1030
MicroCal

Technical Manual

Contents

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**

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.

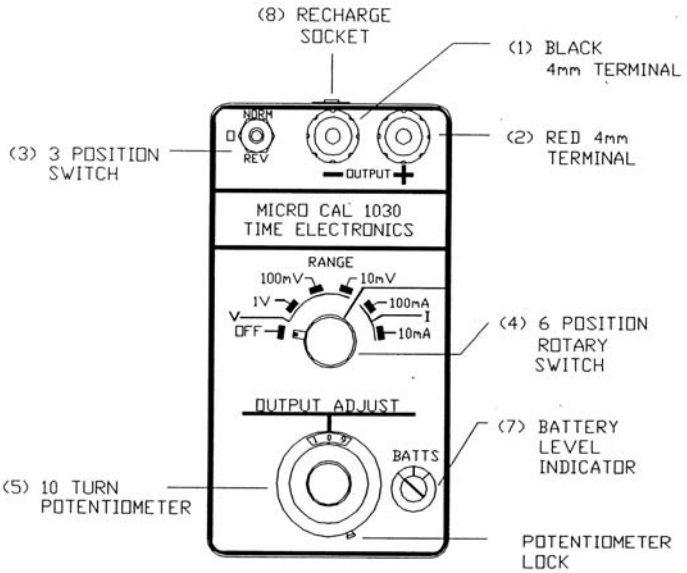
The unit is powered from internal batteries and is supplied with a carry case making the 1030 ideal for field or site use.

2. Specifications

Voltage Ranges:	1 Volt. 100 mV. 10 mV. 8 Volts using current-shunt resistor provided.
Current Ranges:	100 mA. 10mA.
Accuracy:	
1 Volt and 100mV ranges:	± 0.1% of full scale.
10mV and current ranges:	± 0.2% of full scale.
8 Volt range:	± 0.3% of full scale.
Linearity:	0.15%.
Temp. Coeff:	150 ppm / degree Centigrade (1V range).
Noise:	30 ppm of full scale (1V range).
Battery:	9V PP3 type. Approx. 60 hours life depending on output current. Nicad rechargeable available as extra.
Battery Condition:	Continuously monitored by front panel indicator.
Output Polarity:	Positive or Negative, switch selected. 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.

3. Controls



1) Black 4mm terminal	Negative output
2) Red 4mm terminal	Positive output
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 position is locked.
7) Battery level indicator	Warns of battery failure
8) Recharge socket	For recharging Ni-Cad cell (if fitted)

4. Operation

Suggested operation procedure is as follows:

1) Select Off position on output switch.
2) Turn on, and select required range.
3) Check battery level indicator for high enough reading (see 'Battery Replacement').
4) 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 Turn	1 Division (1/100)
1V	100mV	10mV	1mV
100mV	10mV	1mV	100uV
10mV	1mV	100uV	10uV
100mA	10mA	1mA	100uA
10mA	1mA	100uA	10uA

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

5) Switch output to Normal or Reverse as required.

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.

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 x I is less than 8 volts.

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 Output Resistance	Error in selected Output Voltage
1,000:1	0.1%
100:1	1.0%
10:1	9.0%
1:1	50.0%

5. Applications

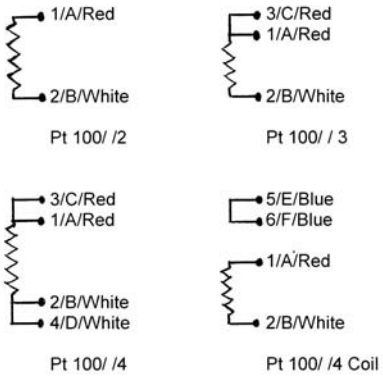
Four Terminal Resistance Measurements

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	253.9	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 resistor can be limited to a known value, and lead resistance does not effect the accuracy of the readings.

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.

Outputs of Common Thermocouple Types in Microvolts: Assuming a Reference Temperature of 0°C
(taken from the relevant section of B.S. 4937)

Temp °C	-100	-50	-25	0	25	37	50	75	100	125	150	200	250	300
Type K NiCr/NiAl	-3553	-1889	-968	0	1000	1489	2022	3058	4095	5124	6137	8137	10151	12207
Type T Cu/Con	-3378	-1819	-940	0	992	1486	2035	3131	4277	5469	6702	9286	12011	14860
Type J Fe/Con	-4632	-2431	-1239	0	1277	1901	2585	3917	5268	6633	8008	10777	13553	16325
Type R Pt/ Pt 13% RH	_	-226	-123	0	141	214	296	466	647	839	1041	1468	1923	2400

Temp °C	350	400	450	500	550	600	700	800	900	1000	1100	1200	1400	1600
Type K NiCr/NiAl	14292	16395	18513	20640	22772	24902	29128	33277	37325	41269	45108	48828	_	_
Type T Cu/Con	17816	20869	_	_	_	_	_	_	_	_	_	_	_	_
Type J Fe/Con	19089	21846	24607	27388	30210	33096	39130	45498	51875	57942	63777	69536	_	_
Type R Pt/ Pt 13% RH	2896	3407	3933	4471	5021	5582	6741	7949	9203	10503	11846	13224	16035	18842

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 font 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.

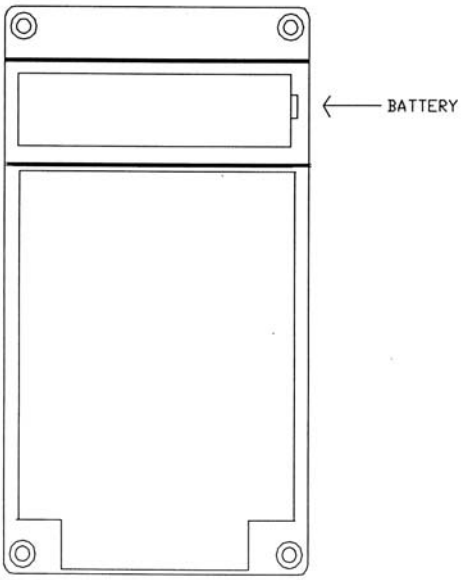


Fig. 1

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

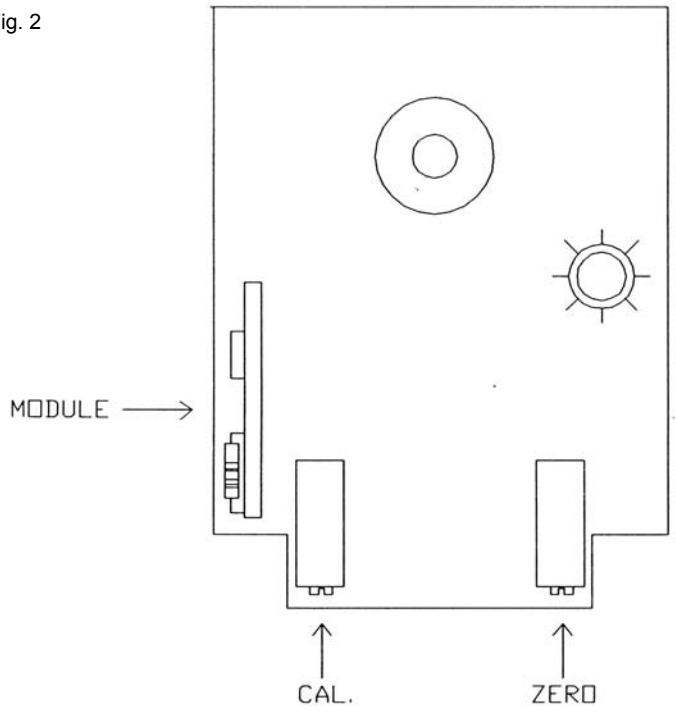
Calibration is carried out on the full scale and zero of the 100mV range. By correctly calibrating this range, the other ranges are also calibrated.

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.

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

The instrument can now be reassembled.

8. Guarantee & Servicing

The 1030 is guaranteed for a period of 12 months from its delivery to the purchaser, covering replacement of defective parts.

We maintain comprehensive after sales facilities and the instrument can, if necessary be returned to us for servicing. 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.

Serivce after the 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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