



Time Electronics
1030 MicroCal
Voltage & Current Source.

Technical Manual



Contents

1.	Introduction	3
1.1.	General Description	3
2.	Specifications	4
2.1.	Ordering Information and Optional Extras	5
3.	Controls	6
3.1.	Controls Diagram and Key	6
3.2.	Description of Controls	7
4.	Operation	8
4.1.	Voltage Ranges	8
4.2.	Output Voltages above 1V	8
4.3.	Current Ranges	9
4.4.	Output Resistance	9
5.	Applications	10
5.1.	Four Terminal Resistance Measurements	10
5.2	Thermocouple Simulation	11
6.	Battery Replacement & Recharging	12
7.	Calibration	13
7.1.	Preparing for calibration	13
7.2.	Module and Trimmer Location	14
8.	Maintenance and Repair.....	15
8.1.	Dismantling the Instrument	15
8.2.	Battery Replacement.	15
8.3.	Repair	15
9.	Guarantee & Servicing.....	16

All Time Electronics' instruments are subject to continuous development and improvement and in consequence may incorporate minor detail changes from the information contained herein.

1. Introduction

- **3 Voltage Ranges up to 1 Volt**
- **Extremely Compact**
- **2 Current Ranges up to 100 mA**
- **0.1% Accuracy**
- **Uses a single PP3 Battery**



1.1. General Description

The 1030 is a compact, low cost, portable voltage and current calibrator for general purpose signal injection.

Three voltage ranges give adjustable output from 10uV to 1V, and two current ranges give 10uA to 100mA.

The output is scaled directly and is varied by a high quality 10 turn dial.

The 1030 is simple to operate and does not require any standardisation prior to use. The user need only switch on, check the battery condition, select the required range and output.

The unit is powered from internal batteries and is supplied with a carry case making the 1030 ideal for field or site use.

The 1030 is supplied with a leatherette carry case.

2. Specifications

Voltage Ranges:	0 - 1V (1mV resolution). 0 - 100 mV (100 μ V resolution). 0 - 10 mV (10 μ V resolution). 8 Volts (10mV resolution) using external precision 1K Ω resistor supplied.
Current Ranges:	0 - 100mA (100 μ A resolution), 0 - 10mA (10 μ A resolution).
Accuracy:	
1 Volt range:	$\pm 0.1\%$ of FS $\pm 30\mu$ V.
100mV range:	$\pm 0.1\%$ of FS $\pm 3\mu$ V.
10mV range:	$\pm 0.2\%$ of FS $\pm 0.3\mu$ V.
100mA range:	$\pm 0.2\%$ of FS $\pm 3\mu$ A.
10mA range:	$\pm 0.2\%$ of FS $\pm 0.3\mu$ A.
8 Volt range:	$\pm 0.3\%$ of FS.
Linearity:	0.15% of setting.
Temp. Coeff:	150 ppm of FS / $^{\circ}$ C (Outside 18 to 28 $^{\circ}$ C).
Noise:	30 ppm of full scale.
Battery:	9V PP3 type. Approx. 60 hours life depending on output current. Nicad rechargeable available as an optional extra.
Battery Condition:	Continuously monitored by front panel indicator.
Output Polarity:	Positive or Negative, 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 although it should be noted that loads of less than 1k ohm will give greater than 0.1% error.
Maximum Output Voltage (Current Ranges):	8V.
Output Protection:	The 1030 can withstand continuous short circuit or open circuit on all ranges.

Output Resistance:	0.2 ohm on 1V and 100mV ranges. 10 ohm on 10mV range. 1K ohm when using the current shunt resistor.
Dimensions:	115mm x 62mm x 55mm.
Carry Case:	A black carry case is supplied.

2.1. Ordering Information and Optional Extras

Order Code	Description
1030	MicroCal (Combined Voltage and Current Source)
1031	Rechargeable Battery Pack (NiCad Battery and 240V Mains Charger)
1032	Rechargeable Battery Pack (NiCad Battery and 110V Mains Charger)
9155	Factory (NPL Traceable) Calibration Certificate)
9110	UKAS Calibration Certificate (ISO 17025)

3. Controls



3.1. Controls Diagram and Key

- | | |
|-----------------------------|---|
| 1) Black 4mm terminal | Negative output terminal. |
| 2) Red 4mm terminal | Positive output terminal. |
| 3) 3 Position switch | Selects Normal/Off/Reverse output |
| 4) 6 Position rotary switch | Selects range and turns instrument on |
| 5) 10 turn potentiometer | Selects required output |
| 6) Potentiometer lock | Right position is free, left is locked. |
| 7) Battery level indicator | Warns of battery failure |
| 8) Recharge socket | For recharging Ni-Cad cell (if fitted) |

3.2. Description of Controls

1 / 2. Output Terminals

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

3. 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.

4. 6 way Position range switch

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

5. 10 Turn fine adjust dial. Scaled 0-100. Linearly output from 0 – 100% of select output range located on the top side of the 1030

6. 10 Turn dial potentiometer lock . Enables the output to be temporary locked.

7. Battery Level Indicator

Located on the top side of the 1030 this continuously monitors the battery voltage. A minimum mark indicates when the batteries require recharging.

8. 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 (see 'Battery Replacement').

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 56.2mV:

- 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	1/10 th of a Turn	1 Division (1/100)
Voltage Output.			
1V	100 mV	10 mV	1 mV
100 mV	10 mV	1 mV	100uV
10 mV	1 mV	100uV	10uV
Current Output			
100 mA	10 mA	1 mA	100 uA
10 mA	1 mA	100 uA	10 uA

NOTE: 0.001V = 1mV = 1000uV
0.001A = 1mA = 1000uA

- 5) Switch output to Normal or Reverse as required.

4.2. Output Voltages above 1V

To use the 8V range, connect the supplied 1K ohm 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 0V and $\pm 8V$ with a 10mV 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 8V drive capability.

This can easily be checked by either measuring the voltage across the 1030's terminals when under load, or by checking that $R \times I$ 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

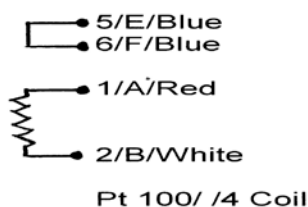
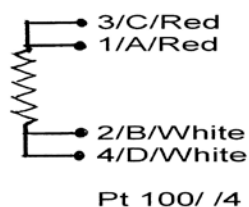
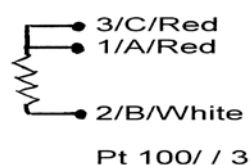
5.1. Four Terminal Resistance Measurements

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 & 4 wire Resistance Thermometers



Using this technique, the current passed through to the resistor can be limited to a known value, and lead resistance does not effect the accuracy of the readings.

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 ITS90.

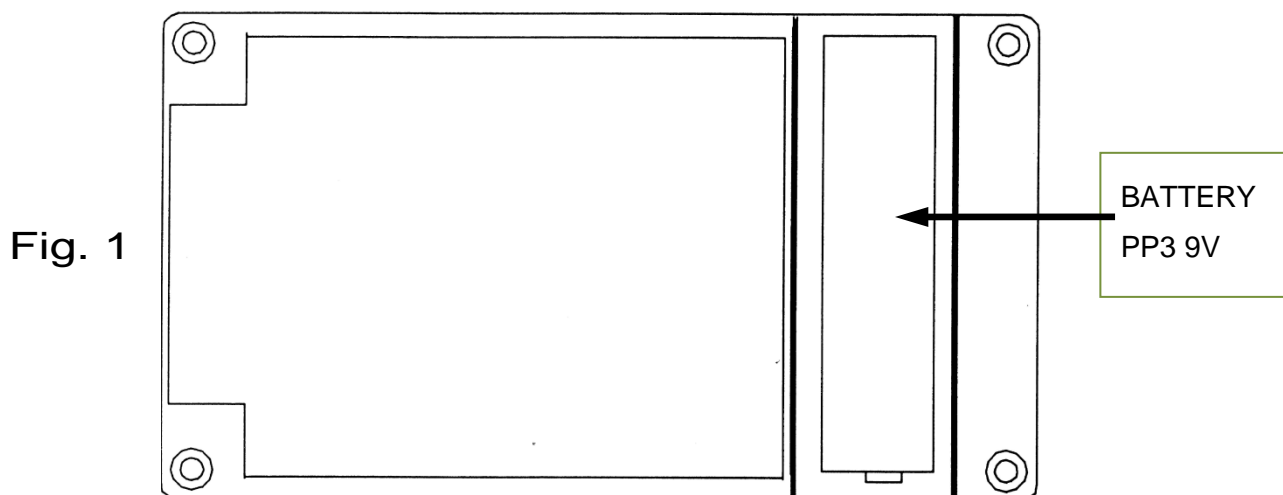
	Temp °C	100°C	-50°C	-25°C	0°C	25°C	37°C	50°C	75°C	100°C
T/C TYPE		mV	mV	mV	mV	mV	mV	mV	mV	mV
Type K	NiCr/NiAl	-3.554	-1.889	-0.968	0.000	1.000	1.489	2.023	3.059	4.096
Type T	Cu/Con	-3.379	-1.819	-0.940	0.000	0.992	1.486	2.036	3.132	4.279
Type J	Fe/Con	-	-	-	0.000	1.277	1.902	2.585	3.918	5.269
Type R	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 & Recharging

The battery capacity for rechargeable types is approx. 110mAH, whereas non-rechargeable types are approx. 70mAH. The 1030 circuitry takes 2mA, and will operate over a battery 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, battery life is reduced to about 50 minutes.

The battery should be replaced or recharged when the front panel battery level indicator fails to register in the green section of the scale. The life of Ni-Cad batteries is considerably reduced if they are subject to excessive discharging caused by operating the instrument with an insufficient reading on the battery level indicator.

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 Fig.1). Carefully remove the old battery, and insert the new one. Screw the rear cover back on, and test the battery condition.



To recharge a Ni-Cad 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 Ni-Cad battery. The Ni-Cad battery can also be recharged from a 12V D.C. supply by connecting the 1030 recharge socket to the 12V D.C. supply via a 300 Ohm, 1/4 watt resistor.

If it is required to power the 1030 from an external source, remove the internal battery, and connect a 9 volt DC constant Voltage Power Unit into the recharge connector. 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:

10mV with 10uV resolution

100mV with 10uV resolution

1V with 100uV resolution

100mA with 100uA resolution

10mA with 10uA resolution

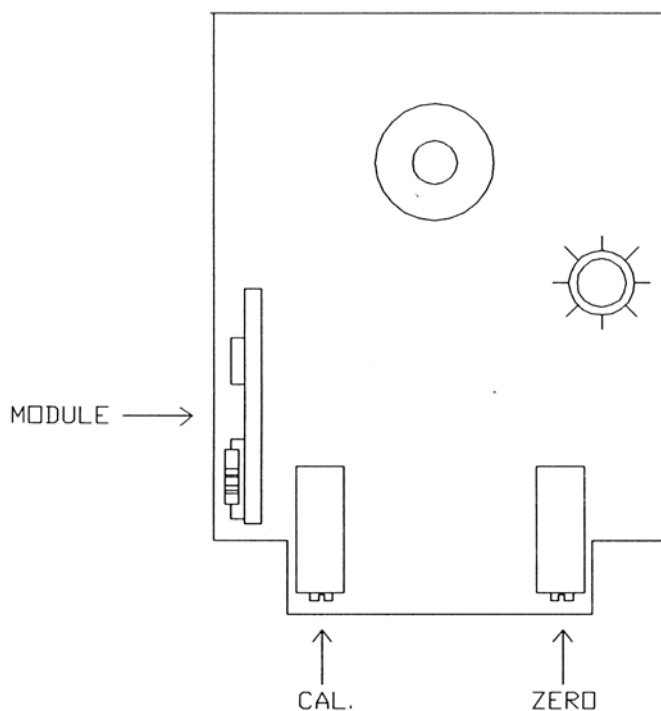
Calibration is carried out on the full scale and zero of the 100mV range. By correctly calibrating this range, the other ranges are also calibrated.

7.1. Preparing for calibration

- 1 Turn instrument out Off.
- 2 Switch to 100mV 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 body of the 1030.
- 5 Carefully unscrew the rear cover.
- 6 The main P.C.B. can now be gently eased out of the case.
- 7 If the module is to be replaced, it can be unplugged now, and the new one fitted.
The 1030 will then need to be recalibrated.
- 8 The full scale calibration trimmer is next to the module, on the left looking down at the P.C.B. from the component side. The zero calibration trimmer is in a corresponding position on the right of the P.C.B. (see Fig. 2).
- 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 turning back to zero. The zero for the instrument is then set up correctly

7.2. Module and Trimmer Location

Fig. 2



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

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.

10mV F.S.	R6
10mA F.S.	R9
100mA F.S.	R5

- 12 The instrument can now be reassembled.

8. Maintenance and Repair.

8.1. Dismantling the Instrument

Remove rubber protection boot and then removal of four 6BA screws enables the cover to be taken off which provides access to all parts of the instrument.

8.2. Battery Replacement.

Remove protection cover and then removal of four screws enables the cover to be taken off which provides access to the battery lift battery out of holder and careful disconnect battery connector, connect new battery and replace into case replace 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.

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

9. Guarantee & Servicing

Guarantee Period

This unit is guaranteed against defects in materials and workmanship for a period of **one year** from its delivery to the customer.

We maintain comprehensive after sales facilities and the unit can, if necessary be returned to us for servicing. During this period, Time Electronics Ltd will, at its discretion, repair or replace the defective items. For servicing under guarantee, the instrument type and serial number must always be quoted, together with details of any fault and the service required. The purchaser of the instrument must prepay all shipping charges. Time Electronics Ltd will pay return shipping charges.

This guarantee is void if servicing has been attempted by an unauthorised person or agent. If, during the guarantee period, failure is due to misuse or abuse of the unit, the repair will be put in hand without delay and charged unless other instructions are received.

Please note that if you require a new UKAS Certificate during the warranty period, this will be charged at the current rate on our price list.

Service After Guarantee Period

Even after the guarantee period has expired, Time Electronics Ltd., can still service your instrument. As the manufacturer, we have the specialised knowledge needed to keep your instrument in peak condition and we also maintain a comprehensive spare parts service.

Please enclose details of the service required and your full company details including a contact name when returning for servicing.

Returning Instruments

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:-

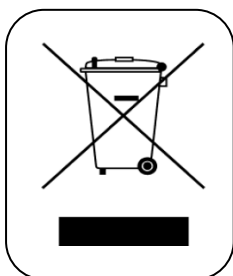
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Disposal of your old equipment

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.