit on the output terminals.

6-way Position range switch

Switch Position	Switch Function
1	OFF
Voltage Ranges	
2	0 – 1V (1mV resolution)
3	0 – 100mV (100µV resolution)
4	0 – 10mV (10µV resolution)
0 – 8V (10mV resolution), using external precision 1kohm resistor (included)	
Current Ranges	
5	0 – 100mA (100µA resolution)
6	0 – 10mA (10µA resolution

10 Turn potentiometer fine adjust dial
Scaled 0-100. Linearly output from 0 – 100% of selected output range.

10 Turn dial potentiometer lock
Enables the set output to be temporary locked.

Battery Level Indicator
This continuously monitors the battery voltage. The battery should be replaced or recharged when the LED battery level indicator changes from green to red.

Recharge Socket
The mains recharger is a separate unit, the output of which is supplied via a flying lead fitted with a non-reversible plug. Recharge time is between 12 and 14 hours.

CAUTION
UNDER NO CIRCUMSTANCES MUST AN ADDITIONAL VOLTAGE BE CONNECTED IN SERIES WITH THE OUTPUT OF THE 1030 IN AN ATTEMPT TO INCREASE THE VOLTAGE CAPABILITY AS THIS WILL CAUSE DAMAGE TO THE OUTPUT CIRCUITRY.

4 Operation

4.1 Voltage Ranges

Suggested operation procedure is as follows:

Select Off position on output switch.

Turn on and select required range.

Check battery level indicator for high enough reading, or when fitted, LED is Illuminated green (see Battery Replacement Section 6).

Select required output on the ten-turn potentiometer, which can then be locked by pushing the lever at the bottom to the left. The ten-turn potentiometer linearly adjusts the output from zero to full scale on any range. The number of complete turns is displayed in the dials window, parts of a turn are red on the inner scale, (calibrated 0-9 with 100 divisions), using the red indent as a pointer.

EXAMPLE: To set 56.2 mV:

1) Select 100 mV range.
2) Turn dial until 5 appears in the centre of the window.
3) Set inner scale to 6.2.

The table below shows the effect of the dial on each range.

Range	1 Turn	1/10th of a Turn	1 Division (1/100)
Voltage Output			
1 V	100 mV	10 mV	1 mV
100 mV	10 mV	1 mV	100 µV
10 mV	1 mV	100 µV	10 µV
Current Output			
100 mA	10 mA	1 mA	100 µA
10 mA	1 mA	100 µA	10 µA

NOTE: 0.001 V = 1 mV = 1000 µV

0.001 A = 1 mA = 1000 µA

4) Switch output to Normal or Reverse as required.

4.2 Output Voltages above 1 V

To use the 8V range, connect the supplied 1 kΩ resistor across the output terminals, and switch to the 10mA range. The 1030 will act as a voltage source, the output being adjusted with the 10-turn dial, with a scale of 1 volt per turn up to a maximum of about 8 volts with a good battery.

This allows the output to be set between 0 V and ± 8 V with a 10 mV resolution and an accuracy of 0.3 % of full scale.

4.3 Current Ranges

On the current ranges, the drive voltage available at the terminals is governed by the battery voltage. Care should be taken not to exceed the 1030 voltage limit, as large errors will result if the load/current product exceeds the 1030 8 V drive capability.

This can easily be checked by either measuring the voltage across the 1030's terminals when under load, or by checking using ohms law that R x I is less than 8 volts.

4.4 Output Resistance

The table below illustrates how the voltage appearing at the output terminals of the calibrator will be affected by load resistance:

Ratio of Load Resistance to Calibrator	**Error in selected**
Output Resistance	Output Voltage
1,000:1	0.1 %
100:1	1.0 %
10:1	9.0 %
1:1	50.0 %

5 Applications

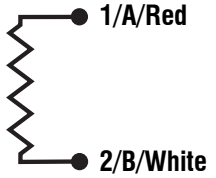
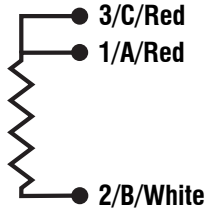
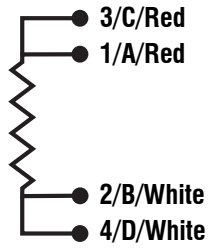
5.1 Four Terminal Resistance Measurements

Accurate measurements of low ohm values, such as P.R.T, can be performed by using the 1030 as a current source and measuring the voltage across the LOAD with a DVM.
From Ohms Law: V/I=R

Resistance vs Temperature Relationship for Platinum Resistance Thermometer Detector Element (DIN 43760)

°C	Ω		°C	Ω		°C	Ω		°C	Ω
-200	18.48		60	123.24		320	219.12		580	307.15
-180	27.08		80	130.89		340	226.17		600	313.59
-160	35.53		100	138.50		360	233.17		620	319.99
-140	43.87		120	146.06		380	240.13		640	326.35
-120	52.11		140	153.58		400	247.04		660	332.66
-100	60.25		160	161.04		420	253.90		680	338.92
-80	68.33		180	166.46		440	260.72		700	345.13
-60	76.33		200	175.84		460	267.49		720	351.30
-40	84.27		220	183.17		480	274.22		740	357.42
-20	92.16		240	190.45		500	280.90		760	363.50
0	100.00		260	197.69		520	287.53		780	369.53
20	107.79		280	204.88		540	294.11		800	375.51
40	115.54		300	212.02		560	300.65		820	381.45

Typical connections for 2, 3 and 4 wire resistance thermometers

Diagram	Description
	**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.

5.2 Thermocouple Simulation

The 10mV range of the 1030 is ideal for simulation of all types of thermocouple. Just find the voltage required from the British Standard tables, (common values given below), and set up on the 1030's dial. Do not forget to allow for the Cold Junction temperature.

Thermocouples Temperature tables ITS-90

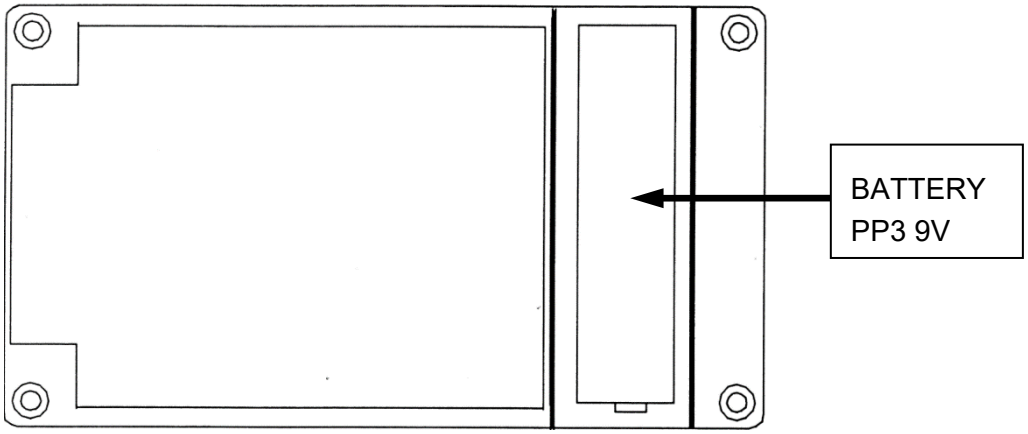
	Temp °C	**-100°C**	**-50°C**	**-25°C**	**0°C**	**25°C**	**37°C**	**50°C**	**75°C**	**100°C**
T/C TYPE		**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**
Type K	NiCr/NiAl	-3.554	-1.889	-0.968	0.000	1.000	1.489	2.023	3.059	4.096
Type T	Cu/Con	-3.379	-1.819	-0.940	0.000	0.992	1.486	2.036	3.132	4.279
Type J	Fe/Con	-	-	-	0.000	1.277	1.902	2.585	3.918	5.269
Type R	Pt13%RH/Pt	-	-	-0.123	0.000	0.141	0.214	0.296	0.466	0.647
Type B	Pt30%RH / Pt6%RH	-	-	-	0.000	-0.002	-0.002	0.002	0.014	0.033
Type S	Pt10%RH/Pt	-	-	-0.127	0.000	0.143	0.216	0.299	0.467	0.646
Type N	NiCr/NiSi	-	-	-0.646	0.000	0.659	0.983	1.340	2.045	2.774
	Temp °C	**150°C**	**200°C**	**300°C**	**400°C**	**500°C**	**600°C**	**700°C**	**800°C**	**900°C**
T/C TYPE		**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**
Type K	NiCr/NiAl	6.138	8.138	12.209	16.397	20.644	24.905	29.129	33.275	37.326
Type T	Cu/Con	6.704	9.288	14.862	20.872	-	-	-	-	-
Type J	Fe/Con	8.010	10.779	16.327	21.848	27.393	33.102	39.132	45.494	51.877
Type R	Pt/Pt 13%RH	1.041	1.469	2.401	3.408	4.471	5.583	6.743	7.950	9.205
Type B	Pt30%RH / Pt6%RH	0.092	0.178	0.431	0.787	1.242	1.792	2.431	3.154	3.957
Type S	Pt10%RH/Pt	1.029	1.441	2.323	3.259	4.233	5.239	6.275	7.345	8.449
Type N	NiCr/NiSi	4.302	5.913	9.341	12.974	16.748	20.613	24.527	28.455	32.371
	Temp °C	**1000°C**	**1100°C**	**1200°C**	**1300°C**	**1400°C**	**1500°C**	**1600°C**	**1700°C**	**1800°C**
T/C TYPE		**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**	**mV**
Type K	NiCr/NiAl	41.276	45.119	48.838	52.410	-	-	-	-	-
Type T	Cu/Con	-	-	-	-	-	-	-	-	-
Type J	Fe/Con	57.953	63.792	69.553	-	-	-	-	-	-
Type R	Pt/Pt 13%RH	10.506	11.850	13.228	14.629	16.040	17.451	18.849	20.222	
Type B	Pt30%RH / Pt6%RH	4.834	5.780	6.786	7.848	8.956	10.099	11.263	12.433	13.591
Type S	Pt10%RH/Pt	9.587	10.757	11.951	13.159	14.373	15.582	16.777	17.947	-
Type N	NiCr/NiSi	36.256	40.087	43.846	47.513	-	-	-	-	-

6 Battery Replacement and Recharging

The battery capacity for rechargeable types is approx. 150 mAH, whereas non rechargeable types are approx. 500 mAH. The 1030 circuitry takes approximately 8 mA and will operate over a DC supply voltage range of 7-12 volts. The battery life is primarily dependent on the output current used. With low output currents, battery life can exceed 60 hours, but when driving a 100mA output current alkaline battery life is reduced to about 3.5 hours, or 1.3 hours on NiMH rechargeable types.

The battery should be replaced or recharged when the battery level indicator fails to register green. The lifespan of NiMH batteries is considerably reduced if they are subject to excessive discharging caused by using the instrument beyond the normal operating battery level.

To replace the battery, unscrew the four screws in the rear cover of the instrument.
The battery is visible above the main P.C.B., (see below). Carefully remove the old battery, and insert the new one. Screw the rear cover back on, and test the battery condition.



To recharge a NiMH battery, it is recommended that the instrument is turned off, in order to reduce charging time to the 15hrs minimum. The charger is then plugged into the recharge socket on the back. Note that it is NOT necessary to remove the battery to recharge it. The battery will not be overcharged if the recharger is connected continuously.

The charger is of the constant current type and should only be used when recharging the internal NiMH battery. By removing the NiMH battery from the 1030, the battery can also be recharged from an external PP3 NiMH type charger (not supplied).

This enables a second fully charged battery to be readily available (not supplied).

If it is required to power the 1030 from an external source, remove the internal battery, and connect a low noise 9 volt DC constant Voltage Power Unit into the recharge connector (observe polarity). Note that the output is not isolated from the charger socket.

By powering the 1030 from an external source, it is possible to increase the voltage limit on the current ranges to 12 volts.

7 Calibration

The instrument is calibrated before it leaves the factory and the calibration controls will not normally require adjustment.

If re-adjustment is considered necessary, and the trimmer range is found to be insufficient for recalibration, there is a fault with the instrument.

To calibrate the instrument a DVM of 0.1% accuracy is required. It should also be capable of measuring:

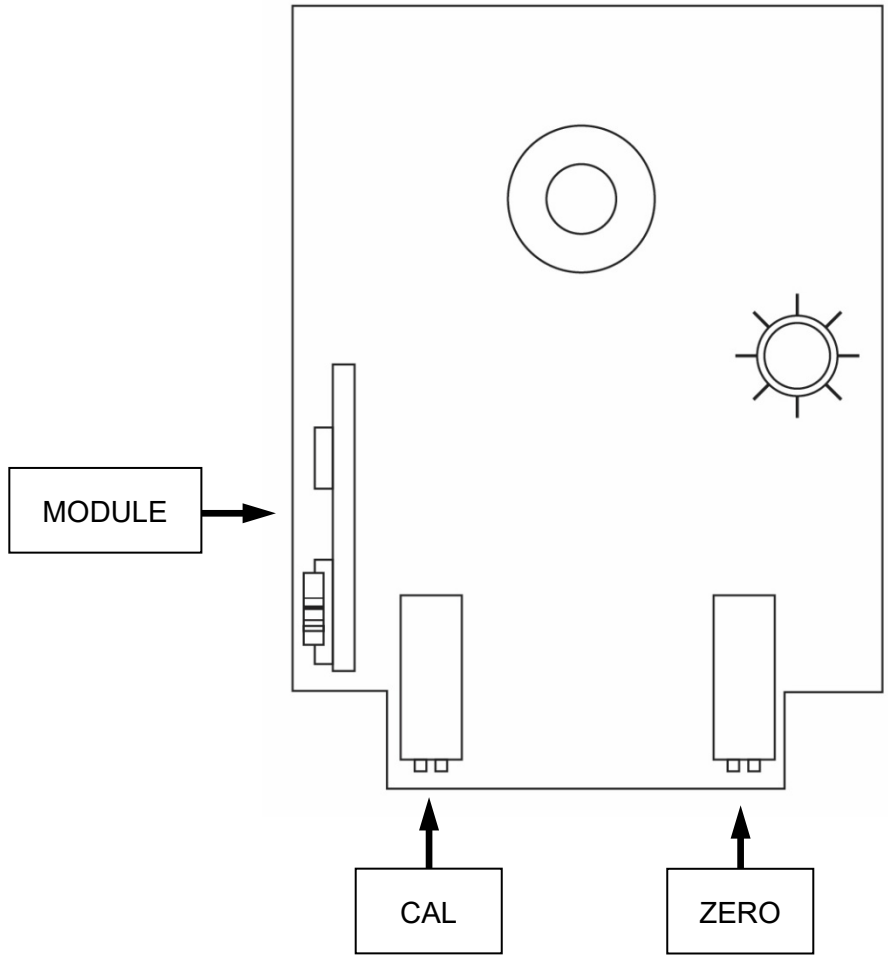
- 10 mV with 10 µV resolution
- 100 mV with 10 µV resolution
- 1 V with 100 µV resolution
- 100 mA with 100 µA resolution
- 10 mA with 10 µA resolution

Calibration is carried out on the full scale and zero of the 100 mV range.
By correctly calibrating this range, the other ranges are also calibrated.

7.1 Preparing for calibration

1. Turn instrument off, remove rear cover, and battery.
2. Switch to 100 mV range.
3. Remove cap from top of range switch knob, and loosen the screw inside.
   The range switch knob should then be removed.
4. Undo the nut which attaches the output switch to the case of the 1030.
5. The main PCB can now be gently eased out of the case. Noting lead dressing.
6. If the module is to be replaced, it can be unplugged now, and the new one fitted.
7. Re-connect good battery, check battery indicator.
   The 1030 will then need to be recalibrated.
8. The FS calibration trimmer (CAL) is next to the module, on the left looking down at the PCB from the component side. The zero calibration trimmer (ZERO) is in a corresponding position on the right of the PCB (see trimmer location diagram).
9. Plug the DVM into the output terminals and turn the output switch to Normal.
10. Turn the output adjustment pot. to zero. The 1030's output will not go negative, so the 'ZERO' trimmer should be set by first adjusting for a positive output, then slowly turn back to zero. The zero calibration for the instrument is then set up correctly.

7.2 Module and Trimmer Location



11. Turn the output adjustment pot. to full scale, and adjust the FS (CAL) calibration trimmer until the DVM reads 100 mV.

    The full scale for the instrument is then set up correctly.

    The other ranges do not normally require calibration, and therefore are not fitted with trimmers.

    Should calibration become necessary, adjust or replace the resistors listed below:

    - 10 mV FS **R6**
    - 10 mA FS **R9**
    - 100 mA FS **R5**

12. The instrument can now be reassembled, taking care not to trap connecting wires.

8 Maintenance and Repair.

8.1 Dismantling the Instrument

Remove protection carry case, and then remove four 6BA screws enabling the rear cover to be taken off which provides access to all parts of the instrument.

8.2 Battery Replacement.

See section 6. Remove rear cover, lift battery out of holder and carefully disconnect the connector, connect new battery and replace into case checking that the wires are dressed neatly, and cannot be trapped; refit rear case cover and recheck battery level.

8.3 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 of the precision components used in this instrument are not readily available and make repairs by the customer difficult if these components are damaged.

Overload conditions can cause a unit failure which will be indicated by one of the following conditions:

a) Instrument inoperative and battery level indicator at zero or LED battery indicator not illuminated.

b) Battery level indicator displaying green, but no output at the output terminals.

9 Warranty and Servicing

Warranty

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

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

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

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

Product Registration

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

Calibration and Repair Services

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

Contacting Time Electronics

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

By phone:
+44 (0) 1732 355993

By email:
mail@timeelectronics.co.uk

Returning Instruments

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

Send the instrument, shipping charges paid to:

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

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

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

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.